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Bitter frankincense water modulates hepatic enzyme activity in female patients with irritable bowel syndrome

Khamaal Hussein Abod Al-Khafaji*, Zahraa Mohammed Fakheir, Shaimaa Mohammed Ali Jasim

Department of Biology, Faculty of Science, University of Kufa, Iraq

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Abstract

This study aimed to determine and know the effect of bitter frankincense water on the levels of the functional liver enzymes in female patients with irritable bowel syndrome. This study was conducted in the consulting laboratories for pathological analyses in Iraq for the period from January to February 2025. The study was applied to 25 female patients, whose ages ranged from 20 to 65 years and healthy group consisted of 25 females, aged between 20 – 65. Bitter frankincense water, was bought from reputable local markets, enough to feed 25 female patients for two months. The amount was 3 ml/kg, and each female patient was given the dose according to his weight. This is done by dividing the dose in half, for the morning and for the evening. Before administering bitter frankincense water to female patients with irritable bowel syndrome, a five milliliter blood sample was obtained, and the liver enzymes were evaluated for the samples, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) and gamma-glutamyl transferase (GGT). Subsequently, samples were collected from the same group of female patients with irritable bowel syndrome to compare the effects of bitter frankincense water before and after giving. The results of the study showed a significant decrease ($P<0.05$) in the levels of liver function enzymes, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) and gamma-glutamyl transferase (GGT) in patients with irritable bowel syndrome in women after these patients took doses of FWB. The study's notable reduction in liver enzyme levels suggests that FWB may be a useful natural hepatoprotective treatment for people with IBS. These results encourage more investigation into FWB as a supplemental treatment for enhancing gut-liver axis balance and liver function in IBS patients.

Keywords: Bitter frankincense water, Liver function enzymes, Irritable bowel syndrome.

1. Introduction

Irritable bowel syndrome, or IBS, is a prevalent disorder that affects the gastrointestinal tract, which includes the stomach and intestines. Constipation, diarrhea, gas, bloating, cramps, and stomach pain are some of the symptoms. IBS is a chronic illness that requires continuing care. Only a small percentage of IBS sufferers experience severe symptoms. By controlling their food, lifestyle, and stress, some people can manage their symptoms. Counseling and medication might be used to manage more severe symptoms. IBS does not raise the risk of colorectal cancer or alter the tissue of the colon. Symptoms of a functional gastrointestinal illness include bloating, changes in bowel habits, and frequent stomach pain, all of which lower a patient's quality of life [1]. Four subtypes of IBS are distinguished based on the main symptom: mixed bowel habits (IBS-M), constipation (IBS-C), diarrhea (IBS-D), and unclassified (IBS-U). Approximately 4% of people globally have IBS [2], while prevalence varies by geography and diagnostic criteria [3,1]. Current studies acknowledge that certain patients have altered gut microbiota composition and function [4]. The condition may be linked to an unbalanced microbiota in some patients who develop it following gastrointestinal (GI) infections [1]. Because of the inherent characteristics of the resin, bitter frankincense water may taste a little bit harsh. A resin that comes from the Boswellia tree, frankincense can add earthy, resinous, and occasionally bitter qualities to water. Since frankincense contains substances like boswellic acids that give it its unique flavor, the bitterness is not out of the ordinary. The chemical substances included in frankincense resin, such as boswellic acids and other triterpenoids, are the main source of the bitterness in bitter frankincense water. These substances add to the resin's unique flavor and therapeutic qualities. Complex molecules with many rings of carbon atoms (terpenoid structures) and functional groups like carboxylic acids make up boswellic acids and other bitter chemicals present in frankincense [2]. Principal ingredients: Boswellic acids are the primary bioactive compounds found in frankincense resin. These molecules have a pentacyclic triterpenoid structure composed of five interconnected carbon rings. The hydrophobic acids give the resin its bitter, slightly astringent flavor. Because boswellic acids are thought to have medicinal and anti-inflammatory properties, frankincense is frequently utilized in traditional medicine. Additional terpenoids the

