Indian Journal of Research in Homoeopathy

Volume 18 | Issue 4 Article 2

23-12-2024

An in vitro comparative assessment of antidiabetic efficacy: Abroma augusta Q, Gymnema sylvestre Q, Cephalandra indica Q, Momordica charantia Q, Syzygium jambolanum Q in comparison to Metformin

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How to cite this article

Adharshna SP, Arul V. An in vitro comparative assessment of antidiabetic efficacy: Abroma augusta Q, Gymnema sylvestre Q, Cephalandra indica Q, Momordica charantia Q, Syzygium jambolanum Q in comparison to Metformin. Indian J Res Homoeopathy 2024;18:228-235.

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Abstract

Background: Homoeopathic mother tinctures are gaining attention for managing diabetes by inhibiting key enzymes in glucose metabolism.

Objective: This study aimed to compare popular homoeopathic mother tinctures *Abroma augusta* Q (AAQ), *Cephalandra indica* Q (CIQ), *Gymnema sylvestre* Q (GSQ), *Momordica charantia* Q (MCQ) and *Syzygium jambolanum* Q (SJQ) with Metformin (MET) in inhibiting diabetes associated α-amylase and α-glucosidase enzymes.

Methods: Mother tinctures AAQ, CIQ, GSQ, MCQ, SJQ and MET of concentrations 10 µL/mL, 50 µL/mL, 100 µL/mL, 250 µL/mL, and 500 µL/mL were assessed through α-amylase and α-glucosidase inhibitory assay.

Results: All mother tinctures show significant inhibitory action at $p < 0.01$. AAQ and GSQ exhibited potent inhibition of both enzymes, with inhibitory percentages ranging from 70.41% (500 µL/mL) to 58.98% (10 µL/mL) for α-amylase and 68% (500 µL/mL) to 43.72% (10 µL/mL) for α-glucosidase and 73.98% (500 µL/mL) to 63.66% (10 µL/mL) for α-amylase and 65.31% (500 µL/mL) to 25.99% (10 µL/mL) for α-glucosidase, respectively. AAQ has an IC50 value of 107.9 µL/mL (α-amylase) and 43.87 µL/mL (α-glucosidase) which makes it evidently, a potent antidiabetic mother tincture.

Conclusion: AAQ and GSQ demonstrated significant inhibition of diabetes associated enzymes when compared with MET.

Acknowledgments and Source of Funding

The authors are thankful to Trichy Research Institute of Biotechnology Pvt. Ltd., Trichy–620018,Tamilnadu, for the facilities provided.

Original Article

An *in vitro* comparative assessment of antidiabetic efficacy: *Abroma augusta* Q, *Gymnema sylvestre* Q, *Cephalandra indica* Q, *Momordica charantia* Q, *Syzygium jambolanum* Q in comparison to Metformin

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Abstract

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Key words: α-amylase, α-glucosidase, Anti diabetic, Diabetes, Homoeopathy, *In vitro*, Mother tinctures

Introduction

Diabetes mellitus remains a significant global health concern, with its prevalence steadily increasing over the years.[1] As the medical community grapples with the rising incidence of this chronic metabolic disorder, there has been a growing interest in exploring alternative and complementary therapeutic approaches.[2] Homoeopathy, a system of alternative medicine, has gained attention for its potential in managing various health conditions, including diabetes.[3]

Homoeopathic mother tinctures, characterised by their pronounced dilution and potentisation of natural substances, have become the focal point of exploration within the homoeopathic community.[4] The homoeopathic mother tinctures are believed to possess bioactive components that may influence various physiological processes.[5] Among these preparations, several mother tinctures have gained prominence for their potential antidiabetic effects, including *Abroma augusta* Q (AAQ), *Cephalandra indica* Q (CIQ), *Gymnema sylvestre* Q (GSQ), *Momordica charantia* Q (MCQ) and *Syzygium jambolanum* Q (SJQ).[6] These natural remedies have piqued curiosity within the homoeopathic community and beyond, with the prospect of offering safer and more accessible options for diabetes management.

One of the key mechanisms in diabetes pathology involves the dysregulation of glucose metabolism, driven by the

Access this article online	
Quick Response Code: Available in print version only	Website: www.ijrh.org
	DOI: 10.53945/2320-7094.1941

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Received: 06 September 2023; **Accepted:** 28 November 2024

How to cite this article: Adharshna SP, Arul V. An *in vitro* comparative assessment of antidiabetic efficacy: *Abroma augusta* Q, *Gymnema sylvestre* Q, *Cephalandra indica* Q, *Momordica charantia* Q, *Syzygium jambolanum* Q in comparison to Metformin. Indian J Res Homoeopathy 2024;18:228-235.

activity of enzymes like α-amylase and α-glucosidase, which play crucial roles in carbohydrate digestion and glucose absorption.[7] The inhibition of these enzymes can contribute to better glycaemic control and serve as a potential therapeutic strategy for diabetes.[8] This study seeks to address the curiosity surrounding the comparative effectiveness of prevalent homoeopathic mother tinctures, alongside the conventional antidiabetic drug Metformin (MET), in inhibiting these key diabetic enzymes.

