Effect of the Energy of Consciousness (The Trivedi Effect®) on Withania somnifera Root Extract Using Gas Chromatography – Mass Spectrometry and Nuclear Magnetic Resonance Spectroscopy

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Abstract: Withania somnifera (Ashwagandha) root extract is very popular ancient herbal medicine. The objective of the study was to characterize and evaluate the impact of The Trivedi Effect® - Energy of Consciousness Healing Treatment (Biofield Energy Healing) on phytoconstituents present in the ashwagandha root extract using GC-MS and NMR. Ashwagandha root extract was divided into two parts. One part was denoted as the control, while the other part was defined as The Trivedi Effect® - Biofield Energy Treated sample, which received The Trivedi Effect® - Energy of Consciousness Healing Treatment remotely from eighteen renowned Biofield Energy Healers. The GC-MS data indicated that the peak height and peak area of The Trivedi Effect® - Biofield Energy Treated sample were found to be altered compared with the control sample. The peak height of the phytoconstituents present in the treated ashwagandha sample was altered significantly in the range of -8.32% to 89.25% compared with the control sample. Similarly, the peak area of the treated sample was altered significantly in the range of -4.28% to 216.30% compared with the control sample. Overall, the change in the peak area% of the treated sample was significantly altered in the range of -18.29% to 170.18% compared with the control sample. The GC-MS and NMR analysis results identified the presence of withanolides such as glyco-withanolides, alkaloids, and sugars in the root extract in both the sample. The peak area of 2,3,4,5-tetrahydropyridazine (1), methyl ethyl sulfoxide (2), 5,6-dihydro-2-methyl-4(H)pyran-3,4-dione (4), diethoxy-2-methyl-propane (5), 2,3,4,5-tetrahydroxy-tetrahydro-pyran (6), and 3,4-dimethyl-2(3H)-furanone (7) were significantly increased by 170.18%, 58.21%, 7.74%, 139.50%, 23.16%, and 45.63%, respectively in the treated sample compared with the control sample. On the contrary, the peak area% of 2-hydroxy-γ-butyrolactone (3) was decreased by -14.96% in the treated ashwagandha compared with the control sample. From the results, it can be hypothesized that The Trivedi Effect® - Biofield Energy Treatment might have the impact on the intrinsic physicochemical properties of the
phystoconstituents present in the ashwagandha root extract and responsible for the alteration in the relative peak height/area of treated sample compared with the control sample. As a result, the concentrations of the phystoconstituents assumed to be increased in treated sample compared with the control sample. This treated ashwagandha root extract would be helpful for designing better nutraceutical/pharmaceutical formulations which might be providing a better therapeutic response against autoimmune diseases, nervous and sexual disorders, infectious diseases, antiaging, diabetes, cancer, immunological disorders, stress, arthritis, etc.

**Keywords:** Biofield Energy Healing Treatment, Biofield Energy Healers, Consciousness Energy Healers, The Trivedi Effect®, *Withania somnifera*, Withanolides, GC-MS, NMR

1. Introduction

Now-a-days herbal medicines have been getting exploring throughout the world for the prevention and treatment of various diseases because of their impressive therapeutic effects and fewer side effects compared with the allopathic medicines [1]. The roots of *Withania somnifera* is an ancient Rasayana herb and is popularly known as ‘Ashwagandha’ or winter cherry or ‘Indian ginseng’ [2, 3]. *W. somnifera* is mostly used in the herbal drugs and nutraceuticals for the prevention and treatment of various diseases such as nervous and sexual disorders, immunological disorders, infectious diseases, diabetes, cancer, ulcer, stress, arthritis, etc. As a tonic, it is useful to arrest the aging process, rejuvenate the body and boost the defense system against infectious disorders as well as promote the overall quality of life (QOL) [2-6]. The major active phystoconstituents of *W. somnifera* root extract contains highly oxygenated withanolides, alkaloids, numerous sitoindosides, withanamides, starch, reducing sugars, peroxidases, glycosides, dilaclol, withanicil, benzyl alcohol, 2-phenyl ethanol, benzoic acid phenyl acetic acid, 3,4,5-trihydroxy cinnamic acid, etc. [7-9]. Isolated withanolides from *W. somnifera* possess various pharmacological activities includes antioxidant, anticancer, immunomodulating, neuroprotective, hepatoprotective, anti-inflammatory, antiarthritic, antimicrobial, hypoglycaemic, etc. [10-12]. Therefore, a new proprietary herbomineral formulation was formulated that consisted of the herbal ashwagandha root extract along with minerals like zinc, magnesium, and selenium. This herbomineral formulation was designed as a nutraceutical supplement and can be used for the prevention and treatment of various human disorders.

