



Rhazes' insights on abortion and abortogenic drugs in relation to modern concepts

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Abstract

Abortion remains one of the most prevalent complications of pregnancy, contributing significantly to maternal mortality and presenting a substantial public health challenge. This study aimed to explore Rhazes' perspective on abortion and abortifacient medicinal plants he mentioned in *Kitāb al-Ḥāwī fī al-Ṭibb*. A detailed analysis of his seminal work, *Kitāb al-Ḥāwī fī al-Ṭibb*, was conducted. Relevant keywords such as abortion, stillbirth, fetus, drugs, and abortifacients were examined within *Kitāb al-Ḥāwī fī al-Ṭibb*. The analysis included Rhazes' viewpoints on abortion and the abortogenic drugs he mentioned, as well as their methods of administration, including oral dosage forms and vaginal formulations. Furthermore, relevant current literature was used to find the potential scientific rationales for Rhazes' insights. Our findings indicate that Rhazes contributed to obstetrics and gynecology as he discussed abortion, its prevention, and management in his book. Also, he identified various medicinal plants with potential abortogenic properties. Rhazes explained various administration methods, including rub, decoction, inhalation, suppository, enema, incense, and water bath. Even though his clinical practices and detailed observations provide a rich context for understanding the historical use of these agents, evidence-based medical practices need to be conducted to cleave potentially usable parts of Rhazes' perspectives and his approaches to the prevention and treatment of abortion. Moreover, there is a pressing need for well-designed randomized clinical trials to rigorously evaluate the potential efficacy and safety of the medical insights and the potential therapeutic herbal agents he described.

Keywords Rhazes · Abortion · Pharmacology · Toxicology · Persian medicine · Unani medicine

Introduction

Abortion is a significant complication of pregnancy and a leading cause of maternal mortality, representing a serious public health issue (Harper et al. 2023). Approximately 73 million induced abortions occur globally each year, with 61% of unintended pregnancies and 29% of all pregnancies resulting in induced abortions (Bearak et al. 2020). Alarmingly, unsafe abortions contribute to 4.7 to 13.2% of maternal deaths annually (Say et al. 2014). In developed nations, the mortality rate from unsafe abortions is estimated at 30 deaths per 100,000 procedures, while in developing countries, this figure escalates to 220 deaths per 100,000 (Ganatra et al. 2017). In developing regions, an estimated 7 million women seek hospital treatment annually for complications arising from unsafe abortion (2015). Economically, these

complications impose a burden of approximately US\$553 million per year in post-abortion care costs, alongside \$922 million in lost income due to long-term disabilities (2008). Safe abortions, when performed under appropriate medical conditions, significantly reduce maternal mortality (Kim et al. 2020). However, barriers to accessing safe medical abortion often drive women to resort to unsafe methods, particularly in countries with lax legal frameworks. This situation disproportionately affects young women from low socioeconomic backgrounds, leading to preventable deaths and health complications (Arambepola et al. 2016; Frederico et al. 2018). Therefore, access to safe and comprehensive medical care for abortion is of greater importance to achieve an improved level of health and well-being of women which in turn leads to a healthy society (Costescu et al. 2016; Organization 2003).

The contemporary management of early pregnancy termination increasingly relies on medications such as misoprostol

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and mifepristone, which are effective and cost-efficient alternatives to surgical procedures (Lui and Ho 2020). Nevertheless, these drugs can have side effects, including gastrointestinal discomfort and, in rare cases, severe complications like uterine rupture. Therefore, special attention has been paid to traditional medicine as an alternative and complementary option (Cubo Nava et al. 2019). Historically, ancient Iranians condemned abortion, equating it with the severance of life and divine blessings. Consequently, the punishment for abortion was viewed similarly to that for intentional murder, leading to resistance from both medical practitioners and religious leaders (Yarmohammadi et al. 2013). Ancient texts, such as the Avesta and Vendidad, reference abortifacient drugs, indicating a historical understanding of their use. Moreover, ancient Persians utilized inhalation methods involving abortogenic incense to manage abortion (Nekoolaltak et al. 2012). The use of medicinal plants has been common in ancient Persia and other countries since old times (Sewell and Rafieian-Kopaei 2014; Mollazadeh et al. 2015). The application of medicinal plants for medicinal purposes has persisted throughout history, with a growing recognition of their potential benefits in reducing the side effects associated with medical and surgical abortions. However, there remains an issue among pregnant women regarding the safety of herbal remedies, even though some can pose risks to both the mother and fetus (Graul et al. 2010). At the same time, most pregnant women think that herbal medicines do not interfere with the function of the fetus and mother, but may cause specific side effects of the fetus and mother or drug interaction. (Oduyebo et al. 2016) The potential impacts of indiscriminate use of medicinal plants are embryotoxicity, teratogenicity, and abortion. Some herbal compounds can cross the placenta and reach the fetus. Phytochemicals and their metabolites are known to stimulate uterine contractions and hormonal imbalances that can lead to miscarriage. Changes in the hormonal profile can affect conception, induce teratogenic activity, terminate pregnancy, or cause congenital malformations (Bernstein et al. 2021). Traditional Persian medicine, enriched with clinical knowledge passed down through generations, parallels the Unani medical system in India, which also draws from ancient Persian scholarship, and thus can be applicable after evidence-based approvals (Abdipour Mehrian et al. 2024; Nasiri et al. 2023). One of the most significant figures in this tradition is Abū Bakr Muḥammad ibn Zakariyā al-Rāzī (865–925 AD), known as Rhazes that authored *Kitāb al-Ḥāwī fī al-Ṭibb* (Continens of Rhazes), an extensive medical encyclopedia that encompasses a wealth of information on medical practice (Orimi et al. 2023; Amrollahi-Sharifabadi et al. 2024; Hashempur et al. 2017). This book is written in Arabic in 22 volumes and is a large medical encyclopedia that, like most of Rhazes' other medical works, has been translated into the scientific languages of the world and has

been taught in European medical schools for years (Orimi et al. 2023). In this work, Rhazes has examined a number of medicinal plants with potential abortogenic properties and has described their characteristics and how they bring about dangerous side effects (Zarrintan et al. 2018). Recent research in revising abortion induction methods and seeking alternative and complementary medicine approaches for the mentioned matter has prompted us to the current contribution (Mokaberinejad et al. 2015; Dali et al. 2019; Chen et al. 2023). By examining Rhazes' views on abortion and the medicinal plants mentioned in *Kitāb al-Ḥāwī fī al-Ṭibb*, we aimed to contribute related historical knowledge. However, our findings are not recommended for use in contemporary medicine, including obstetrics and gynecology, before they have been fully approved by evidence-based medical approaches.