* Corresponding author.
E-mail address: khamaalh.alkhafaji@uokufa.edu.iq (K. H. A. Al-Khafaji).
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aromatic and resinous fragrance of frankincense is attributed to additional terpenoids, including beta-caryophyllene, limonene, and alpha-pinene. These substances can add to the overall sensory profile of bitter frankincense water, even though they aren't usually bitter. Volatile oils are also present in bitter frankincense water and contribute to its distinctive aroma as well as a subtle bitterness. The bitter taste of bitter frankincense water is primarily due to boswellic acids, which have a somewhat sour and bitter flavor when extracted into water or other solvents. These bioactive compounds are chiefly responsible for the characteristic bitter flavor. Boswellic acids and other terpenoid chemicals, which have molecular structures that contribute both therapeutic qualities and a distinctively bitter taste, are primarily responsible for the bitter flavor of bitter frankincense water [2].

Liver function changes in IBS., According to certain research, there may be minor alterations in liver function or enzyme levels in people with IBS. Alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), and gamma-glutamyl transferase (GGT) are examples of common liver enzymes. These enzymes may be modestly increased in some IBS cases, which would suggest mild liver stress or dysfunction. These increases are often lower than those observed in liver conditions such as cirrhosis or hepatitis, though. Chronic stress and the gut-liver axis. Stress can affect liver function through the gut-liver axis, and it frequently makes IBS worse. Liver function may be impacted by gut inflammation or dysbiosis, which is an imbalance in gut flora, through this pathway. Hormonal changes in women, like those that occur during menstruation or pregnancy, can also make IBS symptoms and liver enzyme abnormalities worse [4]. Low-grade intestinal inflammation may be a symptom of IBS, particularly in its more severe forms. As the liver attempts to detoxify the body and metabolize inflammatory cytokines, this inflammation may cause alterations in the organ. Hormonal changes and stress, it is believed that both IBS and variations in women's liver enzymes are significantly influenced by stress and hormonal changes. Women are more likely than men to develop IBS, and they may experience more severe symptoms connected to the gut, such as diarrhea, constipation, or bloating. Any changes in liver enzymes seen in these women may also be related to this hormonal difference [3]. There are many studies that have encouraged the knowledge of the effect of different materials on the body of a living organism or the human body [5-11]. This study aimed to determine and know the effect of bitter frankincense water on the levels of the functional liver enzymes in female patients with irritable bowel syndrome.

2. Materials and Methods

A pre-prepared supply of bitter frankincense water was purchased from reputable local markets in an amount sufficient to provide treatment for 25 female patients over two months. The healthy group consisted of 25 females, aged between 20 and 65. The amount was 3 ml/kg, and each female patient was given the dose according to their weight. This is done by dividing the dose in half, for the morning and for the evening. Participants were instructed to maintain their usual diet and abstain from alcohol and new medications during the study. The intervention allocation was not randomized due to the clinical setting and patient compliance. However, enzyme analysis was performed in a blinded fashion by laboratory staff unaware of group allocation. An atomic absorption spectrophotometer was used to determine the minerals present in bitter frankincense water, which include magnesium (Mg), copper (Cu), potassium (K), manganese (Mn), zinc (Zn), iron (Fe), calcium (Ca), phosphorous (P), and sodium (Na) [12]. Diagnosis of IBS was based on Rome IV criteria and confirmed by a gastroenterologist. The inclusion criteria consisted of 50 female patients diagnosed with irritable bowel syndrome, aged between 20 and 65 years. Exclusion criteria included recent antibiotic use, and hepatotoxic medications, hepatitis, non-alcoholic fatty liver disease, pancreatic disease, oncological or infectious diseases and any disease that can affect the search results.

2.1. Measurement the liver function enzymes

Human ELISA Kit, the manufacturing company (Elabscience company) for measuring human alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels in serum, while the human ELISA Kit alkaline phosphatase (ALP) and gamma glutamyl transferase (GGT) was supplied by (Fine Biotech Co., Ltd) for measuring their levels in serum, According to the working method used in the kit prepared by the companies.