Every living organism preserves some kind of unique quality, an élan vital or vital force, which contributes the ‘life’. From the ancient-time, this living force is known as Prana by the Hindus, qi or chi by the Chinese, and ki by the Japanese and is usually believed to create the source of life that is related with soul, spirit, and mind. Now-a-days, this hypothetical vital force is considered as the Bioenergetics Field. This energy field is a dynamic electromagnetic field surrounding the human body. The Biofield Energy is infinite and paradimensional. It can freely flow between the human and the environment that leads to the continuous movement or matter of energy [13, 14]. Thus, the human can harness energy from the earth, the “universal energy field” and transmit it to any living or non-living object(s) around the globe. The objects always receive the energy and respond in a useful way. This process is known as Biofield Energy Healing Treatment [15-17], Biofield (Putative Energy Fields) based Energy Therapies are used worldwide to promote health and healing [18]. The National Center of Complementary and Integrative Health (NCCIH) has been recognized and accepted Biofield Energy Healing as a Complementary and Alternative Medicine (CAM) health care approach in addition to other therapies, medicines and practices such as natural products, deep breathing, yoga, Tai Chi, Qi Gong, chiropractic/osteopathic manipulation, meditation, massage, special diets, homeopathy, progressive relaxation, guided imagery, acupressure, acupuncture, relaxation techniques, hypnotherapy, healing touch, movement therapy, pilates, rolling structural integration, mindfulness, Ayurvedic medicine, traditional Chinese herbs and medicines, naturopathy, essential oils, aromatherapy, Reiki, cranial sacral therapy and applied prayer (as is common in all religions, like Christianity, Hinduism, Buddhism and Judaism) [19]. The Biofield Energy Treatment (The Trivedi Effect®) has been extensively studied with significant outcomes in many scientific fields such as cancer research [20], altered antimicrobial sensitivity of pathogenic microbes in microbiology [21-23], biotechnology [24, 25], genetics [26, 27], changing the structure of the atom in relation to the various metals, ceramics, polymers and chemicals materials science [28-30], altered physical and chemical properties of pharmaceuticals [31, 32], nutraceuticals [33, 34], organic compounds [35-37], and improved overall growth and yield of plants in agricultural science [38, 39].

Modern sophisticated techniques such as high-performance liquid chromatography (HPLC) with photodiode array and evaporative light scattering detection, ultra-performance liquid chromatography (UPLC) electrospray ionization (ESI) normally hyphenated with mass spectrometry, gas chromatography (GC), nuclear magnetic resonance (NMR) are very useful for the metabolite profiling and identification of the crude herbal extract [8, 40-42]. The LC-MS/MS, GC-MS and NMR analysis of *W. somnifera* hydro-alcoholic root extract revealed the presence of several known withanolides, alkaloids, glycosides, sugar derivatives, etc. [43]. Therefor, this study was designed for the characterization of the phystoconstituents present in the hydro-alcoholic ashwagandha root extract and to evaluate the influence of The Trivedi Effect® - Energy of Consciousness
Healing Treatment on the phytoconstituents with the help of GC-MS and NMR.