Materials and methods

This research is based on comprehensive research in the *Kitāb al-Ḥāwī fī al-Ṭibb*. In this study, inclusion criteria were the obtained data through using the keywords al-adwiyah al-musqīṭah lil-Janīn, adwiyah al-isqāt, yusahil al-wiladah, isqāt al-jinnah, tasqut al-ajinnah, akhrajā al-Janīn, yaṭraḥ al-jinnah, Yulqi al-walad, asqaṭa al-walad, daw,a yukhrij al-mashīma, qatl al-ajinnah al-aḥy, and akhrajā al-mawtā which were the English counterparts of abortogenic drugs, induced-abortion medications, facilitate difficult childbirth, fetus expulsion, expel the fetus, remove the fetus, deliver the fetus, aborting the fetus, drug to expel the retained placenta, fetocidal agents, and expel the stillbirth were searched in the book, analyzed, and presented in the form of text or table. Also, to adapt *Kitāb al-Ḥāwī fī al-Ṭibb*' data with modern concepts, we searched related literature in PubMed, Embase, Scopus, and Web of Science. Exclusion criteria were abortifacient mineral or animal drugs mentioned in *Kitāb al-Ḥāwī fī al-Ṭibb* as well as Rhazes' compound drugs. This research focused on simple botanical drugs.

Results

Rhazes' views on contributing factors for abortion

After discussing disorders related to the uterus, ovaries, and pregnancy, in *Kitāb al-Ḥāwī fī al-Ṭibb* (volume three, part nine), Rhazes explained the causes and contributing factors of abortion. He noted that abortion can occur during any trimester and discussed circumstances that may necessitate pregnancy termination to prevent maternal mortality. He emphasized specific situations

where abortion may be warranted, such as in young pregnant women who cannot endure the strain of pregnancy or in cases of uterine damage that prevents fetal expulsion, leading to intrauterine death. Other contributing factors included acute illnesses like high fever, severe blood loss, obesity, trauma, and intense emotional stress (Rhazes et al. 2001). Rhazes addressed signs of potential stillbirth, including the thinning of a pregnant woman's breasts, asserting that abortion should only be considered once these signs manifest. He listed various drugs linked to abortion, including strong medicines, laxatives, emetics, diuretics, and uterine relaxants, as well as substances like vinegar, *Cinchona succirubra*, and *Crocus sativus*. He cautioned that excessive use of strong diuretics or prolonged consumption of mild diuretics, such as celery and fennel seeds, can significantly increase the risk of miscarriage. Notably, he stated that "there is nothing more harmful to the fetus and more effective in aborting it quickly than the use of laxative drugs (al-adwiyah al-mushilah)" (Rhazes et al. 2001). Rhazes observed that abortion is more prevalent before the fourth month and after the seventh month of pregnancy, advising against the use of drugs or activities that could harm the fetus during these periods. He highlighted the need to avoid emmenagogue medicinal plants (al-adwiyah al-muder al-tamth), known for their abortogenic properties, during pregnancy. Furthermore, he recommended administering cleansing drugs via the vaginal route rather than orally, cautioning that these should be limited to the cervix and not reach the uterus. For cases involving a dead fetus, he suggested using strong abortifacient drugs, such as soda water and castor oil or decoctions of fenugreek and dates. He noted various methods, including oral medications, vaginal suppositories (farzaja), and incense, are effective for facilitating the removal of the retained placenta. He also mentioned potential side effects of abortion drugs, such as mental disorders associated with the consumption of *Bryonia alba* (Rhazes et al. 2001).

Rhazes' perspective on preventing abortion in pregnant women

Rhazes outlined several measures to prevent abortion in pregnant women. He advised against consuming spicy or bitter foods, such as unripe olives, and foods that may cause constipation, like chickpeas and sesame. He recommended a diet of easily digestible foods, discouraging heavy or hard-to-digest items, particularly at the beginning of pregnancy. He identified certain foods as beneficial for preserving the fetus, emphasizing those that strengthen the heart. The consumption of these foods is particularly encouraged

for pregnant women at risk of threatened abortion. Rhazes explicitly prohibited the use of laxatives during the first and last trimesters of pregnancy (Rhazes et al. 2001).

Rhazes' botanical abortifacients and fetidicidal agents

Rhazes listed approximately 86 medicinal plants with abortifacient and fetidicidal properties in *Kitāb al-Ḥāwī fī al-Ṭibb* (see Table 1) (Rhazes et al. 2001).

Rhazes' dosage forms and formulations of medicinal plants effective in inducing abortion

In *Kitāb al-Ḥāwī fī al-Ṭibb*, Rhazes detailed various medicinal plants used to induce abortion, noting their forms of application (see Table 2). These include the following:

- Tala: A thin liquid medicine applied to the skin equivalent to liniment.
- Tabikh: A water-boiled extract equivalent to decoction.
- Bukhūwr: An inhalational medicine that produces vapor.
- Humūwl: A cloth-soaked medicine for sustained release, applied rectally or vaginally.
- Farzaja: equivalent to vaginal suppository.
- Hughnih: Rectal application of liquid medicine equivalent to enema.
- Jūlūwus: A water bath infused with medicine.
- Tadkhin: Incense used for inhaling its smoke.

Rhazes believed that inhaling bukhūwr could effectively induce abortion. He also recommended water baths with abortifacient properties and described various vaginal suppositories made from medicinal plants. He categorized the preparations into three main forms: solid, liquid, and vapor, all aimed at facilitating medical abortion (Rhazes et al. 2001).

Rhazes' views on the description of the effectiveness of medicinal plants in abortion

Rhazes explained the potency of drugs in *Kitāb al-Ḥāwī fī al-Ṭibb* with different expressions, including "It works. It is a good medicine. It is potent and effects quickly. it expelled the fetus promptly. It is very potent" (see Table 1). He was also particularly interested in some herbal medicines that had an amazing effect on abortion as he described them with some phrases including "It is very surprising that it immediately ejects the fetus, it is very surprising that it immediately aborts the fetus, or it has an anti-abortion effect faster than any drug" (Rhazes et al. 2001).

