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Original Article

Identification of Bioactive Ingredients of Traditional Medicinal Plants *Psiadia arabica* Jaub. *Tamarix articulata, Terminalia arjuna* and *Rhazya stricta* by GC-MS in Saudi Arabia

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ABSTRACT

Objectives: This study identified the main bioactive constituents extracted from a mixture containing four plant extracts. Four Saudi Traditional Medicinal plant extracts containing *Psiadia arabica* Jaub, *Tamarix articulata, Terminalia arjuna* and *Rhazya stricta* were identified using GC-Mass. **Materials and Methods:** The samples *Psiadia arabica* Jaub, *Tamarix articulata, Terminalia arjuna* and *Rhazya stricta* were collected from various regions of Saudi Arabia. The air-dried parts of each plant were powdered and soaked in methanol for 24 hr, except *Psiadia arabica* Jaub in chloroform. After that, it was obtaining the concentration plant extract through a rotary evaporator. The mixture of plant extracts was analyzed by GC-MS spectrometry. **Results:** The most abundant compounds identified including heneicosane (7.3%), tetradecane 4,11-dimethyl- (7.11%), Phytol (1.5%), dodecane, 2,6,10-trimethyl- (1.9%) and hexadecane (1.1%), while the lowest concentrations were observed for 10-methylnonadecane, n-hexadecane, tridecane, 2-methyl-, Naphthalene, 1,2,4a,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)- and Dodecane, 2,6,11-trimethyl-. One of the main constituents noticed in the combination of four plants was heneicosane, which exhibits a strong antimicrobial effect. In addition, phytol showed multiple effects, including anti-inflammatory, antimicrobial, ant nociceptive, anxiolytic, metabolism-modulating and immune-modulating. **Conclusion:** These functional molecules identified are known to have different biological activities as antioxidant, antimicrobial, anti-proliferative and antidiabetic. Further studies needed to investigate the mechanism of action through signaling pathway *in vivo* and *in vitro* study.

Keywords: Bioactive ingredients, Traditional medicinal plants, Saudi Arabia, GC-MS analysis, *Psiadia arabica* Jaub, *Tamarix articulata*, *Terminalia arjuna*, *Rhazya stricta*.

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INTRODUCTION

The combination of various medicinal plants is worthy of special attention.[1] The recognition of bioactive compounds found in plants is a pivotal aspect related to plant research that can lead to further studies in the biology and pharmacology field.[2,3] Plants found in Saudi Arabia are precious genetic resources that can be applied in agriculture and medicine.[4] Saudi plants are grown under adverse weather conditions because of their geographic position. As a result of that, the Saudi plant's genomes are remarkably unique and researchers have conducted studies to treat a wide range of diseases.[5,6] All plants contain essential compounds known as primary metabolites. Primary metabolites are necessary for normal plant growth and development. On the other side, secondary metabolites are not necessary for the plant's survival but produced by particular species of plants to interact with the environment. A few plant species produce secondary metabolites, while the primary metabolites are present in all plants.[7] The extreme environmental conditions in

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Saudi Arabia led plants to adapt to such ecological conditions. Despite this, researchers in the phytochemical study find that plants produce a large number of secondary metabolites including flavonoids, alkaloids, polyphenols, tannins, saponins and glycosides.[8] One of the common analytical techniques is Gas Chromatography-Mass Spectrometry (GC-MS), which is employed to determine and quantify diverse phytoconstituents found in plant extracts. The separation potency and accuracy of GC-MS enable the researchers to know the precision of chemical fingerprints specifically that applied GC-MS in pharmacology.[9] This study aimed to identify the main bioactive constituents extracted from a mixture containing four Saudi traditional medicinal plant extracts containing *Psiadia arabica* Jaub. *Tamarix articulata, Terminalia arjuna* and *Rhazya stricta* were identified using GC-Mass.

MATERIALS AND METHODS

Sample Preparation

Four different Saudi plants used in the research, namely, *Psiadia arabica* Jaub, *Tamarix articulata, Terminalia arjuna* and *Rhazya stricta* were collected from various regions in Saudi Arabia. Arial parts of plants were cleaned, ground and mashed into powder and put in vacuum bags. The extracts are stored in a well-closed container. 30 g of *Tamarix articulata, Terminalia arjuna* and *Rhazya stricta* were extracted in methanol, whileile chloroforms was used for*Psiadia arabica* Jaub. (1:2 weight volume). The Plants extraction process was performed on a water bath at 60°C for a day. The subsequent extract was filtered through (Whatman No.1). Obtained extracts were dried by removing their solvent under the vacuum of the rotavapor evaporator. The collected residue was purified and lyophilized to get its powder by freeze-drying. After extraction, all samples were preserved at a temperature of -20°C for future experiments.

Separation of constituents by gas chromatography/ mass spectrum

The separation was achieved by GC/MS, Agleint model, capillary Column with 30 m, 0.25 mm inner diameter and 0.25 um d_f. The injection volume of the sample was 10 µL. Additionally, the temperature of the injector was set at 200°C. The initial temperature was set at 80°C (hold for 7 min) then 280°C was programmed as the final temperature. The rising rate is 5°C/ min (hold for 10 min). The identification of the compounds was performed based on the comparison of their relative retention time and mass spectra with those of the NIST data of the GC-MS system.