2. Materials and Methods

2.1. Chemicals

Withania somnifera (Ashwagandha) hydro-alcoholic root extract was purchased from Sanat Product Ltd., India. All the other chemicals used in this experiment were analytical grade and procured from Sigma Aldrich, Bangalore, India.

2.2. Energy of Consciousness Treatment Strategies

Ashwagandha root extract powder was one of the components of the new proprietary herbomineral formulation, developed by our research team, and it was used per se as the test sample for the current study. The test sample was divided into two parts, one part of the test sample was treated with the The Trivedi Effect® - Biofield Energy Treatment by renowned Biofield Energy Healers and defined as The Trivedi Effect® - Biofield Energy Treated sample, while the second part of the test sample did not receive any sort of treatment and defined as untreated or control ashwagandha root extract sample. The group of eighteen Biofield Energy Healers who participated in this study performed The Trivedi Effect® - Energy of Consciousness Healing Treatment remotely to the test sample. Eleven of the Biofield Energy Healers were located in the U.S.A., four in Canada, one in Ireland, one in the United Kingdom, and one in Russia performed the Biofield Energy Treatment on the test sample that was located in the research laboratory of GVK Biosciences Pvt. Ltd., Hyderabad, India. This Biofield Energy Treatment (The Trivedi Effect®) was provided for 5 minutes through Healer’s Unique Energy Transmission process remotely to the test sample under the laboratory conditions. None of the Biofield Energy Healers in this study visited the laboratory in person, nor had any contact with the sample. Similarly, the control sample was subjected to “sham” healers for 5 minutes, under the same laboratory conditions. The sham healer did not have any knowledge about the Biofield Energy Treatment. After that, the treated and untreated samples were kept in similar sealed conditions and characterized thoroughly by GC-MS and NMR.

2.3. Characterization

2.3.1. Gas Chromatography-Mass Spectrometry (GC-MS) Analysis

GC-MS analysis of the test samples were analyzed by following the same procedure as mentioned in the recent literature [43] with the help of Agilent 7890B with 5977A Mass selective detector, USA equipped with a Quadrupole detector with pre-filter and flame ionization detector (FID). The control and Biofield Energy Treated extract powders were dissolved in dimethylsulfoxide to afford a 1 mg/mL stock solution. An aliquot of 1.0 µL of the stock solution was injected with a total run time of 44.0 min. The identification of analytes was performed using the retention time with a comparison of the mass spectra of the identified substances with references. Percent change in peak height, peak area, and peak area% were calculated using following equation 1:

\[
\text{% change in peak height/area/area%} = \left( \frac{P_{\text{Treated}} - P_{\text{Control}}}{P_{\text{Control}}} \right) \times 100
\]

Where, \(P_{\text{Control}}\) and \(P_{\text{Treated}}\) are the peak height, peak area, and peak area% of the control and Biofield Energy Treated samples, respectively.

2.3.2. Nuclear Magnetic Resonance (NMR) Analysis

\(^1\)H NMR and \(^13\)C NMR analysis of the test samples extract powders were performed on a 400 MHz VARIAN FT-NMR spectrometer and 100.00 MHz on a VARIAN FT-NMR spectrometer, respectively using the same procedure as mentioned in the recent literature [43]. \(^1\)H NMR multiplicities were labelled as singlet (s), doublet (d), doublet of doublet (dd), triplet (t), quartet (q), multiplet (m), broad (br), apparent (app). Chemical shifts (δ) were in parts per million (ppm) relative to the solvent’s residual proton chemical shift (CD3OD, δ = 3.31, 4.80 ppm) and solvent’s residual carbon chemical shift (CD3OD, δ = 49.15 ppm) [44].