Table 1 Botanical abortifacient and fetidical agents introduced in Rhazes’s *al-Hāwī ft al-Tibb*

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)					Plant part					Activity			
						Humūwl Far- zaja	Bukhūwr Tala (Rub- bing agents)	Hoghnihi Tabikhs (Enema) (Decoc- tion spray agents)	Jūlūws (Water bath)	Tadkhin (Smoke)	Root	Seed	Leaf	Flower	Extract		All	Abor- Fetus Placenta- Extrac- tor	
1	Zafārān	<i>Crocus sativus</i> L.	Iridaceae	Saffron	Crocetin, picrocrocin, kaempferol, safranal, phenol, delphinidin, flavonoids	It throws out the fetus very quickly			×								×	×	×
2	Soddāb	<i>Ruta graveolens</i> L.	Rutaceae	Common rue	Chalepensis, rutin, polyphenolic compounds	It will immediately kill the fetus	×	×									×	×	×
3	Holba	<i>Trigonella foenum-graecum</i>	Fabaceae	Fenugreek	Alkaloids, flavonoids, saponin compounds	It is one of the most powerful abortion drugs			×								×	×	×
4	Hummus	<i>Cicer arietinum</i> L.	Fabaceae	Chickpea	Flavonoid compounds	It is a good helper for expelling the fetus	×											×	×
5	Ghār	<i>Laurus nobilis</i>	Lauraceae	Bay laurel	Alkaloids, flavonoids, phenols and sterol compounds	The bark of the root of this plant will kill the fetus				×						×		×	
6	Semsem	<i>Sesamum indicum</i>	Pedaliaceae	Sesame	Lignans compounds such as sesamin, sesamol, sesaminol, and sesamolin	The liquid obtained by soaking it aborts the fetus	×									×		×	
7	Habb al-rashād	<i>Lepidium sativum</i>	Brassicaceae	Garden cress	Alkaloids, and flavonoid compounds.	It will have a very strong effect on killing the fetus.	×										×	×	
8	Al-fulayyah	<i>Mentha Pulegium</i> L.	Lamiaceae	European Penny royal	Essential oils such as pulegone and menthone	It has the property of killing the fetus.	×	×								×	×	×	

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)						Plant part				Activity		
						Humūl Far- zaja	Bukhūwr Tala (Rubbing agents)	Hoghniħ Tabikħis Julūwus Tadkhin (Enema) (Decoc- tion spray agents)	Root	Seed	Leaf	Flower	Extract	All	Abor- tifa- cient	Fetus	Extrac- tor	tor
9	Kharbaq- Abyad	<i>Veratrum album</i> L.	Melanthi- aceae	<i>White hel- lebore</i>	Steroidal alkaloid compounds such as jervine and veratramine.	×	×	×						×	×	×	×	×
10	Kharbaq- Aswad	<i>Helleborus niger</i> L.	Ranuncu- laceae	Hellebore	It will have a very strong effect on killing the fetus	×	×							×	×	×	×	×
11	Az-Zaqum	<i>Euphorbia resin- ifera</i>	Euphorbi- aceae	Euphorbia	3-O-glucosylir- hamnoside									×	×			
12	Al-saqamonyā	<i>Convolvulus scam- monia</i>	Convolvu- laceae	Scammony	Resciniferatoxin, 12-Deoxyphor- bol and Proresin- iferatoxin.	×								×	×			
13	Darcini	<i>Cinnamomum zeylanicum</i>	Lauraceae	Cinnamon	If women put it in their uterus, it will kill the fetus	×								×	×	×		×
14	Sakbmaj Qmah	<i>Ferula persica</i>	Umbellif- erae	Persian asa- foetida	Polyphenol, fla- vonoid, tannin, saponin, cardiac glycoside, it will cause an abortion and terpenoid.	×								×	×	×		
15	Susan	<i>Iris florentina</i>	Iridaceae	Florentine Iris	Resins gums, terpenoids, coumarins and essential oils.									×	×	×		