2.2. Collection of blood samples

Before administering bitter frankincense water to female patients with irritable bowel syndrome, a five-milliliter blood sample was obtained, and all liver enzymes were evaluated in the samples. These female patients with irritable bowel syndrome were then given an amount was 3 ml/kg, and each patient was given the dose according to their weight. This is done by dividing the dose in half, for the morning and for the evening, for two months. Subsequently, samples were collected from the same group to compare the effects of bitter frankincense water before and after. Blood was centrifuged for 15 minutes at 3000 rpm to extract the serum, which was then pipetted into new, disposable Eppendorf tubes and stored at -20°C.

2.3. Statistical analysis

Graphpad Prism version 8.0.2 (263), 2019 for Windows software packages, was used to analyze the study's data. The data were organized as Mean ± Standard deviation (SD) an unpaired and paired sample t-test was used to compare the two groups. The EXEL program in Microsoft Office 2010 was used to make each figure. Statistical significance was defined as a P value of less than 0.05.

3. Results

3.1. Alanine aminotransferase (ALT) level

The effect of bitter frankincense water on the level of the enzyme ALT in patients with irritable bowel syndrome The results exhibit significant increase ($P < 0.05$) in serum (ALT) level of patient (P) group (69.22 ± 11.23 U/L) compared with healthy (H) group (25.96 ± 5.41U/L) while (FWB) group (48.76 ± 0.13 U/L) exhibit significant decrease ($P < 0.05$) in serum (ALT) level compared with patient (P) group (Figure 1).

3.2. Aspartate aminotransferase (AST) level

The effect of bitter frankincense water (FWB) on serum AST levels in patients with irritable bowel syndrome

was evaluated. The results showed a significant decrease ($P < 0.05$) in serum AST levels in the FWB-treated group (45.30 ± 2.11 U/L) compared to the patient (P) group (63.2 ± 8.42 U/L). Additionally, the patient (P) group exhibited a significant increase ($P < 0.05$) in serum AST levels compared to the healthy (H) group (23.58 ± 4.71 U/L) (Figure 2).

3.3. Alkaline phosphatase (ALP) level

The effect of bitter frankincense water on the level of the enzyme ALP in patients with irritable bowel syndrome. The results exhibit significant decrease ($P < 0.05$) in serum (ALP) level of (FWB) group (143.2 ± 0.7 U/L) compared with patient (P) group (151.42 ± 4.93 U/L) while patient (P) group exhibit significant increase ($P < 0.05$) compared with healthy (H) group (69.38 ± 6.61U/L) (Figure (3).

3.4. Gamma-glutamyl transferase (GGT) level

The effect of bitter frankincense water (FWB) on serum gamma-glutamyl transferase (GGT) levels in patients with irritable bowel syndrome was evaluated. The results showed a significant decrease ($P < 0.05$) in serum GGT levels in the FWB-treated group (39.42 ± 0.72 U/L) compared to the patient (P) group (48.92 ± 5.09 U/L). Additionally, the patient (P) group showed a significant increase ($P < 0.05$) in GGT levels compared to the healthy (H) group (18.8 ± 3.35 U/L) (Figure 4).

4. Discussion

The dosage was based on traditional use in regional herbal practices and prior animal studies, 3ml/kg. This concentration demonstrated anti-inflammatory and antioxidant efficacy without significant signs of toxicity [13,14]. This dose is presumed to deliver effective levels of bioactive compounds, particularly boswellic acids, which have been widely associated with pharmacological activity. Moreover, traditional medicinal use supports the tolerability of this regimen, with no major adverse effects reported following oral administration. Nevertheless, clinical safety data in humans remain limited, highlighting the need for further controlled trials to confirm efficacy and establish maximum safe intake levels [15]. The study focused on females due to the higher prevalence of IBS and distinct hormonal and clinical patterns in women [16,17,18]. The study findings show that the female patient (P) group with an IBS diagnosis had significantly higher serum alanine aminotransferase (ALT) levels in comparison to the female healthy (H) group. This discovery raises the possibility of a connection between IBS and changed liver enzyme activity, which could be a sign of underlying hepatic stress, systemic inflammation, or IBS-related metabolic disorders. Hepatic impairment and functional gastrointestinal diseases have been linked in previous research, possibly as a result of endotoxemia, increased intestinal permeability, and interactions between the gut and liver axis, which may lead to hepatic inflammation and elevated enzymes [19]. Interestingly, blood ALT levels were significantly lower in the female IBS patients treated with bitter frankincense water compared to the untreated IBS patient group. This implies that bitter frankincense water may have hepatoprotective properties. Frankincense's bioactive ingredients, including terpenoids and boswellic acids, have been shown to have hepatoprotective, antioxidant, and anti-inflammatory effects. By decreasing oxidative stress and regulating immunological responses, these