This study aims to assess the relative effectiveness of well-known homoeopathic mother tinctures when compared to the conventional antidiabetic medication. By exclusively using plant-based medications, we aim to minimise variability and ensure a consistent research environment, avoiding selection bias. These plants were chosen based on mother tinctures commonly used by homoeopaths in clinical practice.[6,9] International guidelines indicate MET as the only oral hypoglycemic medication for type 2 diabetes that is first-line of treatment and has been shown to be safe, reliable, and economically viable.[10]

Although the precise processes behind MET's pharmacological actions are still unknown, several studies have verified its multi-target effects in lowering intestinal and hepatic glucose absorption and production, enhancing pancreatic β-cell activity, and enhancing insulin sensitivity.[11] This study uses MET as a standard control due to its significant clinical benefits in treating Type 2 diabetes mellitus.[12]

Ethanol (ETH) which is a vehicle for homoeopathic mother tinctures is assigned as the negative control provides baseline for accurate comparison and evaluation and method reliability. A negative control, such as ETH, guarantees that any biological effects are caused by the active components of the homoeopathic cure and not by the ETH itself.

With diabetes emerging as a global health challenge, the exploration of alternative therapeutic approaches, including homoeopathic mother tinctures, is increasingly gaining traction. This study seeks to evaluate the comparative efficacy of selected mother tinctures and MET in inhibiting key enzymatic targets linked to diabetes pathophysiology. Through a rigorous examination, it aims to illuminate the potential role of Homoeopathy in diabetes management, offering fresh insights into its integration with modern healthcare strategies. This research aspires to contribute to the ongoing discourse on diversifying therapeutic options, potentially broadening the scope of effective diabetes interventions within contemporary medical frameworks.

Materials and Methods

Materials

All homoeopathic mother tinctures and ETH (90% v/v) were bought from SBL Pvt. Ltd. MET was utilised as the standard reference, and a solution containing 90% v/v ETH served as the control vehicle. α-Glucosidase (Saccharomyces cerevisiae), α-amylase (procaine pancreas), and 3,5-di-nitro salicylic acid (DNS) were sourced from Sigma-Aldrich located in Bangalore. P-nitro-phenyl-α-D-glucopyranoside (p-NPG), sodium carbonate (Na2 CO3), sodium dihydrogen phosphate, and di-sodium hydrogen phosphate were acquired from Hi-Media, based in Mumbai. Sodium phosphate buffer, DMSO (Dimethyl sulfoxide), starch, sodium and potassium tartrate, as well as NaOH, were purchased from Merk, a supplier in the United States. The study was done in Trichy Research Institute of Biotechnology (P) Ltd, Tiruchirappalli, Tamil Nadu.

Methods

Preparation of Stock solution

To prepare a 1 mg/mL stock solution of a mother tincture the required volume is calculated based on the specific gravity of the tincture, which varies depending on the tincture and the brand. The specific gravities for the mother tinctures determined are: *Abroma augusta* (1.63 g/mL), *Cephalandra* (2.54 g/mL), *Gymnema* (0.93 g/mL), *Momordica charantia* (1.72 g/mL) and *Syzygium* (0.91 g/mL). The volume is calculated using the formula:

$$\text{Volume}\,(\text{mL})\,\text{needed to be taken to achive 1 mg/mL} = \frac{1}{\text{Specific gravity}(\text{g/mL})}$$

This formula determines the precise volume of the tincture needed to provide 1 mg of weight per mL of the solution. The calculated volume is measured accurately using a micropipette and transferred to a container, followed by dilution to a final volume of 1 mL with a suitable solvent such as phosphate buffer. The prepared stock solution is then used to create further diluted stepwise to obtain working concentrations of 500 µg/mL, 250 µg/mL, 100 µg/mL, 50 µg/mL and 10 µg/mL for further enzymatic testing.

α-amylase inhibitory activity

The assessment of α-amylase inhibitory activity followed a method adapted from Dong *et al.*,[13] with suitable modifications. This adaptation accounted for the unique line properties of these tinctures, such as their ETH content and potential interactions with enzymatic activity. Various concentrations (500, 250, 100, 50 and 10 µg/mL) of homoeopathic mother tincture samples were mixed with 200 µL of α-amylase solution (1.0 U/mL in phosphate buffer pH 6.9) and incubated at 25°C for 30 mins. After pre-incubation, 400 µL of 0.25% starch solution in phosphate buffer (pH 6.9) was added to initiate the reaction, which proceeded at 37°C for 5 mins. Termination involved the addition of 1.0 ml of the DNS reagent (1% 3, 5-dinitrosalicylic acid and 12% sodium potassium tartrate in 0.4 M NaOH), followed by boiling and cooling. Dilution to a final volume of 10 ml with distilled water allowed measurement of absorbance (A) at 540 nm. Control incubations and blank incubations were performed for reference. α-amylase inhibitory activity

was expressed as a percentage of inhibition, calculated as per the provided formula.

$$\% \text{ Inhibition} = \frac{A_{control} - \left(A_{test} - A_{background}\right)}{Control} \times 100$$

Where $A_{control}$, A_{test}, $A_{background}$ represented the absorbance of 100% enzyme activity, test sample with the enzyme and test sample without the enzyme, respectively.