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)					Plant part				Activity	
						Humūl Far- zaja	Bukhūwr Tala (Rubbing agents)	Hoghniħ Tabikħs Julnuħs Tadkhin (Enema) (Decoc- tion spray agents)	Julnuħs (Water bath)	Tadkhin (Smoke)	Root	Seed	Leaf	Flower Extract	All	Abor- Fetus Placenta- Extractor
16	Burbūrāstn	<i>Cyclamen purpurascens</i>	Primulaceae	Sowbread	Triterpene saponins: (cyclamine)	Rubbing it on the belly of a pregnant woman will cause an abortion	×						×		×	×
17	Qasā al-Hemār	<i>Cucumis sativus</i>	Cucurbitaceae	Cucumber	Oxygenated tetracyclic triterpenes, cucurbitacin B and C	It has the negative effect on fetus	×							×		×
18	Al-Thuwya	<i>Thuja orientalis</i> L.	Arborvitae	Oriental Arbor Vitae	Thujones, bicyclic monoterpenes thujones, alpha-thujone, fenchone, beta-thujone	Using it as an enema will remove the fetus. And if it is used in the vagina, it will kill the live fetus and throw it out	×							×		×
19	Fāshrā	<i>Bryonia alba</i> L.	Labiatae	Bryony	Flavonoids compounds	Drinking it kills the fetus		×			×				×	×
20	Kharrūb	<i>Ceratonia siliqua</i> L.	Leguminosae	Carob tree	Flavonoids, tannins, and phenolic compounds	It has a powerful efficiency that no medicine can match		×		×		×	×		×	×
21	Hashishat Al-Dahab	<i>Lagocelia cumi- noides</i>	Apiaceae	Common wild cumin	Rosmarinic acid chlorogenic acid, hesperidin, hesperetin, vanillin	It works as an amazing abortogenic agent	×			×					×	×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Rhaze's prescription (Formulation)					Plant part				Activity		
						Humūwl Far- zaja	Bukhūwlr Tala (Rubbing agents)	Hoghniħ Tabikħs (Enema)	Jolūwus (Water bath)	Tadkhin (Smoke)	Root	Seed	Leaf	Flower Extract			
22	Khūwlinjān	<i>Alpinia officinarum</i> Hance	Zingiberaceae	Lesser galangal	Monoterpene etheroxide compounds such as 1,8-cineole	×			×						×	×	×
23	Lūwf	<i>Arcetium lappa</i> L.	Araceae	Burdock	Phytosterols, terpenes/terpenoids, seed, suppository and flavonoid compounds	×		×		×	×					×	
24	Yabrūħ	<i>Mandragora officinarum</i>	Solanaceae	Mandrake	Tropane alkaloids such as scopolamine and L-hyoscyamine.			×			×				×		×
25	Al-Ashnān	<i>Salicornia europaea</i> L.	Chenopodiaceae	Chenopodi-glasswort	Isorhamnetin-3-O-glucoside, 3-caffeoyl-4-dihydrocaffeoylquinic acid, and quercetin		×								×		×
26	Kondos	<i>Veratrum album</i> L.	Melanthiaceae	The false hellebore, white hellebore	Steroid alkaloids: e.g. protoveratrine, and alkaline esters such as jervine derivatives (furanopiperiti) e.g. cyclopamine										×		×
27	Kharwaa	<i>Ricinus communis</i> L.	Euphorbiaceae	Castor oil plant	Ricin and isopressic acid			×						×			×
28	Zaytūn	<i>Olea europaea</i>	Oleaceae	Olive	Fatty acids, Oleic acids and phenolic compounds			×						×			×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically Description Rhaze's prescription (Formulation)				Plant part				Activity			
					Humtūwl Far- zaja	Bukhtwrl Tala (Rubbing agents)	Hoghnlh Tablkhs (Enema)	Jūlwus (Water bath)	Tadkhln (Smoke)	Root	Seed	Leaf		Flower Extract	All	
29	Azriyūn	<i>Calendula officinalis</i> L.	Compositae	Pot Marigold	Polyphenols, triterpenoids, and saponins compounds	It is useful for abortion			×						×	×
30	Qirfah	<i>Cinnamomum bejolghota</i> (Buch.-Ham.) Sweet	Lauraceae	Dun Ye Gui	Phenolic compounds, terpenoids, flavonoids, flavon-3-ols, glucoside, proanthocyanidin, ong-chain fatty acids, alcohols	It has a strong abortogenic effect	×		×						×	×
31	Sarkhas	<i>Dryopteris filix-mas</i>	Polypodiaceae	Fern	Filicic acid, flavaspidic acid, filmaron, and flavonoids.	Drinking it will kill the living fetus			×		×				×	
32	Şābūniyah Makhzaniyah	<i>Saponaria officinalis</i> L.	Caryophyllaceae	Soapwort, bouncing-bet	Triterpenoid saponins: saponarinside A and B	It has a strong abortogenic effect	×								×	×
33	Kurub	<i>Brassica oleracea</i>	Brassicaceae	Cabbage	Phenethyl isothiocyanate and 3-Indolylmethyl glucosinolate	Placing flower suppositories will destroy that fetus	×					×			×	
34	Narijs	<i>Narcissus jonquilla</i> L.	Liliaceae	Daffodil, Jonquil	Isoquinoline alkaloids (Amaryllidaceae alkaloids) such as lycorine, galanthamine, homolycorine, haemanthamine	It has the property of killing and expelling the fetus	×								×	×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)						Plant part				Activity	
						Humūl Far- zaja	Bukhūwr Tala (Rub- bing agents)	Hoghmih Tabikhs (Enema)	Juluwus (Water bath)	Tadkhin (Smoke)	Root	Seed	Leaf	Flower	Extract	All	Abor- Fetus Placenta- Extrac- tor
35	Muql Azraq	<i>Commiphora mukul</i>	Burseraceae	Bdellium	Essential oil (0.4%) with phenylpropanoids: e.g. methylchavicol in unspecified quantities. Terpenoids: e.g. myrcene, dimyrcene, polymyrcene	It is one of the most powerful abortogenic drugs	×	×	×	×	×	×	×	×	×	×	×
36	Murr	<i>Commiphora myrrha</i>	Burseraceae	Myrrh	Volatile fraction: furanosesquiterpenes: e.g. curzerenone, methoxy-furanodien, furanoelevenes, furano-germacranes	It kills the fetus and takes out the placenta	×	×	×	×	×	×	×	×	×	×	×
37	Abhal	<i>Juniperus sabina</i> L.	Cupressaceae	Savin	Sabinyl acetate and Sabinene, deoxypodophyllotoxin, terpene	It kills the fetus and takes out the placenta	×	×	×	×	×	×	×	×	×	×	×
38	Qam Al-Ghazāl	<i>Cyclamen purpurascens</i> Miller	Primulaceae	Hardy cyclamen	Alkaloids, flavonoids, phenols, tannins, saponins, sterols, glycosides	It is one of the most powerful abortogenic drugs	×	×	×	×	×	×	×	×	×	×	×
39	Fuwaht	<i>Rubia tinctorum</i> L.	Rubiaceae	Madder	Purpurin and their derivatives, ruberythric acid, alizarin, primeveroside, pseudopurpurin, lucidin-primeveroside	It is fatal to the fetus	×	×	×	×	×	×	×	×	×	×	×
40	Tamr	<i>Phoenix dactylifera</i> L.	Palmaceae	Date -plam	Anthocyanins, phenolics, sterols, carotenoids, procyanidins, and flavonoids compounds	Cooked dates causes abortion	×	×	×	×	×	×	×	×	×	×	×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Rhaze's prescription (Formulation)					Plant part			Activity			
						Humūwl Far- zaja	Bukhūwlr Tala (Rubbing agents)	Hoghlnh (Enema)	Tablkhs (Decoc- tion spray agents)	Juluwus (Water bath)	Tadkhln (Smoke)	Root	Seed	Leaf	Flower Extract	All	Abor- tifa- cient for Extrac- tor
41	Baqdunis	<i>Apium petroselinum</i>	Apiaceae	Parsley	Phenylpropanoids, Smokmg myristicin, elem- icin, apiole						×				×	×	×
42	Alak Al-Anbat	<i>Pistacia terebinthus</i>	Anacardi- aceae	Terebinth	Monoterpenoids, sesquiterpenes, will monoterpenes, α-pinene	×					×				×	×	
43	Qemā	<i>Ferula gummosa</i> Boiss	Apiaceae	Galbanum	Monoterpene and sesquiterpene β-pinene, δ-3- carene, α-pinene, β-myrcene	×			×		×				×	×	×
44	Al-Tirmis	<i>Lupinus termis</i> L.	Legumi- nosae	Lupine	Sparteine, lupin- ine, trilupine, im- mediatly expel the fetus	×							×		×	×	×
45	Ashaq	<i>Dorema ammonia- cum</i>	Umbellif- erae	Ammoniac	Essential oils containing δ-cadinene, liguloxide, damorphene, α-selinene, β-selinene and α-himachalene.		×								×	×	
46	Zarāvand	<i>Aristolochia indica</i>	Aristolochi- aceae	Bereztzem	Aristolochic acid-I It causes abortion and the exit of the fetus	×	×		×						×	×	×
47	Harmal	<i>Peganum harmala</i>	Zygophyl- laceae	Wild rue	β-carbolines, harmaline, harminel, quinalosine alka- loids, vasicine, vasicinonel	×					×		×		×	×	×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)						Plant part				Activity	
						Humūl Far- zaja	Bukhūwr Tala (Rubbing agents)	Hoghmih (Enema) (Decoc- tion spray agents)	Juluwus (Water bath)	Tadkhin (Smoke)	Root	Seed	Leaf	Flower Extract	All	Abor- tifa- cient	Fetus Extrac- tor
48	Šhitaraj	<i>Plumbago indica</i> L.	Plumbagi- naceae	Ditany	Hydroxyl propyl betacyclodextrin and plumbagin	The very pungent smell of the egg will kill the fetus on the spot	×				×				×	×	×
49	Moshkīarāms̄hi	<i>Origanum dictamnus</i> L.	Lamiaceae	Ditany of Crete	Terpenes, resorcinol derivatives, flavonoids, dep- sides, neolignans and jasmonates	It will immediately abort the fetus	×		×						×	×	×
50	Bukhūr- MaryamCyclamen euro- paeum		Primula- ceae	Swinebread	Triterpene saponins, cyclamine	Its root has no coun- terpart among medi- cines and causes abortion	×	×	×	×	×				×		
51	Hanzal	<i>Citrullus colocyn- this</i>	Cucurbita- ceae	Bitter cucum- ber	Tannins, saponins, phenolic, flavonoids, terpenoids, alkaloids, anthranol, steroids, Cucurbitacin A, B, C, D, E, α-elaterin, caffeic acid, car- diac glycosides	It is stronger than other abor- togenic drug	×	×						×	×	×	×
52	Haša	<i>Coridothymus capitatus</i> /Thymus capitatus	Lamiaceae	Thymus capitatus	Thymol, carvacrol, linalool, γ-terpinene, pcy- mene, borneol, β-bisabolene	It expels the fetus		×				×				×	×
53	Basal	<i>Allium cepa</i> L.	Amarylli- daceae	Onion	Prostaglandins, β-sitosterol, kaempferol, myricital acid, ferulic acid	It causes the fetus to come out	×						×				×
54	Jintawryyah	<i>Centaureum minus Moench</i>	Gentian- aceae	Centaury	Terpenoids, xan- thones, phenolic acids	It is an abortifa- cient	×				×				×	×	×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Rhaze's prescription (Formulation)						Plant part	Activity		
						Humūl Far- zaja	Bukhūwr Tala (Rubbing agents)	Hoghmih Tabikhs (Enema)	Juluwus Tadkhin (Water bath)	Root	Seed	Leaf	Flower Extract	All	Abor-Fetus tifa- cient for Extrac- tor
55	Qamh Sifly	<i>Triticum aestivum</i> L.	Poaceae	Wheat	Oxyphytosterols, the removal of the placenta compounds, and the dead fetus	It causes the removal of the placenta compounds, and the dead fetus									
56	Kheiri Al-Asfar	<i>Cheiranthus cheiri</i> L./ <i>Erysimum cheiri</i> L.	Brassicaceae	Wallflower	Cardenolides, cheirotoxin, strophanthidin derivative	Eating it causes abortion and throwing it out									
57	Sawsan	<i>Iris ensata</i> Thunb	Iridaceae	Orris	Flavonoids, isoflavonoids, glycosides, tannins	It kills and expels the fetus									
58	Habb Al-Balsan	<i>Commiphora opobalsamum</i>	Burseraceae	Balsam of Mecca	Sabinene, terpinen-4-ol, a-pinene, cymene	It causes abortion and expulsion of the placenta and fetus									
59	Afsanfin	<i>Artemisia absinthium</i>	Compositae	Absinthium	Sabinol, sabinene, artemisia ketone	It causes abortion and expulsion of the placenta and fetus									
60	Al-Thum	<i>Allium sativum</i>	Liliaceae	Garlic	Ajoene, allicin, allyl methyl thiosulfinate, methyl allyl thiosulfinate	It causes the fetus to be expelled									