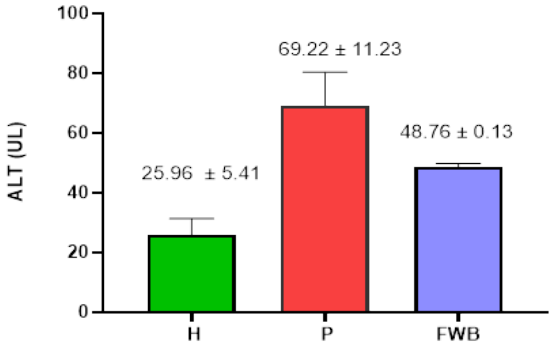

Fig. 1. Comparison of serum ALT levels among female patients with irritable bowel syndrome, FWB-treated female patients with irritable bowel syndrome, and healthy female controls.

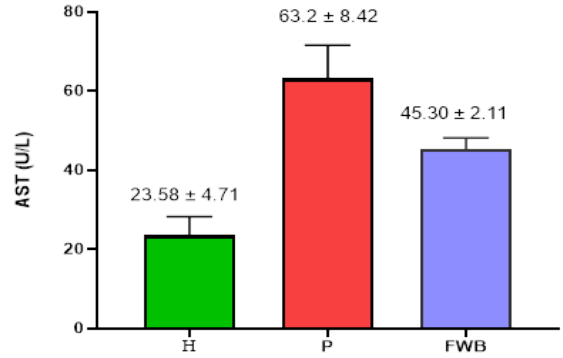

Fig. 2. Comparison of serum AST levels among female patients with irritable bowel syndrome, FWB-treated female patients, and healthy female controls.

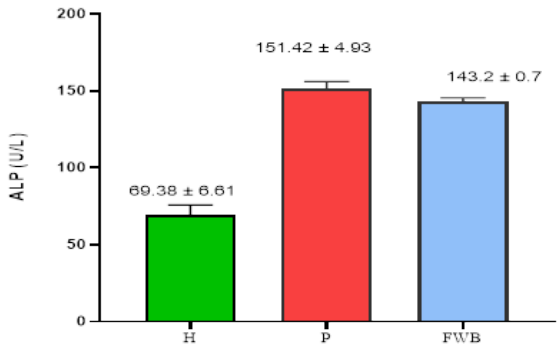

Fig. 3. Comparison of serum ALP levels among female patients with irritable bowel syndrome, FWB-treated female patients, and healthy controls.

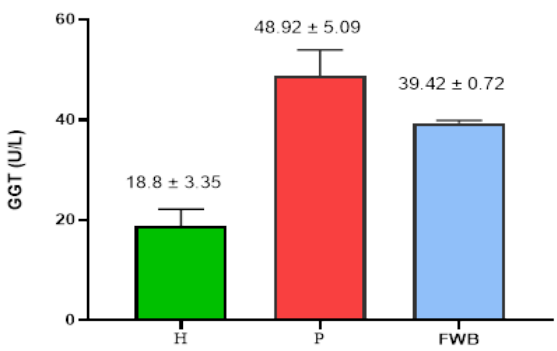

Fig. 4. Comparison of serum GGT levels among female patients with irritable bowel syndrome, FWB-treated female patients, and healthy controls.

substances may help to improve liver function and lessen hepatic inflammation [20]. By improving intestinal integrity and lowering systemic inflammation, the bitter frankincense water female group's reported decrease in ALT levels suggests that this natural treatment may have positive impacts on liver function in IBS patients. To clarify the precise mechanisms by which bitter frankincense water affects liver function in IBS patients, more mechanistic research is needed [21]. Further clinical trials with larger sample sizes and longer intervention times would also be beneficial to validate these results and evaluate possible therapeutic uses. The results indicate that drinking bitter frankincense water may provide hepatoprotective advantages by lowering blood ALT levels in affected patients, and that IBS may be linked to high ALT levels, suggesting potential liver involvement. These findings call for more research to examine frankincense's potential as a treatment for hepatic changes brought on by IBS [22].