Table 1: Biologically active constituents of a mixture of different plant extracts.

Peak	Retention Time (Min)	Hit Compound Name	Formula	Area %	CAS Library
1	6.288	Limonene	$C_{10}H_{16}$	0.783	138-86-3 replib
2	7.219	Tridecane	$C_{13}H_{28}$	0.553	629-50-5 mainlib
3	13.781	Dodecane, 2,6,10-trimethyl-	$C_{15}H_{32}$	1.977	3891-98-3 replib
4	16.678	Caryophyllene	$C_{15}H_{24}$	0.935	87-44-5 mainlib
5	17.208	Dodecane, 2,7,10-trimethyl-	$C_{15}H_{32}$	0.483	74645-98-0 mainlib
6	17.283	à-Caryophyllene	$C_{15}H_{24}$	0.535	6753-98-6 replib
7	17.658	Eicosane	$C_{20}H_{42}$	0.984	112-95-8 replib
8	17.733	Heneicosane	$C_{21}H_{44}$	7.358	629-94-7 replib
9	17.883	Dodecane, 2,6,11-trimethyl-	$C_{15}H_{32}$	0.444	31295-56-4 replib
10	17.953	Naphthalene, 1,2,4a,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-	$C_{15}H_{24}$	0.439	31983-22-9 mainlib
11	18.423	Heneicosane	$C_{21}H_{44}$	1.007	629-94-7 replib
12	16.678	Caryophyllene Oxide	$C_{15}H_{24}$	0.935	1139-30-6 replib
13	19.469	n-Hexadecane	$C_{16}H_{34}$	0.426	544-76-3 Pfleger
14	19.984	Pentadecane, 2,6,10-trimethyl-	$C_{18}H_{38}$	0.465	3892-00-0 mainlib
15	20.394	Tridecane, 2-methyl-	$C_{14}H_{30}$	0.437	1560-96-9 mainlib
16	20.589	Hexadecane, 2,6,10,14-tetramethyl-	$C_{20}H_{42}$	1.164	638-36-8 replib
17	20.649	Tetradecane, 4,11-dimethyl-	$C_{16}H_{34}$	7.118	55045-12-0 mainlib
18	20.994	10-Methylnonadecane	$C_{20}H_{42}$	0.401	56862-62-5 mainlib
19	22.42	Phytol	$C_{20}H_{40}$	1.517	150-86-7 replib
20	22.775	1 Phenanthrene, tetradecahydro-4,5-dimethyl-	$C_{16}H_{28}$	0.463	56292-68-3 mainlib

RESULTS

Table 1 showed the bioactive compounds extracted by combination of four plants. The GC-MS result of a combinations of plants disclosed about fifty bioactive compounds. The main 20 of compounds were listed in Table 1. To express the concentration of each compound, we utilize the peak area percentage, which indicates the relative amount of the compound. The most abundant compounds were found heneicosane (7.3%), tetradecane 4,11-dimethyl- (7.11%), Phytol (1.5%), dodecane, 2,6,10-trimethyl- (1.9%) and hexadecane (1.1%), while the lowest concentrations was observed for 10-methylnonadecane, n-hexadecane, tridecane, 2-methyl-, Naphthalene, 1,2,4a,5,6,8a-hexahydro-4,7- dimethyl-1-(1-methylethyl)- and Dodecane, 2,6,11-trimethyl-.

DISCUSSION

Saudi Arabia are rich in medicinal herbs used as traditional and complementary medicine as colic disease, anti-ulcer, anti-diabetic, hypotensive and etc. Here in, we identified the components of main foru extarcts of common used palnts by GC/MS. Data obtained showed that, Heneicosane exhibits powerful antimicrobial activity on both *Streptococcus pneumoniae* and *Aspergillus fumigatus*.[10] Phytol is a compound that can be used as a precursor of two vitamins A and K.[11,12] Phytol was found to be lethal to some cancer cells.[13] Further, Phytol was confirmed to have numerous effects such as anxiolytic, anti-inflammatory, anxiolytic, antinociceptive, antioxidant, antimicrobial and modulating in metabolism and immune system[14-16] Phytol was found in other plants, exhibits lower cell aging and cholesterol and acts as an anticancer agent.[17] The mixture extracts were identified and their bioactive compounds were characterized through spectroscopic analysis. Further biological and pharmacological studies are necessary to determine the diverse biologically active compounds present in the mixture extracts. Phenanthrene compound is a natural product in plants. At present, Phenanthrene derivatives are interesting in research, due to different structures and biological effects such as anticancer, anti-inflammatory, antioxidant and antimicrobial activity.[18,19]

CONCLUSION

These functional molecules identified are known to have different biological activities as antioxidant, antimicrobial, anti-proliferative and antidiabetic. Further studies needed to investigate the mechanism of action through signaling pathway in vivo and in vitro study.

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ETHICAL APPROVAL

The study protocol was approved by the Ethics Committee of King Abdulaziz University, Jeddah, Saudi Arabia. The protocol was done according to the ethical guidelines of the 1975 Declaration of Helsinki.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR'S CONTRIBUTION

TK, EB and SSM design the experiments. AA, TA running the practical section and MQ, data analysis and interpretation. ALL authors share in write and review manuscript.

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