α-glucosidase inhibitory activity

The evaluation of α-glucosidase inhibitory activity is from the methodology outlined by Dong *et al.*[13] The experiment involved combining 60 µl of the homoeopathic mother tincture sample at varying concentrations (500, 250, 100, 50 and 10 µg/mL) with 50 µL of 0.1 M phosphate buffer (pH 6.8) containing α-glucosidase solution (0.2 U/mL). This mixture was incubated in 96-well plates at 37°C for 30 min. Following the pre-incubation step, 50 µL: of a 5 mM ρ-nitrophenyl–α–D-glucopyranoside (PNPG) solution in 0.1 M phosphate buffer (pH 6.8) was added to each well, and the plates were incubated again at 37°C for an additional 20 min.

The reaction was terminated by adding 160 µL of 0.2 M $NaCO_3$ to each well, and the absorbance readings (A) were recorded at 405 nm using a microplate reader. These absorbance values were compared to those of a control sample, where 60 µL of buffer solution was used instead of the extract. In addition, blank incubations were carried out by replacing the enzyme solution with buffer solution, and the corresponding absorbance values were recorded. The α-glucosidase inhibitory activity was calculated as a percentage of inhibition using the provided formula.

$$\% \text{ Inhibition} = \frac{A_{control} - \left(A_{test} - A_{background}\right)}{Control} \times 100$$

Where $A_{control}$, A_{test}, $A_{background}$ represented the absorbance of 100% enzyme activity, test sample with the enzyme and test sample without the enzyme, respectively.

Result

α-amylase inhibitory activity

In this study, we investigated the inhibitory effects of the said experimental dosage forms including MET, alongside a 90% v/v ETH as a vehicle control, on α-amylase activity. We conducted this analysis across a range of concentrations (500 µL/mL, 250 µL/mL, 100 µL/mL, 50 µL/mL and 10 µL/mL) in triplicates [Table 1]. The results revealed substantial variations in inhibition percentages among the different samples at varying concentrations. GSQ displayed concentration-dependent inhibition, ranging from 73.98% at 500 µL/mL to 63.66% at 10 µL/mL. AAQ closely followed with concentration-dependent inhibition, showing percentages from 70.41% at 500 µL/mL to 58.98% at 10 µL/mL. SJQ also exhibited concentration-dependent inhibition, with percentages ranging from 66.23% at 500 µL/mL to 43.91% at 10 µL/mL, while MET displayed a similar pattern, with inhibition percentages ranging from 66.39% at 500 µL/mL to 45.20% at 10 µL/mL. Comparatively, CIQ, MCQ and ETH demonstrated lower inhibitory effects than MET. These findings were visually represented through an interaction plot graph [Figure 1]. IC_{50} values, indicating the concentration at which 50% inhibition was achieved using GraphPad Prism 6.0 software, were determined to be 43.87 µL/mL for MET, 107.9 µL/mL for AAQ, 120.8 µL/mL for SJQ, 121 µL/mL for CIQ, 133.7 µL/mL for ETH, 137.1 µL/mL for MCQ, and 160.8 µL/mL for GSQ [Table 2 and Figure 2]. Comparative analysis against the ETH control indicated significant inhibitory activity for AAQ, CIQ, GSQ, MCQ and SJQ at ($p < 0.01$), suggesting their potential utility as α-amylase inhibitors with potential implications for carbohydrate metabolism and glycaemic control.

α-glucosidase inhibitory activity

In this study, we investigated the inhibitory effects of the said experimental dosage forms including MET, in addition to a 90% v/v ETH used as a vehicle control, on α-glucosidase activity. The study involved examining these effects across a spectrum of concentrations (500 µL/mL, 250 µL/mL, 100 µL/mL, 50 µL/mL and 10 µL/mL) and was conducted in triplicates. The obtained data unveiled noteworthy variations in the inhibition percentages of each sample at different concentration levels. Notably, AAQ exhibited concentration-dependent inhibition, with inhibition percentages ranging from 68% at 500 µL/mL to 43.72% at 10 µL/mL. MET similarly displayed concentration-dependent inhibition, with percentages ranging from 66.39% at 500 µL/mL to 45.20% at 10 µL/mL. GSQ followed closely with concentration-dependent inhibition, displaying percentages ranging from 65.31% at 500 µL/mL to 25.99% at 10 µL/mL. In addition, CIQ also exhibited concentration-dependent inhibition, with percentages ranging from 62.45% at 500 µL/mL to 47.56% at 10 µL/mL. Conversely, MCQ, SJQ, and ETH demonstrated lower inhibitory effects compared to MET. These findings were effectively visualised through an interaction plot graph [Figure 3]. Furthermore, the IC_{50} values, indicating the concentration at which 50% inhibition was achieved, were calculated using GraphPad Prism 6.0 software and determined to be 36.92 µL/mL for AAQ, 43.87 µL/mL for MET, 45.86 µL/mL for SJQ, 53.39 µL/mL for CIQ, 58.51 µL/mL for GSQ, 74.13 µL/mL for MCQ and 137.6 µL/mL for ETH. Comparative analysis against the ETH control demonstrated significant inhibitory activity for AAQ, CIQ, GSQ, MCQ and SJQ at ($p < 0.01$), [Figure 4] indicating their potential as α-glucosidase inhibitors with potential implications for carbohydrate metabolism and glycemic control.