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Rhaze's prescription (Formulation)					Plant part				Activity			
						Humūwl Far- zaja	Bukhūwr Tala (Rubbing agents)	Hoghmih Tabikhs (Enema) (Decoc- tion spray agents)	Juluwus (Water bath)	Tadhkhin (Smoke)	Root	Seed	Leaf	Flower Extract	All	Abor- tifa- cient	Fetus Extrac- tor	
61	Brinjāsf	<i>Artemisia vulgaris</i>	Composi- tae	Mugwort	Essential oils containing the monoterpenes, eucalyptol, camphor, linalool, thujone, 4-terpineol, borneol, α-cadinol, and spathulenol		×											
62	Jintāna	<i>Gentiana lutea</i>	Gentian- aceae	Great yellow gentian	Xanthone, Isogen- It is fatal to the fetus tisin, secoiridoid glycosides, gentiopicroside, amarogentin, swertiamarin, amaroswerin, mangiferin, gentiopicroin, gentisin					×							×	×
63	Jazar Al-Barri	<i>Daucus carota</i>	Umbellif- erae	Carrot	Essential oil: phenylpropanoids: e.g. methylisoeugenol, methyleugenol, elemicine, beta asarone			×									×	×
64	Dārshishān	<i>Calicotome spinosa</i> L.	Fabaceae	German tamarisk	Dihydrobenzofuran, tannins, phenylethanoid, basalethanoid, β-sitosterol, stigmasterol, chrysine, glucopyranoside, calythropsin			×									×	×
65	Filfil	<i>Piper nigrum</i>	Piperaceae	pepper	Thujon, piperet- It is aborti- tine, piperolin A, facient piperolin B, and terpene				×								×	×
66	Aṣṣnān Al-Fārsi	<i>Salicornia herbacea</i> L.	Chenopodi- aceae	Glasswort	Isorhamnetin 3-O-glucoside, tungtungmadic acid, quercetin 3-O-glucoside				×								×	×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)				Plant part				Activity		
						Humūwl Far- zaja	Bukhūwv Tala (Rubbing agents)	Hoghniħ Tabikħs Julūwus (Enema) (Decoc- tion bath) spray agents)	Tadkħin (Smoke)	Root	Seed	Leaf	Flower Extract		All	
67	Khardal	<i>Brassica juncea L</i>	Ranunculaceae	Mustard	The seed oil contains sitosterol, campesterol and brassicasterol. The chemical constituents include glucosinolates, ascorbate, folate and sterols (brassicasterol, sitosterol and brassinosteroids).	It is fatal to the fetus			×					×	×	
68	Sa'tar	<i>Zataria multiflora Boiss</i>	Lamiaceae	Savory	β-sitosterol, luteolin, apigenin, linalool, 6-hydroxyluteolin, thymol, carvacrol, γterpinene, and p-cymene	It throws out the dead fetus	×							×		×
69	Turbud	<i>Operculina turpethum</i> Syn. <i>Ipomoea turpethum</i>	Convolvulaceae	Turbith (Indian jalap)	Glycosidic resin, turpethin and turpethin. Turpethin is made up of 1-turpethin containing jalapic, ipomoic, tannipicolic acids, and f-turpethin.	Its suppositories are suitable for expelling live and dead fetus	×							×		×
70	Shahtarj	<i>Fumaria parviflora Lam.</i>	Fumariaceae	Fumitory	Flavonoids, glycosides, tannins, saponins, steroids, triterpenoids, henols, and alkaloids	It is abortifacient	×							×		×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)					Plant part		Activity				
						Humūl Far- zaja	Bukhūr Tala (Rubbing agents)	Hoghniħ Tabikhs (Enema) (Decoc- tion spray agents)	Juluwus (Water bath)	Tadkhiñ (Smoke)	Root	Seed		Leaf	Flower Extract	All	
71	Hilit	<i>Ferula assa-foetida</i> L.	Umbellif- erae	Ferula	Essential oil con- tains monoter- penes and other terpenoids and resins including coumarins, ses- quiterpene cou- marins (such as asacoumarin A, B), terpenoids, ferulic acid and its esters	It causes abortion and mis- carriage	×							×	×	×	
72	Kāfur	<i>Cinnamomum camphora</i>	Lauraceae	Camphor	Oils contains cam- phor, 1,8-cin- eole, saffrole and terpinen-4-ol	It is amaz- ingly effective for get- ting the fetus out	×							×		×	
73	Fāshrā	<i>Bryonia alba</i> L.	Cucurbita- ceae	Bryony	Oxygenated tetra- cyclic triterpene derivatives; e.g. cucurbitacines	It ejects the fetus and placenta		×			×			×		×	×
74	Jaawshūr	<i>Opopanax chiro- ntium</i> Guss.	Apiaceae	Hercules' all-heal	Coumarins compounds, heraclenin, imperatorin	It is aborti- facient		×		×				×		×	

