Antioxidant Properties of Orally Administered of Aqueous Extracts of Selected Medicinal Plants and Paracetamol in Human Volunteers: In vivo

Nessrin G. Alabdallat

1Department of Medical Laboratory Sciences, Majmaah University, Majmaah, Saudi Arabia.
Corresponding author: Nessrin G. Alabdallat (E-mail: n.alabdallat@mu.edu.sa)
Submitted: 19 February 2021 – Revised version received: 10 April 2021 – Accepted: 14 May 2021 – Published online: 26 June 2021

Abstract

Objectives In the current study, we used the herbal plant extracts and studied antioxidative value against the well-known drug Paracetamol.

Methods 54 Healthy volunteers were grouped into six groups, 5 groups drinking 200-250ml of aqueous extract from selected medicinal plants daily for 5 days and group six received 2 tablets of paracetamol (each tablet, 500 mg) daily for five days. Blood samples were taken before and 1 hr after the administration (samples 1 and 2, respectively) and then one day after the last dose of day five (sample 3). Serum total antioxidant status (TAS), red blood cell reduced glutathione (GSH), red blood cell malondialdehyde (MDA), and red blood cell superoxide dismutase (SOD) were used as assays.

Results Oral administration of aqueous extracts of studied plants increased significantly the serum total antioxidant status and red blood cell reduced glutathione after 5 days of administration compared to 0 time of administration. Data also showed that red blood cell superoxide dismutase increased significantly after five days of aqueous extracts of Zingiber officinale, Rosmarinus officinalis & Salvia triloba administration compared to 0 time of administration. Oral administration of aqueous extracts of Zingiber officinale, Rosmarinus officinalis, Verbena triphylla, caused a significant decrease in red blood cell malondialdehyde. Oral administration of Paracetamol for 5 days did not affect total antioxidant status red blood cell malondialdehyde, red blood cell reduced glutathione and red blood cell superoxide dismutase.

Conclusion Paracetamol is a very common antipyretic drug. It doesn’t show antioxidative property. On other hand some herbal products (Zingiber officinale, Rosmarinus officinalis, Verbena triphylla, Salvia triloba and Origanum syriacum) having antioxidative property. Therefore, a person taking herbal product can enhance the in vivo antioxidant capacity of body by increasing the antioxidative property of body.

Keywords Antioxidants, Malondialdehyde, Glutathione, Superoxide Dismutase

Introduction

Antioxidants neutralize oxidative stress and its deleterious effects on human health. Antioxidants can stop those free radical-mediated oxidative damages due to the scavenging properties of free radicals. Because of synthetic antioxidants has toxic properties, natural antioxidants are needed.1,2

Medicinal plants are potential sources of natural antioxidants. Antioxidant actions to Prevent oxidative damage are through free radical scavenging activity, inhibition of their formation due to metal chelating properties.3

Medicinal plants are widely used by people in Jordan, in fact people in Jordan taking a cup of herbal extract once or more daily as the habit of tea or coffee drinking. Paracetamol is one of the most popular and most commonly used analgesic and antipyretic drugs around the world, available without a prescription, both in mono- and multi-component preparations.

The in vitro antioxidant properties of studied herbs previously evaluated,4,5 although there are no published studies displaying there could be in vivo antioxidants properties of the orally administrated of studied plants. Therefore, this study proposed to see the in vivo effects of the following plants: Zingiber officinale (rhizomes), Rosmarinus officinalis (leaves), Verbena triphylla (leaves), Salvia triloba (leaves), Origanum syriacum (leaves) regarding antioxidant capacities.

Materials and Methods

Plant Material

The selected plants (Zingiber officinale (rhizomes), Rosmarinus officinalis (leaves), Verbena triphylla (leaves), Salvia triloba (leaves), Origanum syriacum (leaves)) were obtained from the local herbal stores in madaba, Jordan. The choice of plant material used was dependent on the large use of public as folk medicine.

Preparation of Aqueous Extracts

250 grams of each dried plants from the following medicinal plant (Salvia triloba, Origanum syriacum, Zingiber officinale, Rosmarinus officinalis, Verbena triphylla) was poiling with 12 Liter water for 10-15 mints, and then it covered and left soaking for 4-5 hr at 25 °C. After that the soaked or aqueous extract filled in clean bottles (each one contains 1.250 L).