Discussion

In this study, we conducted enzymatic evaluations on some frequently used homoeopathic mother tinctures, using *in vitro* assays for α-amylase and α-glucosidase. Remarkably, all these mother tinctures demonstrated significant effects

Table 1: α-Amylase inhibitory assay

Mean value of % of inhibition of AAQ, CIQ, GSQ, MCQ, SJQ, MET and ETH, in different concentrations by alpha amylase inhibitory assay

S. No.	Concentration (μL/mL)	AAQ % of Inhibition	CIQ % of inhibition	GSQ % of inhibition	MCQ % of inhibition	SJQ % of inhibition	MET % of inhibition	ETH % of inhibition
1	10	58.9817	28.6083	63.666	34.0937	43.9104	45.20918	0
2	50	61.0591	31.7447	64.7522	41.6429	49.3007	58.70445	5.457875
3	100	64.6029	40.1901	66.5173	45.5126	52.8445	60.59379	10.87912
4	250	67.8344	46.5716	70.5635	48.4318	59.8506	63.29285	17.47253
5	500	70.4141	53.5098	73.9851	61.5071	66.2322	66.39676	34.50549

AAQ: *Abroma augusta* Q, CIQ: *Cephalandra indica* Q, GSQ: *Gymnema sylvestre* Q, MCQ: *Momordica charantia* Q, SJQ: *Syzygium jambolanum* Q, MET: Metformin, ETH: Ethanol

Table 2: α-Glucosidase inhibitory assay

Mean value of % of inhibition of AAQ, CIQ, GSQ, MCQ, SJQ, MET and ETH, in different concentrations by alpha glucosidase inhibitory assay

S. No.	Concentration (μL/mL)	AAQ % of inhibition	CIQ % of inhibition	GSQ % of inhibition	MCQ % of inhibition	SJQ % of inhibition	MET % of inhibition	ETH % of inhibition
1	10	43.7205	47.5626	25.9916	38.2184	25.1282	45.2092	3.34401
2	50	47.4444	55.863	44.3882	45.8333	44.4872	58.7045	9.71185
3	100	56.3333	57.444	53.3333	49.1379	48.9744	60.5938	16.0441
4	250	59.7778	59.9473	59.7468	52.2989	53.2051	63.2929	24.582
5	500	68.1453	62.4506	65.3165	56.6092	57.4359	66.3968	36.9264

AAQ: *Abroma augusta* Q, CIQ: *Cephalandra indica* Q, GSQ: *Gymnema sylvestre* Q, MCQ: *Momordica charantia* Q, SJQ: *Syzygium jambolanum* Q, MET: Metformin, ETH: Ethanol

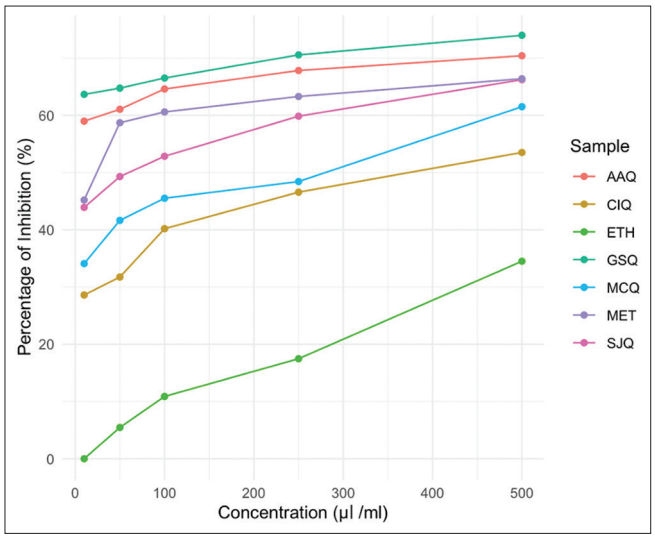

Figure 1: Comparison of mean value of % of inhibition of *Abroma augusta* Q, *Cephalandra indica* Q, *Gymnema sylvestre* Q, *Momordica charantia* Q, *Syzygium jambolanum* Q, Metformin and Ethanol