3. Results and Discussion

3.1. Gas Chromatography-Mass Spectrometry (GC-MS) Analysis

The control and treated W. somnifera root extract were analyzed by GC-MS. The total ion chromatograms (TIC) having the chromatographic peaks with the retention times are shown in Figure 1, which further helped for the qualitative comparison between the treated and untreated samples. The mass of the proposed metabolites corresponding to retention time (Rt) is described in Table 1. The metabolites are carefully identified with the help of reported published literature [43, 45-48] and mass spectrometry Data Centre, NIST (http://www.nist.gov) in order to overcome the complex and overlapping of spectra to identify the correct molecule.

The TIC of the control sample of ashwagandha root extract showed the peak at Rt of 11.36, 11.57, 12.19, 12.85, 13.26, 13.54, 13.80, 14.16, 14.29, 14.39, 15.77, 15.87, 16.28, 16.84, 30.16, 30.40, 31.60, 32.46, 32.65, and 32.86 min. Similarly, the treated ashwagandha shown the peak at Rt of 11.35, 11.56, 12.21, 12.87, 13.28, 13.56, 13.83, 14.18, 14.31, 14.40, 15.76, 15.87, 16.28, 16.84, 30.16, 30.40, 31.60, 32.46, 32.65, and 32.86. Several Rt in the TIC indicated the presence of numerous metabolites in the root extract. These results revealed that Rt of the treated and control samples of ashwagandha were nearly similar. From the results, it is concluded that, the polarity of the metabolites in the treated ashwagandha was not altered compared with the control sample.

The peak height and peak area of each peak in the TIC were calculated for both the samples and found to be altered in the treated sample compared with the control sample (Table 1). The change in the peak height of metabolites in the
treated ashwagandha was significantly altered in the range of -8.32% to 89.25% compared with the control sample (Table 1). The total peak heights of the metabolites significantly increased by 5.58% compared with the control sample (Table 1). Similarly, the change in the peak area of metabolites in the treated ashwagandha was significantly altered in the range of -4.28% to 216.30% compared with the control sample (Table 1). The total peak area was significantly increased by 10.07% in the treated sample compared with the control sample (Table 1). Overall, the change in the peak area% of the treated sample was significantly altered in the range of -18.29% to 170.18% compared with the control sample.

The peak area results indicated the relative concentration (amount) of the metabolites present in the sample. In a GC analysis, the area under the peak is proportional to the amount of analyte injected onto the column [49]. Mathematically:

\[ A = k C \]

Where, A: peak area; C: concentration of sample; k: constant.

In many cases, the peak areas of metabolites of the treated sample were increased compared with the control sample. Therefore, qualitatively the relative concentration of the metabolite in treated ashwagandha was assumed to be increased compared with the control sample, provided the similar experimental condition (i.e. 1 mg/mL in DMSO with the injection volume of 1.0 µL).

Table 1. Retention times, peak heights, peak areas, % change in the peak height and peak area in TIC of Biofield Energy Treated sample compared with the control sample.