Blood Samples

54 Healthy volunteers were grouped into six groups, (each group n = 9), their age and sex were shown in table 1. 5 groups drinking 200–250 ml of aqueous extract from the selected medicinal plants (Salvia triloba, Origanum syriacum, Zingiber officinale, Rosmarinus officinalis, Verbena triphylla) and 1 group drinking the Paracetamol (each tablet, 500 mg). Blood samples were taken before and 1 hr after the administration (samples 1 and 2, respectively) and then one day after the last dose of day five (sample 3). Serum total antioxidant status (TAS), red blood cell reduced glutathione (GSH), red blood cell malondialdehyde (MDA), and red blood cell superoxide dismutase (SOD) were used as assays.

Results Oral administration of aqueous extracts of studied plants increased significantly the serum total antioxidant status and red blood cell reduced glutathione after 5 days of administration compared to 0 time of administration. Data also showed that red blood cell superoxide dismutase increased significantly after five days of aqueous extracts of Zingiber officinale, Rosmarinus officinalis & Salvia triloba administration compared to 0 time of administration. Oral administration of aqueous extracts of Zingiber officinale, Rosmarinus officinalis, Verbena triphylla, caused a significant decrease in red blood cell malondialdehyde. Oral administration of Paracetamol for 5 days did not affect total antioxidant status red blood cell malondialdehyde, red blood cell reduced glutathione and red blood cell superoxide dismutase.

Conclusion Paracetamol is a very common antipyretic drug. It doesn’t show antioxidative property. On other hand some herbal products (Zingiber officinale, Rosmarinus officinalis, Verbena triphylla, Salvia triloba and Origanum syriacum) having antioxidative property. Therefore, a person taking herbal product can enhance the in vivo antioxidant capacity of body by increasing the antioxidative property of body.
All the tested plants: Zingiber officinale, Rosmarinus officinalis, Verbena triphilla, Salvia triloba, Nigella sativum & Origanum syriacum also caused a significant increase in erythrocyte reduced glutathione at the sixth day of administration. Paracetamol did not affect erythrocyte reduced glutathione (Table 3). However, erythrocyte superoxide dismutase increased significantly at the sixth day of administration of Zingiber officinale, Rosmarinus officinalis and Salvia triloba compared to 0 time of administration, whereas Origanum syriacum & Verbena triphilla although caused some increase in erythrocyte superoxide dismutase but did not reached to significant level (Table 4).

Oral administration of aqueous extracts of Zingiber officinale, Verbena triphilla, Rosmarinus officinalis caused a significant decrease in erythrocyte Malondialdehyde (MDA) at the sixth of administration. Paracetamol did not affect erythrocyte MDA (Table 5).

Table 1. Age and Sex of participant.

| Group                | Age (Mean±S.D.) | Female/Male |
|----------------------|-----------------|-------------|
| Origanum syriacum    | 35.8±14.7       | 4/5         |
| Salvia triloba       | 42.8±14.6       | 6/3         |
| Verbena triphilla    | 34±18.6         | 4/5         |
| Zingiber officinale  | 41.8±7.6        | 7/2         |
| Rosmarinus officinalis | 35.4±13.5    | 4/5         |
| Paracetamol          | 30.6±9.8        | 3/6         |

Table 2. Total Antioxidant Status (TAS) of the given medicinal plants. Each value represents the mean ± S.D., (n=9), *P value ≤ 0.05, compared to 0 time administration.

| Group                | TAS (mmol/l) |
|----------------------|--------------|
|                      | 0 time       | 1hr (day 1) | Day 6    |
| Rosmarinus officinalis | 1.14±0.3     | 1.31±0.27*  | 1.30±0.20* |
| Verbena triphilla    | 1.23±0.2     | 1.36±0.2*   | 1.37±0.22* |
| Zingiber officinale  | 1.08±0.16    | 1.20±0.10   | 1.24±0.12* |
| Salvia triloba       | 1.12±0.11    | 1.16±0.15   | 1.22±0.16* |
| Origanum syriacum    | 1.14±0.10    | 1.21±0.11   | 1.28±0.09* |
| Paracetamol          | 1.42±0.27    | 1.30±0.3    | 1.31±0.9  |

