# Therapeutic bio-compounds from avocado residual biomass

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## Introduction

**The use of natural extracts with pharmacological activity is of great interest because they have therapeutic potential in the treatment of different diseases with fewer side effects. In this context, agri-food waste, as a plant matrix, can also be applied to look for natural compounds with bioactive properties.**

## Objectives

**To review the pharmacological potential of avocado waste (peel, stone and leaf), the chemical composition of the extracts, and to compare the antioxidant activity reported in literature with that of extracts obtained using water as a solvent for environmentally friendly extraction.**


## Material and Methods

**•A bibliographic research was carried out for finding and accessing reviews, articles in academic journals, institutional repositories, archives using databases and search engines. Most recent literature was selected (mainly, since the last five years).**
**•Antioxidant extracts were obtained as follow:**

Avocado peel
Avocado stone

→ **Conditioning**
Air-drying
Milling < 1 mm

→ **Soxhlet extraction water**
Aqueous extract

→ **Soxhlet extraction ethanol**
Ethanolic extract

**•Total phenolic content (Folin-Ciocalteu method)**
**•Total flavonoid content (aluminum chloride colorimetric method)**
**•ABTS radical scavenging and Ferric Reducing Antioxidant Power (FRAP) assays.**

## Results and discussion

### Bioactive properties

| Avocado part | Pharmacological action | Bio-compound | Study type[a] | Ref. |
|---|---|---|---|---|
| Stone | Antioxidant and cancer inhibitory activity | Polyphenols | IVT | [1] |
| Stone | Moderate activity against epimastigotes and trypomastigotes | trihydroxyheptadecane and trihydroxy-nonadecane derivatives | IVT | [2] |
| Stone and leaf | Pro-apoptotic effect on Jurkat lymphoblastic leukemia cells that are eliminated through an oxidative stress mechanism. | NR | IVT | [3] |
| Peel | Antibacterial activity against a wide range of infectious agents. Anti-oxidative properties. Antimicrobial properties, including fungi, yeasts, bacteria, and viruses. | Phenolic compounds Alkaloids | IVT | [4] |
| Leaf | Antinociceptive effect on UVB radiation-induced skin injury in mice. Treatment of the pain associated with sunburn. | Phenolic compounds such as (+)-catechin, chlorogenic acid and rutin | IVV | [5] |
| Leaf | Antioxidant activity. | Phenolic compounds, including phenolic acids and flavonoids | IVT | [6] |
| Stone | Anti-inflammatory activity. | Perseorangin | IVT | [7] |

[a]IVT: *in vitro*; IVV: *in vivo*

### Total phenolic content (TPC), total flavonoid content (TFC) and antioxidant activity determined by the ABTS and FRAP assays

| Part | Extraction method | Solvent | TPC (g GAE/kg) | TFC (g RE/kg) | ABTS (g TE/kg) | FRAP (g TE/kg) | Ref. |
|---|---|---|---|---|---|---|---|
| Peel | Soxhlet extraction | Water | 266 | 342 | 281 | 245 | This study |
| | Boiling | Water | 20 | 11 | ND | 23 | [8] |
| | Ultrasound-assisted extraction | 80% Ethanol | 64 | ND | 198 | ND | [9] |
| | Homogenization | 70% Acetone | 90 | ND | ND | ND | [10] |
| | Homogenization | 70% Acetone | 51 | ND | ND | ND | [11] |
| | Stirring in bath | 50% Ethanol | 31 | ND | 66 | 110 | [12] |
| | Homogenization | 50% Methanol and 70% acetone | 137 | ND | ND | 137 | [13] |
| | Heated & filtered | Water | 52 | 2 | ND | ND | [4] |
| Stone | Soxhlet extraction | Water | 18 | 27 | 25 | 19 | This study |
| | Boiling | Water | 6 | 3 | ND | 10 | [8] |
| | Ultrasound-assisted extraction | 80% Ethanol | 57 | ND | 162 | ND | [9] |
| | Acelerated solvent extraction | 50% Ethanol | ND | ND | 88 | ND | [14] |
| | Homogenization | 70% Acetone | 61 | ND | ND | ND | [15] |
| | Homogenization | 70% Acetone | 41 | ND | ND | ND | [11] |
| | Homogenization | 50% methanol and 70% acetone | 81 | | ND | 77 | [13] |
| | Microwave-assisted extraction | 70% Acetone | 307 | ND | 607 | ND | [16] |
| | Microwave-assisted extraction | 58.5% Ethanol | 254 | ND | 516 | ND | [16] |

GAE, gallic acid equivalents; RE, rutin equivalents; TE, Trolox equivalents.

## Conclusions

- ***In vitro* and *in vivo* studies suggest that avocado waste possesses bioactive properties. Phenolic compounds are generally the antioxidant compounds found in the extracts, but other phytochemicals have been identified in active extracts with anti-inflammatory and trypanocidal activity, including a glycosylated benzotropolone and trihydroxyheptadecane and trihydroxynonadecane derivatives.**
- **Nonetheless, further *in vivo* and clinical studies are required to confirm these studies that enable the development of functional ingredients for applications in the food, nutraceutical, pharmaceutical and cosmetic sectors.**

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