<table>
<thead>
<tr>
<th>W. somnifera control</th>
<th>W. somnifera Biofield Treated</th>
<th>% change in PH</th>
<th>% change in PA</th>
<th>% change in PA%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rt (min)</td>
<td>Peak Height</td>
<td>Peak Area</td>
<td>Peak Area%</td>
<td>Rt (min)</td>
</tr>
<tr>
<td>11.36</td>
<td>13536</td>
<td>213882</td>
<td>1.049</td>
<td>11.35</td>
</tr>
<tr>
<td>11.57</td>
<td>37434</td>
<td>1095743</td>
<td>5.373</td>
<td>11.56</td>
</tr>
<tr>
<td>12.19</td>
<td>6910</td>
<td>218140</td>
<td>1.070</td>
<td>12.21</td>
</tr>
<tr>
<td>12.85</td>
<td>19444</td>
<td>729891</td>
<td>3.579</td>
<td>12.87</td>
</tr>
<tr>
<td>13.26</td>
<td>9818</td>
<td>321767</td>
<td>1.578</td>
<td>13.28</td>
</tr>
<tr>
<td>13.54</td>
<td>25468</td>
<td>1152450</td>
<td>5.65</td>
<td>13.56</td>
</tr>
<tr>
<td>13.80</td>
<td>8718</td>
<td>321767</td>
<td>1.578</td>
<td>13.83</td>
</tr>
<tr>
<td>14.16</td>
<td>127383</td>
<td>4078103</td>
<td>19.996</td>
<td>14.18</td>
</tr>
</tbody>
</table>
The GC-MS analysis supported a lot to propose some of the metabolites from the control and treated samples (Table 2 and Figure 2). 2,3,4,5-Tetrahydropyridazine (1) at R_2 of 11.3 minutes and m/z = 84 [C,H_10N] was identified. This fragment suggested the presence of anaferine, anahygrine, and tropine like alkaloids in both the sample [45]. At R_0 of 11.5 minutes and m/z = 92 [C,H_12O,S]^+, methyl ethyl sulfoxide (2) was found, which indicated the presence of withanolide sulfoxide (8) like compound in both the extracts (Figure 3) [46]. Five membered lactone rings 2-hydroxy-gamma-butyrolactone (3) (C,H_12O,S; m/z = 102) and 3,4-dimethyl-2(3H)-furanone (7) (C,H_12O,S; m/z = 112) were identified at R_0 of 12.8 and 16.2 minutes, respectively (Figure 2). The five membered lactone rings represented the presence of withanolides like ixocarpalactone A (Figure 3) in ashwagandha root extract [47]. Various sugar sub units, i.e. 5,6-dihydro-2-methyl-4(H)-pyran-3,4-dione (4) (C,H_12O,S; m/z = 112), and 2,3,4,5-tetrahydroxy-tetrahydro-pyran (6) (C,H_12O,S; m/z = 151) were detected at R_0 of 13.8, and 15.7 minutes, respectively (Figure 2 and Table 2). This indicated the presence of 2-hydroxy-γ-butyrolactone (3) was decreased by -14.98% in the Biofield Energy Treated ashwaganda compared with the control sample.

The GC-MS analysis indicated that the peak heights% of the proposed compounds, i.e. 2,3,4,5-tetrahydropyridazine (1), methyl ethyl sulfoxide (2), 5,6-dihydro-2-methyl-4(H)-pyran-3,4-dione (4), diethoxy-2-methyl-propane (5), 2,3,4,5-tetrahydroxy-tetrahydro-pyran (6), and 3,4-dimethyl-2(3H)-furanone (7) were significantly increased by 170.18%, 58.21%, 7.74%, 139.50%, 23.16%, and 45.63%, respectively in the treated sample compared with the control sample. On the contrary, the peak area% of 2-hydroxy-γ-butyrolactone (3) was decreased by -14.96% in the Biofield Energy Treated ashwaganda compared with the control sample.

The identified metabolites from the GC-MS spectra of control and Biofield Energy Treated W. somnifera root extract.

<table>
<thead>
<tr>
<th>R_0 (min)</th>
<th>Proposed metabolite fragments</th>
<th>Mol. Formula</th>
<th>m/z</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.3</td>
<td>2,3,4,5-tetrahydropyridazine (1)</td>
<td>C_6H_10N</td>
<td>84</td>
</tr>
<tr>
<td>11.5</td>
<td>methyl ethyl sulfoxide (2)</td>
<td>C_6H_12O,S</td>
<td>92</td>
</tr>
<tr>
<td>12.8</td>
<td>2-hydroxy-γ-butyrolactone (3)</td>
<td>C_6H_12O,S</td>
<td>102</td>
</tr>
<tr>
<td>13.8</td>
<td>5,6-dihydro-2-methyl-4(H)-pyran-3,4-dione (4)</td>
<td>C_6H_12O,S</td>
<td>126</td>
</tr>
<tr>
<td>14.4</td>
<td>diethoxy-2-methyl-propane (5)</td>
<td>C_6H_12O,S</td>
<td>144</td>
</tr>
<tr>
<td>15.7</td>
<td>2,3,4,5-tetrahydroxy-tetrahydro-pyran (6)</td>
<td>C_6H_12O,S</td>
<td>151</td>
</tr>
<tr>
<td>16.2</td>
<td>3,4-dimethyl-2(3H)-furanone (7)</td>
<td>C_6H_12O,S</td>
<td>112</td>
</tr>
</tbody>
</table>