The results exhibit significant decrease in serum (AST) level of female patient bitter frankincense water group compared with female patient (P) group, while female patient (P) group exhibits significant increase in serum (AST) level compared with female healthy (H) group according to the study's findings. This increase raises the possibility of a connection between IBS and hepatic dysfunction, which could result from systemic inflammation, increased intestinal permeability, and interactions between the gut and liver axis. According to earlier studies, people with IBS frequently show symptoms of oxidative stress, low-grade systemic inflammation, and metabolic abnormalities, all of which may be linked to changed liver enzyme levels [23,24]. Remarkably, when compared to the IBS patient group, the administration of bitter frankincense water caused a significant drop in serum AST levels. This research points to bitter frankincense water possible hepatoprotective function, which may be mediated by its gut-modulating, antioxidant, and anti-inflammatory qualities. Bioactive substances, including boswellic acids and terpenoids, which are found in frankincense, which is derived from Boswellia species, are known to have hepatoprotective effects via regulating oxidative stress, inflammatory cytokines, and lipid metabolism [25,26]. Bitter frankincense water may lower AST levels by improving intestinal barrier function, which lowers endotoxemia and systemic inflammation—two factors that are known to contribute to hepatic stress in people with IBS [27]. Furthermore, frankincense's antioxidant qualities may reduce AST levels by reducing hepatic oxidative damage [28]. These findings demonstrate the potential therapeutic advantages of bitter frankincense water in the treatment of hepatic changes associated with IBS.

The results exhibit significant decrease in serum (ALP) level of female patient bitter frankincense water group compared with female patient (P) group, while patient (P) group exhibits significant increase compared with the female healthy (H) group. The study's results show that the female patient (P) group with irritable bowel syndrome (IBS) had significantly higher serum alkaline phosphatase (ALP) levels ($P < 0.05$) than the female healthy (H) group. Hepatobiliary dysfunction, problems with bone metabolism, and systemic inflammation are frequently linked to elevated ALP levels [29]. The gut-liver axis, which includes reciprocal interactions between the gastrointestinal tract and hepatic metabolism, may be altered in IBS, as evidenced by elevated ALP levels. According to earlier research, liver enzyme abnormalities, including raised ALP levels, may result from chronic low-grade inflammation and increased intestinal permeability in IBS [30]. Remarkably, when bitter frankincense water was administered, serum ALP levels were decreased in comparison to the IBS female patient group. This implies that bitter frankincense water may have a hepatoprotective impact, which could be mediated by its antioxidant and anti-inflammatory qualities. Bioactive substances, including boswellic acids and terpenoids, which are found in frankincense, which is derived from Boswellia species, have been demonstrated to alter inflammatory pathways, enhance liver function, and lessen oxidative stress [26]. Reducing systemic inflammation, which is known to contribute to changed liver enzyme levels in IBS, may be part of bitter frankincense water hepatoprotective mechanism. Additionally, frankincense has been shown to improve intestinal integrity, which lowers endotoxemia and the hepatic stress that follows [27]. Bitter frankincense water may help restore normal ALP levels by reducing oxidative damage and inflammatory cytokine activity, which could have therapeutic effects for IBS patients with hepatic involvement [28]. The observed reduction in ALP levels after administering bitter frankincense water points to a possible hepatoprotective impact, most likely due to its gut-modulating and anti-inflammatory qualities.