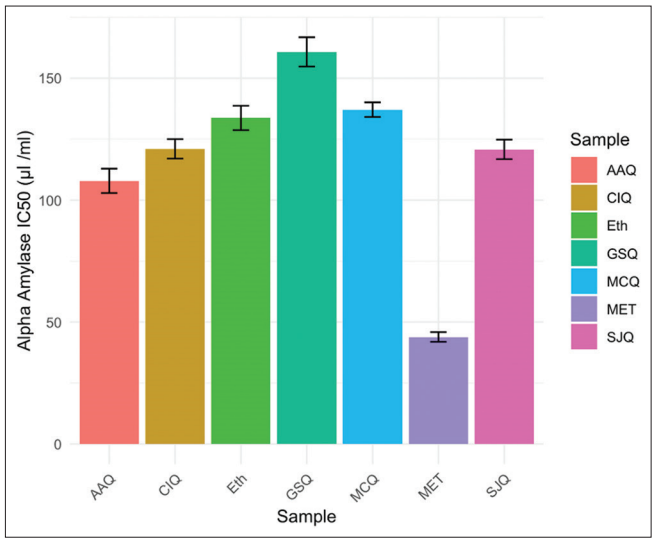

Figure 2: All experiments were carried out in triplicates. Data obtained were analyzed by one-way analysis of variance and means were compared by Tukey's test (SPSS 21.0 version). Representation of the results of α-amylase inhibitory assay, where *Abroma augusta* Q has 107.9 μL/mL, *Cephalandra indica* Q has 121 μL/mL, *Gymnema sylvestre* Q has 160.8 μL/mL, *Momordica charantia* Q has 137.1 μL/mL, *Syzygium jambolanum* Q has 120.8 μL/mL, Metformin has 43.87 μL/mL and Ethanol has 133.7 μL/mL

($p < 0.01$) in both α-amylase and α-glucosidase assays. A comparative analysis between these mother tinctures and the conventional drug MET revealed several intriguing findings.

In prior studies, SJQ, showed potential in managing diabetes by improving carbohydrate and lipid metabolic disorders, mitigating oxidative injuries in diabetic rats, reducing blood glucose, triglycerides, cholesterol levels, insulin levels, and exhibiting antioxidant enzyme activity and antiglycation properties.[14,15] In our *in vitro* studies comparing SJQ with MET, a commonly used conventional drug, we observed that SJQ exhibited similar actions to MET in the α-amylase assay and slightly lower activity than MET in the α-glucosidase assay.

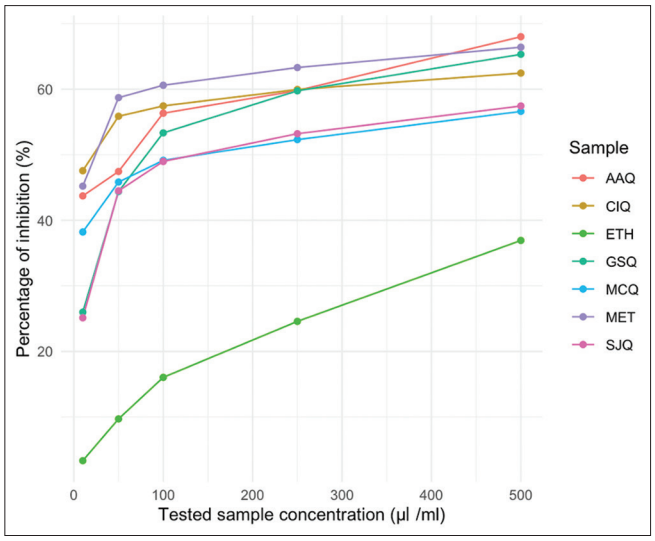

Figure 3: Comparison of mean value of % of inhibition of *Abroma augusta* Q, *Cephalandra indica* Q, *Gymnema sylvestre* Q, *Momordica charantia* Q, *Syzygium jambolanum* Q, Metformin and Ethanol

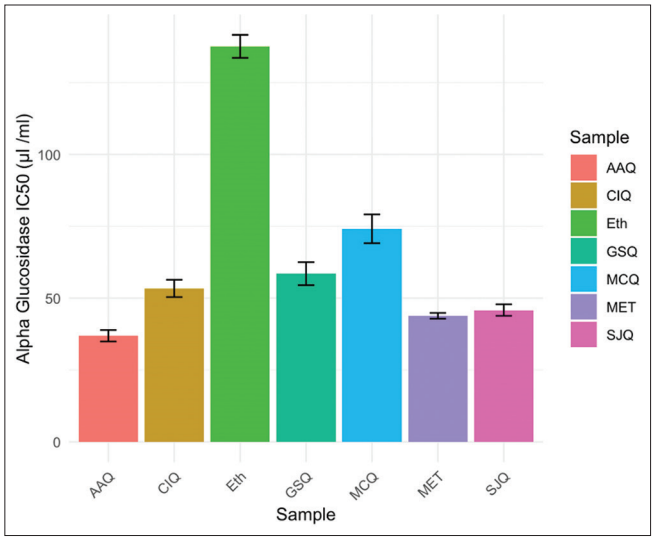

Figure 4: All experiments were carried out in triplicates. Data obtained were analyzed by one-way analysis of variance and means were compared by Tukey's test (SPSS 21.0 version). Representation of the results of α-glucosidase inhibitory assay, where *Abroma augusta* Q has 36.92 µL/mL, *Cephalandra indica* Q has 53.39 µL/mL, *Gymnema sylvestre* Q has 58.51 µL/mL, *Momordica charantia* Q has 74.13 µL/mL, *Syzygium jambolanum* Q has 45.86 µL/mL, Metformin has 43.87 µL/mL and Ethanol has 137.6 µL/mL