Table 2. The identified metabolites from the GC-MS spectra of control and Biofield Energy Treated W. somnifera root extract.

The GC-MS analysis supported a lot to propose some of the metabolites from the control and treated samples (Table 2 and Figure 2). Similarly, diethoxy-2-methyl-propane (5) (C,H_12O,S; m/z = 144) was identified at R_0 of 14.4 minutes (Figure 2 and Table 2).
The possible metabolites identified from the ashwagandha root extract are withanolide sulfoxide (WS; 8), withaferin A (WF A; 9), and withanone (WN; 10) (Figure 3), with support of the GC-MS metabolite profiling.

Figure 3. GC-MS spectra of W. somnifera root extract with proposed fragment of the compounds (1 to 7).
Figure 4. $^1$H-NMR spectra of control and Biofield Energy Treated sample with proposed metabolites (withanolide sulf oxide (WS), withaferin A (WF A), and withanone (WN)) of W. somnifera root extract.

$^1$H and $^{13}$C NMR spectra of control and treated ashwagandha did not show any significant alteration in the NMR shift value ($\delta$ ppm) (Figure 4 and Table 3). These results showed there was no effect of The Trivedi Effect® - Biofield Energy Treatment on the chemical structures of metabolites present in the Biofield Energy Treated ashwagandha root extract compared with the control sample.

Table 3. $^{13}$C-NMR data of the control and Biofield Energy Treated ashwagandha root extract.

<table>
<thead>
<tr>
<th>$^{13}$C NMR $\delta$ (ppm)</th>
<th>Control</th>
<th>Biofield Energy Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.2, 12.97, 16.8, 22.3, 23.9, 24.8, 26.7, 28, 9, 29.3, 31.02, 31.6, 38.98, 41.14, 46.9, 47.2, 48.2, 51.6, 54.9, 60.8, 61.9, 62.7, 69.7, 71.8, 72.9, 73.2, 74.3, 76.6, 77.9, 78.6, 82.4, 84.2, 86.4, 92.21, 98.53, 101.91, 103.91, 124.98, 129.44, 167.04</td>
<td>12.2, 12.9, 18.8, 22.3, 23.9, 24.7, 26.8, 28.8, 29.0, 31.6, 33.7, 38.9, 46.94, 47.15, 48.0, 51.63, 54.96, 58.93, 61.32, 62.9, 65.7, 69.9, 70.2, 71.8, 72.9, 73.2, 74.3, 76.5, 78.0, 81.2, 92.2, 103.9, 114.9, 124.9, 129.5, 156.2, 167.4</td>
<td></td>
</tr>
</tbody>
</table>

The overall analytical observations indicated significant alteration in the peak heights and peak areas of the phytoconstituents present in the treated ashwagandha root extract compared with the control sample. The Trivedi Effect® - Biofield Energy Healing Treatment assumed to be having a significant role in the alteration of the peak height/area of the phytoconstituents in the ashwagandha root extract. The Table 1 revealed that The Trivedi Effect® - Energy of Consciousness Healing Treatment might have the significant effect on the relative amount of the phytoconstituents.

