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Essential oil composition, antibacterial and antioxidant activities of *Tagetes minuta* flower grown in Cala community Eastern Cape Province, South Africa

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Introduction

- Medicinal plants are plants that contains some substances that are use for healing purpose or use to produce useful drugs (Sofowora et al., 2013).

- These substances are bioactive phytochemical compounds that are naturally found in plants, proven to have bacterial and antioxidant activity and the need for natural compound from plants is vital due to the health risk associated with antioxidants drugs and the increased in bacterial resistance to antibiotics (Muyima et al., 2004).

- *Tagetes* (Asteraceae =56 species). *T. minuta* (wild marigold) is use for insect repellent, treatment of stomach and intestinal diseases (Shahzadi et al., 2010).

- However, there have been heightened interest of late in natural products like plant that have the ability to reduce free radicals formation and also used in the treatment of infections caused by microorganism.

Objectives

(1). To determine the chemical constituents of the essential oil (EO) flower of *T. minuta* harvested from Cala community, Eastern Cape Province, South Africa.

(2). To determine the antibacterial properties of the essential oil (EO) flower of *T. minuta* harvested from Cala community, Eastern Cape Province, South Africa.

(3). To determine the antioxidant properties of the essential oil (EO) flower of *T. minuta* harvested from Cala community, Eastern Cape Province, South Africa.

Methodology

- **Plant material**
- Fresh flowers of *T. minuta* were collected from Cala community located in Sakhisizwe Local Municipality Eastern Cape Province, South Africa with geographical coordinates of 31° 33′ 0″South, and 27° 36′ 0″East (Nqeno et al., 2010) and the plant was identified at Selmer Schonland Herbarium, Albany Museum Grahams town , South Africa.
- **Preparation of plant material**
- Prior to essential oil extraction, plant material was rinsed with distilled water, shade dried on foil paper in the laboratory at room temperature for 6 days. Thereafter, *T. minuta* flower was pulverized in a blending machine.
- **Extraction of essential oil**
- The EO obtained was extracted from the powdered flower (377 g) for 3 h with hydrodistillation Clevenger's-type apparatus as described by Omoruyi et al., (2014). The extracted EO was dispensed into tinted vials and was stored at 4 °C.

Experimental Setting

- **Gas chromatography mass spectrometry (GC-MS).** The GC-MS analyses of the EO was performed on Agilent 5977A MSD and 7890B GC system.
- **ABTS {2,2′-Azino-bis(3-ethylbenzthiazoline-6-sulfonic acid)} =** Kannan et al., (2013). % inhibition = {(Abscontrol –Abssample)}/ (Abs control) × 100.
- **DPPH (2,2-diphenyl-1-picrylhydrazyl) scavenging assay =**Ajileye et al., (2015).
- **Lipid peroxidation by TBARS test =**Thiobarbituric acid reactive species (TBARS) assay described by Badmus et al., (2011) was adapted to measure the inhibitory effect of the EO on lipid peroxidation using egg yolk homogenates as lipid rich source.
- **Determination of antibacterial properties.** Bacteria strains used were *S. aureus*, *Enterobacter cloacae*, *Mycobacterium smegmatis*, *Listeria ivanovii*, *Streptococcus uberis*, *Vibrio* species and *E. coli.* For the determination *of* **MIC** and **MBC**, the method of Gullon et al., (2016) was adopted. **MIC** was expressed as the lowest concentration of the EO without bacterial growth. **MBC** was expressed as the lowest concentration of the EO that prevented bacterial growth on MH agar plates.

Results and Discussion

- **Chemical constituents**
- The GC-MS analysis result of the EO flower of *T. minuta* revealed that β-Ocimene (14.40%) was the major compound among the 98 compounds and study done by Chamorro et al. (2008) on the EO from *Tagetes minuta* flower reported that β-Ocimene had the highest chemical content and our result is in agreement with their report.
- **Antioxidant activities**
- The EO as well as the positive control (Vitamin C) displayed concentration dependent inhibitory effects activities on DPPH, ABTS and lipid peroxidation.

- **For DPPH** scavenging assay, at 0.5 mg/mL concentration, the EO showed 72% inhibitory effects while vitamin C showed 76% inhibitory effect and the EO of *T. minuta* flower displayed lower DPPH radical scavenging activity compared to vitamin C and our result is in-line with the report of Muyima et al. (2004).

Results and Discussion

- For ABST assay, at 0.5mg/mL concentration, the EO of *T. minuta* flower displayed lower ABTS inhibitory effect of 70% while vitamin C had higher inhibitory activity of 80%.

- Also, at the highest concentration of 0.5 mg/mL, the EO exhibited the highest percentage lipid peroxidation inhibitory effect of 71% with IC_{50} value of 3.23 mg/mL while vitamin C displayed lower percentage lipid peroxidation inhibitory effects of 54% with IC_{50} value of 4.19 mg/mL.

- The EO of *T. minuta* showed **MIC** value at 0.06 mg/mL against *Vibrio* spp., *E. coli*, *Enterobacter cloacae* and *L. ivanovii* and at 0.125 mg/mL against *S. aurius*, *M. smegatis* and *Streptococcus uberis.* However, the EO was more active against Gram-negative (*E. cloacae*, *Vibro* spp. and *E. coli*) than Gram-positive bacterial. Also, the EO showed **MBC** value at 0.06 mg/mL against *E. cloacae* and *E.* coli, at 0.5 mg/mL against *S. uberis* and at 0.125 mg/mL for *Vibro* species.

Conclusions & Recommendations

- The results from this study shows that apart from the traditional applications of *T. minuta* plant, the essential oil contained vast bioactive constituents and could serve as a potent resource for new antibacterial and antioxidant agents.

- **Recommendation**
- Further studies are required to isolate the main active components, evaluate in-vivo bioactivities and toxicity effect of the essential oil of *T. minuta* flower obtained from Cala community in Eastern Cape Province, South Africa.

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