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically Description Rhaze's prescription (Formulation)				Plant part				Activity	
					Humūwl Far- zaja	Bukhūwr Tala (Rub- bing agents)	Hoghmiħ Tabikħs Julūwus (Enema) (Decoc- tion spray agents)	Julūwus (Water bath)	Tadkħin (Smoke)	Root	Seed	Leaf	Flower Extract	All Extrac- tor
75	Sisālyids	<i>Seseli tortuosum</i> L.	Apiaceae	Lovage	Essential Oils containing monoterpene hydrocarbons such as (b-pinene, a-pinene, 3-carene, sylvestrene and p-cymene), oxygenated monoterpenes (such as thymol methyl ether), sesquiterpenes hydrocarbons and oxygenated sesquiterpene (such as farnesol)	The use of its root and seed will abort the fetus	×		×	×			×	
76	Lādan	<i>Cistus ladanifer</i>	Cistaceae	Rock rose	α-Pinene, viridiflorol, trimethylcyclohexanone, borneol, camphene	It ejects the fetus and placenta		×					×	×
77	Kammūn Barrī	<i>Lagoecia cumi- noides</i> L.	Apiaceae	Lagoecia	Chlorogenic acid, hesperidin, rosmarinic acid, hesperetin, vanillin	It immediately aborts the fetus	×						×	×
78	Smūrmūwn	<i>Smyrniūm perfolia- tum</i> L.	Apiaceae	Golden Alexanders	Isofuranodiene, furanosesquiterpenoid, isofuranodiene, curzerene	It will throw out the dead fetus	×			×			×	×
79	arz Lubnānī	<i>Cedrus libani</i>	Pinaceae	Lebanon Cedar	Rosmarinic acid, carvacrol, thymol, flavonoids	It will kill the living fetus.	×		×				×	×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)				Plant part				Activity		
						Humūwl Far- zaja	Bukhūwr Tala (Rubbing agents)	Hoghmiħ Tabikħs Julūwus (Decoc- tion spray agents)	Tadhkin (Smoke)	Root	Seed	Leaf	Flower Extract			
80	Zabīb Al-Jābal	<i>Delphinium staphisagria</i>	Ranunculaceae	Stavesacre	Diterpenoid alkaloids (such as isoaztine, delphinine, neoline, aztine, and dihydroatisine) and Stavesacre (containing delphinium)	It is abortifacient	×								×	×
81	Māziūn	<i>Daphne mezereum</i>	Thymelaeaceae	Mezereum	Yuanhuacine, tanguitacine, and yuanhuadine.	It is abortifacient	×								×	×
82	Tein	<i>Ficus carica</i>	Moraceae	Fig	in bark: vdit-erpene ester daphnetoxin; coumarines; and daphnin,	It is abortifacient			×						×	×
83	Karāfs	<i>Apium graveolens</i> L.	Umbelliferae	Celery	in seeds: diterpene ester mezeirin and daphnetoxin	It is abortifacient			×						×	×
84	Zurunbād	<i>Zingiber zerumbet</i>	Zingiberaceae	Pinecone ginger	Phytosterols, protease enzymes, furocoumarins, 5-methoxypso-ralen, 8-methoxyorsalen	It is abortifacient			×						×	×
85	Al-Labna	<i>Syrax officinalis</i> L.	Styracaceae	Snowbell bush	D-Limonene, Myrcene, 4-Terpineol, 6β-Selinene, β-pinen, β-caryophyllene, Carnone, Trans-Limonene oxide, α-Terpinolene, α-selinen, Trans-3-butylidenephthalide, α-Muuroloene, Cis-Limonene Oxide, Linalool, α-pinen, Trans-ocimene	It causes the fetus to come out		×							×	×

Table 1 (continued)

No.	Traditional Name	Scientific Name	Family	Common English Name	Pharmacologically active ingredients	Description Rhaze's prescription (Formulation)	Plant part	Activity	
						Humūl Far- zaja	Bukhūwr Tala (Rubbing agents)	Hoghmih Tabikhs Julūwus Tadhkhin Root (Smoke) (Decoc- tion spray agents)	Seed Leaf Flower Extract All Abor- Fetus Placenta- Extractor
86	Henna	<i>Lawsonia inermis</i>	Lythraceae	True alkanna	Terpenes (sesquiterpene) which are zingiberene, phenolic compounds such as gingerol and shogaol, alkaloids, saponins	It causes the fetus to come out	×	×	×