Similarly, CIQ, demonstrated hypoglycemic effects, promoted pancreatic beta cell regeneration, and improved insulin sensitivity in previous investigations.[16] It also displayed robust antiglycation properties and proved effective against diabetic neuropathic pain and nephropathy.[17,18] However, in our current study, CIQ exhibited slightly lower activity in the α-amylase assay when compared to MET, while its activity in the α-glucosidase assay appeared to be more similar to that of MET.

Previous research on MCQ revealed its ability to reduce blood sugar levels in a clinical trial.[19] In our current study, MCQ demonstrated reduced activity in both the α-amylase and α-glucosidase assays compared to MET.

GSQ exhibited antiglycation activity and protection against diabetic nephropathy in previous studies.[20] It also demonstrated the ability to lower blood glucose levels in diabetic rats.[21] In our current research, GSQ displayed a higher inhibitory percentage than MET in the α-amylase assay and a similar inhibitory percentage to MET in the α-glucosidase assay.

AAQ demonstrated mild hypoglycemic potential in previous studies and showed a significant decline in fasting blood sugar, postprandial blood sugar, and HbA1c levels.[22,23] In our study, AAQ exhibited a higher inhibitory percentage in both the α-amylase and α-glucosidase assays when compared to MET.

When we analyse the IC_{50} values within the context of homoeopathic medicine, AAQ stands out with the lowest IC_{50} values for both α-amylase (107.9 µL/mL) and α-glucosidase (43.87 µL/mL). These values clearly indicate that AAQ is the most potent mother tincture for its anti-diabetic activity. On the other hand, GSQ, despite demonstrating substantial inhibitory percentages, presents higher IC_{50} values for both α-amylase (160.8 µL/mL) and α-glucosidase (58.51 µL/mL). This suggests that GSQ is comparatively less potent as a mother tincture when compared to AAQ.

While individual studies have assessed the antidiabetic efficacy of specific mother tinctures, there is a notable absence of research comparing more than three tinctures simultaneously. This study addresses this gap by conducting a comparative assessment of multiple mother tinctures, providing a broader and more comprehensive understanding of their relative effectiveness.

Conclusion

This study evaluated commonly used anti-diabetic homoeopathic mother tinctures, including AAQ, CIQ, GSQ, MCQ and SJQ, revealing significant antidiabetic potential. Among these, AAQ stood out with the strongest anti-diabetic effects, reflected in its notably lower IC_{50} values. These findings call for further molecular research to better understand how *Abroma augusta* aids in diabetes management.

This comparative analysis helps identify the most effective therapeutic option and provides a foundation for better treatment recommendations. Adopting evidence-based approaches allows practitioners to fully optimise the potential of homoeopathic medicines and provide individualised therapy to the patients, catered to their respective requirements.

Financial support and sponsorship

Nil.

Conflicts of interest

None declared.

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Une évaluation comparative in vitro de l'efficacité antidiabétique: *Abroma augusta* Q, *Gymnema sylvestre* Q, *Cephalandra indica* Q, *Momordica charantia* Q, *Syzygium jambolanum* Q par rapport à la metformine

Contexte: Les teintures mères homéopathiques suscitent de plus en plus d'intérêt pour la gestion du diabète en inhibant les enzymes clés du métabolisme du glucose. **Objectif:** Cette étude visait à comparer les teintures mères homéopathiques populaires *Abroma augusta* Q (AAQ), *Cephalandra indica* Q (CIQ), *Gymnema sylvestre* Q (GSQ), *Momordica charantia* Q (MCQ) et *Syzygium jambolanum* Q (SJQ) avec la metformine (MET) pour inhiber les enzymes a-amylase et a-glucosidase associées au diabète. **Méthodes:** Les teintures mères AAQ, CIQ, GSQ, MCQ, SJQ et MET de concentrations de 10 µL/mL, 50 µL/mL, 100 µL/mL, 250 µL/mL et 500 µL/mL ont été évaluées par un test inhibiteur de l'a-amylase et de l'a-glucosidase. **Résultats:** Toutes les teintures mères présentent une action inhibitrice significative à $p < 0,01$. L'AAQ et le GSQ ont montré une puissante inhibition des deux enzymes, avec des pourcentages inhibiteurs allant de 70,41 % (500 µL/mL) à 58,98 % (10 µL/mL) pour l'a-amylase et 68 % (500 µL/mL) à 43,72 % (10 µL/mL) pour l'a-glucosidase et 73,98 % (500 µL/mL) à 63,66 % (10 µL/mL) pour l'a-amylase et 65,31 % (500 µL/mL) à 25,99 % (10µL/mL) pour l'a-glucosidase, respectivement. L'AAQ a une valeur IC50 de 107,9 µL/mL (a-amylase) et de 43,87 µL / mL (a-glucosidase) ce qui en fait de toute évidence une teinture mère antidiabétique puissante. **Conclusion:** L'AAQ et le GSQ ont démontré une inhibition significative des enzymes associées au diabète par rapport au MET.

