Food Bioscience 36 (2020) 100578

Contents lists available at ScienceDirect

Food Bioscience

journal homepage: www.elsevier.com/locate/fbio

# Aroma volatiles, phenolic profile and hypoglycaemic activity of *Ajuga iva* L.

Ameni Khatteli[a,1], Mohamed Ali Benabderrahim[a,*,1], Tebra Triki[a], Ferdaous Guasmi[a]

[a] *Arid Lands and Oasis Cropping Laboratory, Institute of Arid Areas, Medenine, Tunisia*

ARTICLE INFO

*Keywords:*
*Ajuga Iva* L.
Phenolic compounds
Aroma volatiles
Essential oils
Anti-diabetic activity

ABSTRACT

The phenolic profile and aroma volatiles of aerial parts of wild *Ajuga iva* L., collected from the Tunisian Desert, have been investigated. Sixteen phenolic compounds in the methalonic extract were identified including 7 phenolic acids and 9 flavonoids. The major compounds were cirilisiol (32 ± 2%), chlorogenic acid (2.4 ± 0.1%), cirsilineol (1.6 ± 1%), hyperoside (1.7 ± 0.1%), syringic acid (0.7 ± 0.1%), and quinic acid (0.6 ± 0.1%). The chromatographic analysis showed three volatile compounds detected in hydrodistilled essential oil (HDEO), representing 99% of the total oil, while solid-phase microextraction (SPME) showed 6 components constituting 98% of the volatile material. The results showed that monoterpenes β-pinene (70 ± 5%) and α-pinene (20 ± 2%) were predominant in SPME and β-pinene (59 ± 4%) and limonene (26 ± 4%) were predominant in HDEO. Furthermore, the *in vivo* anti-diabetic effect of the extract of *A. iva* aerial parts was monitored. As a supplement at 50% of extract seemed to be beneficial for significantly reducing hyperglycemia (~4 fold), after 8 days in rats.

## 1. Introduction

Plants have long been important for herbal medicine. The attention of scientists to the natural products from plants is due to their various biological activities. Their activities are antioxidant, antimicrobial, and anti-inflammatory effects (Hussain et al., 2012; Liao et al., 2017; Petrosyan et al., 2015). The plant secondary metabolites are useful for the treatment and prevention of many diseases and disorders without visible side effects. The quantification and the role of plant secondary metabolites such as phenolic compounds continues to be studied (Darbinian-Sarkissian et al., 2006; Hellwig, Drossard, Twyman, & Fischer, 2004). Phenolic compounds are widely distributed in many wild plant species and these compounds could contribute to their antioxidant activity. Many recent studies confirmed the antifungal and antibacterial actions of phenol compounds from plant extracts (Alves et al., 2013; Stojkovic et al., 2013).

Of all the plant extracts, essential oils are used in the food, cosmetic and pharmaceutical industries, because of their secure status, their broad acceptance by consumers and their multipurpose uses (Mothana et al., 2012). Recently, greater attention has been given to the screening of EO proprieties such as their antioxidant and antimicrobial activities, and their aroma composition (Ormancey et al., 2001). Plants EO contain many bioactive molecules which show potential antioxidant and antimicrobial activities (Dawidowicz, Wianowska, & Baraniak, 2006). In addition, the EOs is generally less toxic with fewer side effects (Isman et al., 2000; Mukherjee, Saritha, & Suresh, 2002).

*Ajuga iva* (L.), from the Lamiaceae family, is one of the wild traditional species that has a potential in food and for therapeutic purpose. In North African countries (Morocco, Algeria, Tunisia and Lybia), this species is known by the vernacular name of “Chendgoura”, and its aerial parts are used in phytomedicine for many diseases (Chenni et al., 2007; El-Hilaly & Lyoussi, 2002). Several beneficial effects have been confirmed for *A. iva* extracts and other related taxa such as antibacterial (Bennaghmouch, Hajjaji, Zellou, & Cherrah, 2001), hypoglycaemic (El-Hilaly & Lyoussi, 2002), hypolipidemic (Chenni et al., 2007) and antiplasmodial (Kuria et al., 2002) activity. Investigations regarding Tunisian *A. iva* extracts were reported by Makni, Haddar, Kriaa, and Zeghal (2013) showed that the Tunisian *A. iva* extracts had high antioxidant activities.

The aim of this study was to investigate phenolic compounds using HPLC analysis and to analyze aroma volatile components of *A. Iva* using the HD and HS-SPME extraction techniques using GC/MS analysis. As well, the anti-biabetic activity of *A. iva* extracts was also measured *in vivo*.

* Corresponding author. Arid Lands and Oasis Cropping Laboratory, Institute of Arid Areas Km 22, Route Eljorf, 4119, Medenine, Tunisia.
*E-mail addresses:* ameni.khatteli@yahoo.com (A. Khatteli), medali_abderrahim@hotmail.com (M.A. Benabderrahim).
[1] The two authors contributed equally to this study.

https://doi.org/10.1016/j.fbio.2020.100578
Received 15 November 2018; Received in revised form 23 March 2020; Accepted 23 March 2020
Available online 11 April 2020