4. Conclusions

This study evaluated the impact of The Trivedi Effect® - Energy of Consciousness Healing Treatment (Biofield Energy Treatment) on metabolites of W. somnifera root.
extract and helped in a qualitative comparison between the treated and untreated ashwagandha sample using GC-MS and NMR. The GC-MS data indicated that the peak height and peak area of the treated sample was found to be altered compared with the control sample. The peak height of the phytoconstituents present in the treated sample was altered significantly in the range of -8.32% to 89.25% compared with the control sample. Similarly, the peak area of the treated sample was altered significantly in the range of -4.28% to 216.30% compared with the control sample. Overall, the change in the peak area% of the treated sample was significantly altered in the range of -18.29% to 170.18% compared with the control sample. The GC-MS and NMR analysis results identified the presence of withanolides such as glyco-withanolides, alkaloids, and sugars in the root extract. Specifically, the peak area of 2,3,4,5-tetrahydropyrainazine (1), methyl ethyl sulfoxide (2), 5,6-dihydro-2-methyl-4(H)pyran-3,4-dione (4), diethoxy-2-methyl-propane (5), 2,3,4,5-tetrahydroxy-tetrahydro-pyran (6), and 3,4-dimethyl-2(3H)-furanone (7) were significantly increased by 170.18%, 58.21%, 7.74%, 139.50%, 23.16%, and 45.63%, respectively in the treated sample compared with the control sample. On the contrary, the peak area% of 2-hydroxy-γ-butyrrolactone (3) was decreased by -14.96% in the treated ashwagandha compared with the control sample. From the results, it can be hypothesized that The Trivedi Effect® - Energy of Consciousness Healing Treatment might have the impact on the intrinsic physicochemical properties of the phytoconstituents present in the ashwagandha root extract. This could be the probable cause of alteration in the relative peak height and peak area of the treated sample. As a result, the concentrations of the phytoconstituents is assumed to be increased in the treated sample compared with the control sample. This treated ashwagandha root extract would be helpful for designing better pharmaceutical/nutraceutical formulations which might be providing a better therapeutic response against various diseases such as diabetes mellitus, allergies and septic shock; stress-related disorders like sleep disorder, insomnia, anxiety, depression, Attention Deficit Disorder (ADD), Attention Deficit Hyperactive Disorder (ADHD), mental restlessness (mind chattering), brain frog, low libido, impotency, lack of motivation, mood swings, fear of the future, confusion, migraines, headaches, forgetfulness, overwhelm, loneliness, worthlessness, indecisiveness, frustration, irritability, chronic fatigue, obsessive/compulsive behavior and panic attacks; inflammatory diseases and immunological disorders like Lupus, Systemic Lupus Erythematosus, Hashimoto Thyroiditis, Type 1 Diabetes, Asthma, Chronic peptic ulcers, Tuberculosis, Hepatitis, Chronic active hepatitis, Celiac Disease (gluten-sensitive enteropathy), Addison Disease, Crohn's disease, Graves' Disease, Pernicious and Aplastic Anemia, Sjogren Syndrome, Irritable Bowel Syndrome (IBS), Multiple Sclerosis, Rheumatoid arthritis, Chronic periodontitis, Ulcerative colitis, Chronic sinusitis, Myasthenia Gravis, Atherosclerosis, Vasculitis, Dermatitis, Diverticulitis, Rheumatoid Arthritis, Reactive Arthritis, Alopecia Areata, Psoriasis, Scleroderma, Fibromyalgia, Chronic Fatigue Syndrome and Vitiligo; aging-related diseases like cardiovascular disease, arthritis, cancer, Alzheimer’s disease, dementia, cataracts, osteoporosis, diabetes, hypertension, glaucoma, hearing loss, Parkinson’s Disease, Huntington’s Disease, Prion Disease, Motor Neurone Disease, Spinocerebellar Ataxia, Spinal muscular atrophy, Amyotrophic lateral sclerosis, Friedreich’s Ataxia and Lewy Body Disease, chronic infections and much more.

### Abbreviations

- GC-MS: Gas chromatography-mass spectrometry; m/z: Mass-to-charge ratio; NMR: Nuclear magnetic resonance spectroscopy; R: Retention time.

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### References