Eine in vitro vergleichende Bewertung der antidiabetischen Wirksamkeit: *Abroma augusta* Q, *Gymnema sylvestre* Q, *Cephalandra indica* Q, *Momordica charantia* Q, *Syzygium jambolanum* Q im Vergleich zu Metformin

Hintergrund: Homöopathische Urtinkturen gewinnen bei der Behandlung von Diabetes an Bedeutung, indem sie wichtige Enzyme im Glukosestoffwechsel hemmen. **Ziel:** Ziel dieser Studie war es, die gängigen homöopathischen Urtinkturen Abroma augusta Q (AAQ), *Cephalandra indica* Q (CIQ), *Gymnema sylvestre* Q (GSQ), *Momordica charantia* Q (MCQ) und *Syzygium jambolanum* Q (SJQ) mit Metformin (MET) hinsichtlich ihrer Hemmung der mit Diabetes verbundenen α-Amylase- und α-Glucosidaseenzyme zu vergleichen. **Methoden:** Die Urtinkturen AAQ, CIQ, GSQ, MCQ, SJQ und MET in den Konzentrationen 10 µl/ml, 50 µl/ml, 100 µl/ml, 250 µl/ml und 500 µl/ml wurden mittels eines α-Amylase- und α-Glucosidase-Hemmtests untersucht. **Ergebnisse:** Alle Urtinkturen zeigen eine signifikante Hemmwirkung bei $p < 0,01$. AAQ und GSQ zeigten eine starke Hemmwirkung auf beide Enzyme, mit Hemmwirkungsgraden von 70,41 % (500 µL/mL) bis 58,98 % (10 µL/mL) für a-Amylase und 68 % (500 µL/ml) bis 43,72 % (10 µL/ml) für α-Glucosidase und 73,98 % (500 µL/ml) bis 63,66 % (10 µL/ml) für α-Amylase und 65,31 % (500 µL/ml) bis 25,99 % (10 µL/ml) für α-Glucosidase. AAQ hat einen IC50-Wert von 107,9 µL/ml (α-Amylase) und 43,87 µL/ml (α-Glucosidase), was es offensichtlich zu einer potenten antidiabetischen Urtinktur macht. **Fazit:** AAQ und GSQ zeigten im Vergleich zu MET eine signifikante Hemmung diabetesassoziierter Enzyme.

एंटीडायबिटिक प्रभावकारिता का इन विट्रो तुलनात्मक मूल्यांकन: *एब्रोमा ऑगस्टा Q जिम्नेमा सिल्वेस्ट्रे Q, सेफालैंड्रा इंडिका Q, मोमोर्डिका चारेंटिया Q , साइज़ीजियम जंबोलनम Q* की तुलना मेटफॉर्मिन से की गई

पृष्ठभूमि: होम्योपैथिक मदर टिंचर्स ग्लूकोज मेटाबोलिज्म में प्रमुख एंजाइमों को बाधित करके मधुमेह के प्रबंधन के लिए ध्यान आकर्षित कर रहे हैं। **उद्देश्य:** इस अध्ययन का उद्देश्य मधुमेह से जुड़े α एमाइलेज और α -ग्लूकोसिडेस एंजाइमों को बाधित करने में लोकप्रिय होम्योपैथिक मदर टिंचर्स *एब्रोमा ऑगस्टा Q* (AAQ), *सेफालैंड्रा इंडिका* Q (CIQ), *जिम्नेमा सिल्वेस्ट्रे Q* (GSQ) *मोमोर्डिका चारेंटिया Q* (MCQ) और *साइज़ीजियम जंबोलनम Q* (SJQ) की तुलना मेटफॉर्मिन (MET) से करना था। **विधियाँ:** 10 µL/mL, 50 µL/mL, 100 µL/mL, 250 µL/mL, और 500 µL / mL सांद्रता वाले मदर टिंचर्स AAQ, CIQ, GSQ, MCQ, SJQ और MET का मूल्यांकन α - एमाइलेज और α - ग्लूकोसिडेस निरोधात्मक परख के माध्यम से किया गया। **परिणाम:** सभी मदर टिंचर्स ($p < 0.01$) द्वारा महत्वपूर्ण निरोधात्मक क्रिया दिखाई गई हैं। AAQ और GSQ ने दोनों एंजाइमों के लिये शक्तिशाली अवरोध को प्रदर्शित किया, जिसमें निरोधात्मक प्रतिशत क्रमशः α - एमाइलेज के लिए 70.41% (500 µL / mL) से लेकर 58.98% (10 µL / mL) और α-ग्लूकोसिडेस के लिए 68%(500 µL/mL) से 43.72% (10 µL/mL) रहा अथवा α-एमाइलेज के लिए 73.98% (500 µL/mL) से 63.66% (10 µL/mL) और α-ग्लूकोसिडेस के लिए 65.31% (500 µL/mL) से 25.99% (10 µL/mL) तक रहा । AAQ का IC50 मान 107.9 µL/mL (α-एमाइलेज) और 43.87 µL/mL (α-ग्लूकोसिडेस) है जो इसे स्पष्ट रूप से एक शक्तिशाली एंटीडायबिटिक मदर टिंचर दर्शाता है। **निष्कर्ष:** AAQ और GSQ ने MET की तुलना में मधुमेह से जुड़े एंजाइमों के अवरोध में महत्वपूर्ण प्रदर्शन किया।