Table 3. Reduced glutathione (GSH) mg/g Hb of the given medicinal plants. Each value represents the mean ± S. D., (n=9), *P value ≤ 0.05, compared to 0 time administration.

| Group                | GSH          |
|----------------------|--------------|
|                      | 0 time       | Day 6   |
| Zingiber officinale  | 0.74±0.31    | 1.53±0.37* |
| Rosmarinus officinalis | 0.82±0.13    | 1.41±0.23* |
| Verbena triphilla    | 0.80±0.15    | 1.05±0.14* |
| Salvia triloba       | 0.54±0.09    | 0.87±0.10* |
| Origanum syriacum    | 0.73±0.11    | 0.80±0.10* |
| Paracetamol          | 0.73±0.12    | 0.75±0.13 |

Table 4. Superoxide dismutas (SOD) U/gHb of the given medicinal plants. Each value represents the mean ± S. D., (n=8), *P value ≤ 0.05, compared to 0 time administration.

| Group                | GSH          |
|----------------------|--------------|
|                      | 0 time       | Day 6   |
| Zingiber officinale  | 1005.4±298.0 | 1374.5±160.1* |
| Rosmarinus officinalis | 1106.6±118.3 | 1340.5±134.0* |
| Salvia triloba       | 868.0±167.1  | 997.5±192.4* |
| Verbena triphilla    | 1132.0±139.0 | 1210.3±119.2 |
| Origanum syriacum    | 1037.3±155.3 | 1098.0±181.5 |
| Paracetamol          | 1114.5±256.6 | 1091.2±172.1 |

**Serum TAS Assay:**
Serum TAS measured by TAS kit from Randox. The results were expressed as Milli mole per Liter.

**Red Blood Cell MDA**
Red blood cell MDA was determined as a measure of lipid per-oxidation according to stocks and dornmady’s method using thiobarbituric acid (TBA) as modified by sروح et al. All MDA concentrations were expressed as Nano mole per gram Hemoglobin.

**Red Blood Cell GSH**
Red blood cell GSH was determined using Ellman’s method with some modification. All GSH concentrations were expressed in Milligram per gram Hemoglobin.

**Red Blood Cell SOD Activity**
Red blood cell SOD was measured using kit from Randox. The results were plotted as Unit per gram Hemoglobin.

**Statistical Analysis**
Data were analyzed by using SPSS (Statistical Package for Social Sciences) software, version.17.

**Results**
All the tested plants: Rosmarinus officinalis, Verbena triphilla, Zingiber officinale, Salvia triloba & Origanum syriacum caused a significant increase in serum TAS at the sixth day of administration. Paracetamol did not affect serum TAS (Table 2).
The most likely explanation for the increased serum total antioxidant capacity would therefore be as a result of the intestinal absorption with consequent accumulation of the antioxidant compounds contained in the administered plant extracts. The serum concentration of the absorbed antioxidant compounds could also be dependent on their renal clearance which supposed to be dependent on the hydration state of the body & varied according to the chemical structure from one compound to another. This could explain the variation between the tested plants in regard to the time taken after the dose in increasing serum total antioxidant capacity (Table. 2). The increased erythrocyte content of reduced glutathione & activity of superoxide dismutase & the decreased erythrocyte content of MDA indicate the improved cellular antioxidant capacity of the body resulted from the administration of tested plant extracts. However, the present study could not tell the mechanism by which the tested plants increased cellular reduced glutathione & activity of superoxide dismutase & decreased cellular MDA. To our knowledge the present study is the first ever in vivo study in humans regarding the antioxidant properties of tested plants.

**Ethical Approval and Consent to Participate.**

This study was approved by the committee of the University of Jordan, and have therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki. Informed consent was obtained from each individual participants prior to their participation in the research.

**Competing Interests**

Author has declared that there are no conflicts of interest.

**Funding**

This study was funded by the deanship of scientific research, Majmaah University, Research Project Number (R-2021-143).

**Acknowledgments**

The author would like to thank Deanship of Scientific Research at Majmaah University for supporting this work under Project Number R-2021-143.

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