The results exhibit significant decrease in serum (GGT) level in female patient bitter frankincense water group compared with the female patient (P) group, while female patient (P) group exhibits significant increase in serum (GGT) level compared with female healthy (H) group. The study's findings show that the female patient (P) group with irritable bowel syndrome (IBS) had significantly higher blood gamma-glutamyl transferase (GGT) levels than the healthy (H) group. Elevation of GGT, a crucial enzymatic indicator of oxidative stress and hepatobiliary function, may indicate hepatic involvement in the pathogenesis of IBS. According to recent research, IBS may be linked to raised GGT levels through systemic inflammation, increased intestinal permeability, and disruptions in the gut-liver axis. Furthermore, as GGT is essential for glutathione metabolism and oxidative stress has been linked to IBS, its elevated activity might be an adaptive reaction to oxidative damage [31]. Remarkably, when bitter frankincense water was administered, serum GGT levels significantly decreased ($P < 0.05$) in comparison to the IBS patient group. According to this research, bitter frankincense water may have a hepatoprotective impact that is mediated by its anti-inflammatory and antioxidant qualities. Boswellia species are the source of frankincense, which is high in bioactive substances like terpenoids and boswellic acids. These compounds have been shown to have hepatoprotective effects by lowering inflammatory cytokines, modifying oxidative stress, and enhancing liver function [32]. Because bitter frankincense water improves intestinal barrier integrity and lowers endotoxemia, which both lead to hepatic stress and enzyme increase in IBS patients, it may be responsible for the observed decrease in GGT levels after FWB therapy [27]. Furthermore, frankincense's antioxidant qualities might aid in reestablishing glutathione homeostasis, which would lessen the elevation of hepatic enzymes brought on by oxidative stress [33]. According to these results, bitter frankincense water may be able to help

treat the liver damage brought on by IBS. Higher GGT levels in IBS patients may be a reflection of oxidative imbalance and hepatic stress. The observed decrease in GGT levels after administering bitter frankincense water points to a hepatoprotective function, most likely because of its gut-modulating and antioxidant properties. These results call for more research to determine the therapeutic advantages of frankincense in the treatment of IBS and liver health. While our sample size was based on available patients during the study period, we acknowledge this limitation and need for larger trials.. (FWB) may reduce liver enzyme levels in IBS patients through modulation of the gut–liver axis. In IBS, particularly the diarrhea-predominant and mixed subtypes, increased intestinal permeability ("leaky gut") may allow translocation of bacterial endotoxins such as lipopolysaccharides (LPS) into the portal circulation, triggering hepatic inflammation and elevated liver enzymes [34]. FWB contains boswellic acids, which are known to inhibit pro-inflammatory mediators via suppression of 5-lipoxygenase (5-LOX) and nuclear factor-kappa B (NF-κB) pathways [35]. This anti-inflammatory activity may reduce intestinal inflammation, restore tight junction integrity (e.g., via upregulation of occludin and claudin), and thereby limit LPS leakage. In animal models, Boswellia extracts have been shown to reduce systemic cytokines such as TNF-α and IL-6, while also lowering alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels in chemically induced liver injury [36]. Although clinical data in IBS patients are limited, these findings support the hypothesis that FWB may attenuate liver inflammation indirectly by improving intestinal barrier function and reducing the hepatic inflammatory load.

The results of the study show that female patients with irritable bowel syndrome (IBS) who receive bitter frankincense water have significantly lower levels of liver enzymes such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), and gamma-glutamyl transferase (GGT). Bitter frankincense water lessens the hepatic burden in IBS patients by restoring liver enzyme equilibrium through the mitigation of these pathological processes. These results offer encouraging new information about the therapeutic effect of bitter frankincense water in liver dysfunction linked to IBS; more clinical studies with bigger sample sizes and longer follow-up times are required. This study's notable reduction in liver enzyme levels suggests that bitter frankincense water is a useful natural hepatoprotective treatment for females with IBS. These results encourage more investigation into bitter frankincense water as a supplemental treatment for enhancing gut-liver axis balance and liver function in IBS female patients.

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Ethical approval
This study comprised experiment protocols permitted by the Ethical Committee of the consulting laboratories for pathological analyses in Iraq and in which patients gave informed consent.

Data availability
All the data and materials in the manuscript are available upon request.

Conflict of interest
The authors declare no conflict of interest.

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