Una evaluación comparativa in vitro de la eficacia antidiabética: *Abroma augusta* Q, *Gymnema sylvestre* Q, *Cephalandra indica* Q, *Momordica charantia* Q, *Syzygium jambolanum* Q en comparación con la metformina

Antecedentes: Las tinturas madre homeopáticas están ganando atención para el manejo de la diabetes al inhibir las enzimas clave en el metabolismo de la glucosa**. Objetivo:** Este estudio tuvo como objetivo comparar las tinturas madre homeopáticas populares *Abroma augusta* Q (AAQ), *Cephalandra indica* Q (CIQ), *Gymnema sylvestre* Q (GSQ), *Momordica charantia* Q (MCQ) y *Syzygium jambolanum* Q (SJQ) con metformina (MET) en la inhibición de las enzimas a-amilasa y a-glucosidasa asociadas a la

diabetes. **Métodos:** Las tinturas madre AAQ, CIQ, GSQ, MCQ, SJQ y MET de concentraciones 10 µL/mL, 50 µL/mL, 100 µL/mL, 250 µL/mL y 500 µL/mL se evaluaron mediante el ensayo inhibidor de la a-amilasa y la a-glucosidasa. **Resultados:** Todas las tinturas madre muestran una acción inhibidora significativa a p < 0,01. AAQ y GSQ exhibieron una potente inhibición de ambas enzimas, con porcentajes inhibitorios que van desde 70,41 % (500 µL/mL) hasta 58,98 % (10 µL/mL) para la a-amilasa y 68 % (10 µL/mL) para la a-amilasa. (500 µL/mL) a 43.72 % (10 µL/mL) para a - glucosidasa y 73.98 % (500 µL/mL) a 63.66 % (10 µL/mL) para a- amilasa y 65.31 % (500 µL/mL) a 25.99 % (10 µL/mL) para a - glucosidasa, respectivamente. AAQ tiene un valor IC50 de 107.9 µL/mL (a - amilasa) y 43.87 µL/mL (a - glucosidasa) lo que la convierte evidentemente en una potente tintura madre antidiabética. **Conclusión:** AAQ y GSQ demostraron una inhibición significativa de las enzimas asociadas a la diabetes en comparación con MET.

抗糖尿病功效的體外比較評估：*Abroma augusta* Q、*Gymnema sylvestre* Q、*Cephalandra indica* Q、*Momordica charantia* Q、*Syzygium jambolanum* Q 與二甲雙胍相比

背景：順勢療法母酊劑透過抑制葡萄糖代謝中的關鍵酵素來治療糖尿病而受到關注。目的：本研究旨在比較流行的順勢療法母酊劑 *Abroma augusta* Q (AAQ)、*Cephalandra indica* Q (CIQ)、*Gymnema sylvestre* Q (GSQ)、苦瓜Q (MCQ) 和 *Syzygium jambolanum* Q (SJQ) 與二甲雙胍(MET)抑製糖尿病相關的α-澱粉酶和α-葡萄糖苷酶。方法：以α-澱粉酶和a-澱粉酶對濃度爲10µL/mL、50µL/mL、100µL/mL、250µL/mL和500µL/mL的母酊劑AAQ、CIQ、GSQ、MCQ、SJQ和MET進行評估。 - 葡萄糖苷酶抑制測定。結果：所有母酊劑均顯示出顯著的抑製作用（p < 0.01）。 AAQ 和GSQ 對兩種酵素均表現出有效的抑製作用，對a-澱粉酶的抑制百分比範圍爲70.41 % (500 µL/mL) 至58.98 % (10 µL/mL)，對α-澱粉酶的抑制百分比爲68 % 對於α-葡萄糖苷酶，爲(500 µL/mL)至43.72%(10 µL/mL)；對於α-澱粉酶，爲73.98%(500 µL/mL)至63.66%(10 µL/mL)；對於65.31%(500 µL/mL)對於α-葡萄糖苷酶，分別爲25.99% (10 µL/mL)。 AAQ 的 IC50 值爲 107.9 µL/mL（α-澱粉酶）和 43.87 µL/mL（α-葡萄糖苷酶），這使得它顯然是一種有效的抗糖尿病母酊劑。結論：與 MET 相比，AAQ 和 GSQ 對糖尿病相關酵素具有顯著抑製作用。