Rhazes' insights on the effectiveness of different parts of medicinal plants

Rhazes identified various parts of plants such as fruits, seeds, leaves, roots, blossoms, fruit skins, and gums as well as products like juice, extracts, and oils, that can be effective to induce medical abortion (see Table 1) . (2001)

Rhazes' clinical observations on abortion and stillbirth

In *Kitāb al-Ḥāwī fī al-Ṭibb*, Rhazes shared his clinical observations regarding childbirth and abortion, stating, "Most abortions occur before eight months." He recounted a case where a woman in labor for several days was administered two dirhams of saffron, leading to a prompt birth. Rhazes noted this remedy's consistent effectiveness, adding that camphor is remarkably effective for fetal extraction. He asserted that the intrauterine or oral use of soddāb (*Ruta graveolens*) would terminate a pregnancy instantly. Regarding colocynth (*Citrullus colocynthis*), he indicated that a small amount of fresh or cooked juice could gradually lead to fetal expulsion (Rhazes et al. 2001).

Rhazes' views on the post-abortion care

Rhazes emphasized the importance of post-abortion care. He suggested that smoking (incense) herbs like *Peganum harmala*, *Brassica alba*, and *Commiphora mukul* is beneficial for women after the removal of a dead fetus. Additionally, using *Ruta graveolens* juice, *Trigonella foenum-graecum* oil, and *Phoenix dactylifera* is recommended for recovery. Herbal infusions of *Veratrum album* and *Aristolochia longa* can aid in expelling the placenta, while rose oil applied vaginally is advised to enhance uterine function following placental expulsion (Rhazes et al. 2001).

Discussion

This study highlights Rhazes' extensive experiences with abortion and his approaches to prevention and management, particularly in his significant medical text, *Kitāb al-Ḥāwī fī al-Ṭibb*. He was among the pioneers who contributed to obstetrics and gynecology in the Islamic Golden Age (Fadel and Al-Hendy 2022). In his work, aside from discussing about prevention and treatment of abortion, Rhazes elucidated the roles of various medicinal plants in inducing medical abortion (Mokaberinejad et al. 2015; Chen et al. 2023). Our findings show that Rhazes mentioned numerous plants associated with

Table 2 Rhazes' dosage forms of abortifacient medicinal plants by physical state and administration method

Physical condition	Vaginal dosage form		Formulation	Base	Carrier/device
	Traditional	Conventional			
S	Farzaja Humūwl	Cotton-Load Cotton-Load Pessary	Powdered ingredients or semisolids + base (in size of date seed, oak fruit, or middle finger)	Extracts, gum, honey, hot water, milk, oil in wax, rosewater, sugar, vinegar, yolk	An absorbent material like cotton, linen, or wool
L	Jūlūwus	Water bath	Ingredients plus water boiled until halved and filtrated	Oil, water	A tube ^a
L	Hoghnih	Douche			A lubricated tube ^b
G	Bukhūwrs	Fumigation (vapor)	Powdered ingredients, and/or base/dried/burned	Cow's fat, honey, olive oil, wax	A tube, or a seat with a slot
	Tadkhin	Smoking (incense)	-	-	-

S solid, L liquid, G gas (mixture of solid in gas)

^aPatient has to sit in a tub filled with therapeutic liquid for 30 min to 1 h

^bThe tubes for hoghnih were made from the skin of fawn's or yeanning's trotters attached to a wooden straw

abortion and its expulsion. Figure 1 illustrates the putative mechanisms of actions of these agents on the abortion induction. Even though some reports have confirmed the

abortifacient properties of these plants in both in vivo and laboratory settings, other literature rebutted the efficacy and safety of these plants due to their potential adverse

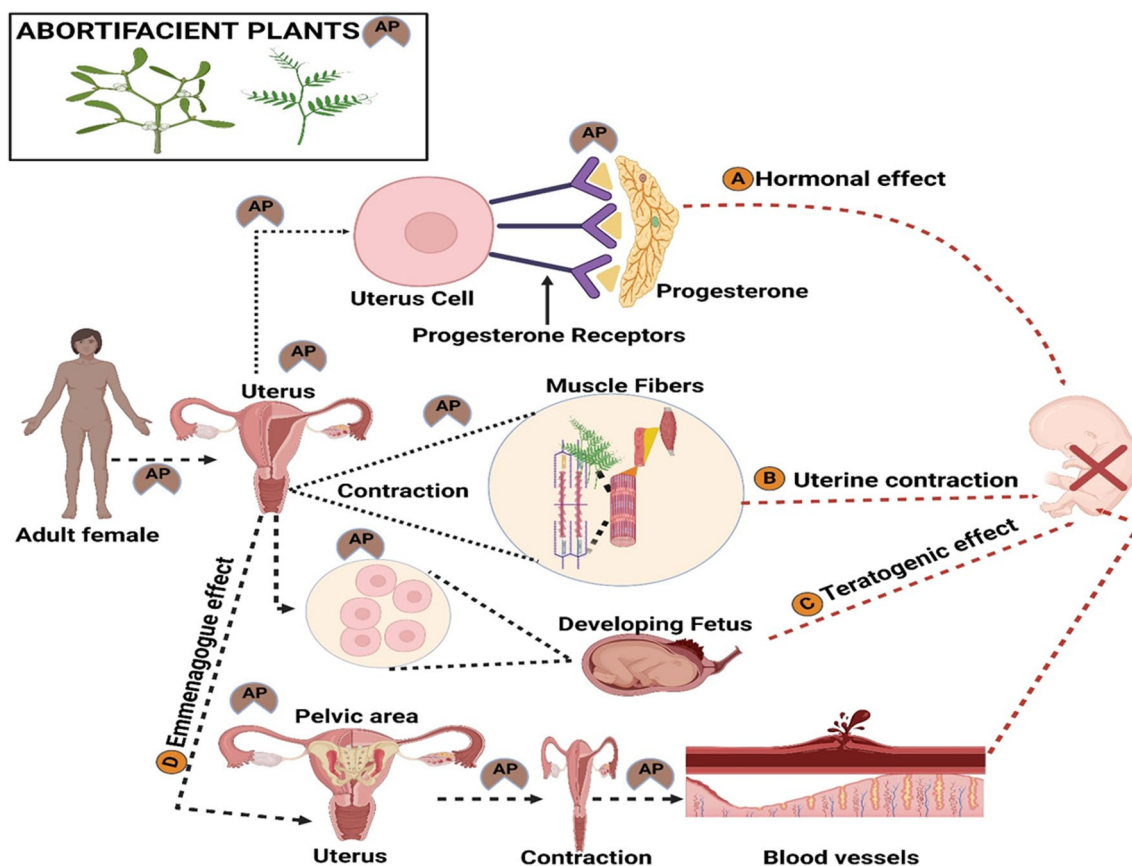


Fig. 1 The illustration shows the putative mechanisms of abortifacient plants (AP) mentioned by Rhazes in *Kitāb al-Ḥāwī fī al-Ṭibb*. **A** Demonstration of how AP can interfere with hormonal balance, particularly progesterone, leading to abortion. **B** Mechanism of uterine

contractions induced by AP. **C** AP contain compounds that can interfere with fetal development, leading to abnormalities or miscarriage. **D** AP stimulate blood flow in the pelvic area and uterus, leading to increased uterine contractions and menstruation

effects on the mother, fetus, and the placenta (Bernstein et al. 2021; Chen et al. 2023). Medicinal plants linked to abortion function through various mechanisms, including emmenagogue effects (e.g., *Rutagraveolens*), uterine stimulation (e.g., *Cicerarietinum*), implantation inhibition (e.g., *Laurusnobilis*), and teratogenic effects (e.g., *Trigonella foenum-graecum*) (Ouzir et al. 2016; Nejatbakhsh et al. 2022). Rhazes recognized the varying effectiveness of different herbal medicines. He mentioned that certain plants, such as *Peganum harmala*, *Veratrum album*, *Aristolochia longa*, *Lepidiumlatifolium*, *Doremaammoniacum*, and *Lepidiumsativum* exhibited potential abortifacient properties. In contrast, others could either increase the risk of miscarriage or induce abortion over a chronic time usage with potential adverse effects. Rhazes employed various administration methods, including oral dosages, liniments, decoctions, inhalers (bukhūwrs), suppositories (humūwl, farzaja), enemas, water baths, and incensing. Vaginal forms were among of commonly used dosage forms, reflecting traditional Persian medicine's preference for treating women's health issues due to the anatomical proximity of the uterus and cervix to the vagina (Mokaberinejad et al. 2015). Generally speaking, in traditional Persian medicine, the use of vaginal drugs has been prioritized for the treatment of women's disorders due to the proximity of the uterus and cervix to the vagina (Akbar 2020a). Rhazes used different formulations and medicinal forms (Table 2). Nevertheless, our findings did not align with contemporary research on the diverse formulations of these medicinal plants (Akbar 2020a). Typical bases included vaginal suppositories, or oils, as well as water-soluble bases (Hmidouche et al. 2023). Rhazes' formulations often featured oily or aqueous bases, utilizing absorbent materials like cotton, or linen for the controlled release of active ingredients. He also recommended specific plant parts, such as roots or seeds, which influence the types and concentrations of active compounds, thus affecting efficacy. The results of our study were consistent with recent studies of ethnopharmacology that have suggested the use of different formulations of the mentioned medicinal plants. Conventional bases are vaginal suppositories or oily or water-soluble or water-miscible bases (Akbar 2020b). Likewise, the formulations introduced by Rhazes had oily or aqueous bases (Abdipour Mehrian et al. 2024). Using an absorbent material such as cotton, linen, or wool as a carrier can control the release of the main drug. Also, in some cases, Rhazes has recommended the use of certain parts of medicinal plants such as roots, seeds, or sap (Mokaberinejad et al. 2015). These variables affect the type and content of active plant compounds, which in turn affect their effectiveness. Recent studies, such as those examining the toxic effects of *Peganum harmala* alkaloid extracts on gametogenesis and embryonic development,

confirm the extract's role in inducing abortion (Bruno et al. 2018). Rhazes similarly noted that both the seeds and green branches of *Peganum harmala* can induce abortion (Mokaberinejad et al. 2015). However, the pharmacological profiles and mechanisms of action of the medicinal plants mentioned in our study require robust, careful, and evidence-based confirmations before any potential consideration for practical usage. Given the limitations of current medical management for abortion, these herbal agents may offer potential alternatives that are more effective and less toxic, particularly in the realm of complementary and alternative medicine. Moreover, special attention needs to be paid to the issue of the consumed dose of herbal medicines as it may render dose-dependent organ toxicities (Bruno et al. 2018).

It is crucial to note that specific complications during pregnancy may prompt women to seek various treatments, including traditional and herbal remedies. Therefore, we strongly advise that the findings of this study not be generalized for unregulated treatments and emphasize that medical abortions should always be conducted under the supervision of qualified healthcare professionals using approved medications. The results of this study can serve as a foundation for future research aimed at evaluating the effectiveness of these plants through rigorous clinical trials. Additionally, there is a pressing need for comprehensive pharmacological and clinical studies to assess the efficacy of the medicinal plants described in *Kitāb al-Hāwī fī al-Tibb*, their mechanisms of action, and potential toxicities.

Conclusion

This research elaborates on Rhazes' perspectives and medical approaches regarding the prevention and treatment of abortion revealing his contributions to obstetrics, gynecology, and women's health. His insights into various herbal medicines and their applications highlight the need to further explore these traditional remedies. Future studies are essential to validate the effectiveness of these pharmacological and therapeutic agents, enhancing our understanding of their potential applications in modern medicine. Our study underscores the importance of ethical considerations in research involving medicinal plants and abortion. Investigations into herbal remedies must prioritize participant safety and well-being, ensuring informed consent and adherence to ethical guidelines. Additionally, traditional practices should be cautiously approached, recognizing potential risks and the necessity for professional oversight. Even though this research provides some valuable insights into Rhazes' contributions to women's health and medicine, several limitations must be acknowledged. The historical context of Rhazes' work cannot be considered completely aligned with

contemporary medical practice standards. Variability in the chemical composition of herbal remedies can affect their efficacy and safety, necessitating further investigation. The lack of extensive clinical trials on these traditional medicines limits the ability to draw definitive conclusions regarding their effectiveness. To build on Rhazes' foundational work, conducting high-quality clinical trials that assess the efficacy and safety of the medicinal plants he described is crucial. Future research should focus on exploring the pharmacological profiles and mechanisms of action of Rhazes' mentioned plants, providing their evidence-based usability before any potential application.

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Declarations

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