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Urban Ethnomedicine as an Adaptive Healthcare System: Women's Knowledge, Medical Pluralism, and Biocultural Conservation in Semarang, Indonesia

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ABSTRACT This study documents women's urban ethnomedicinal knowledge in Semarang City addressing a critical gap in the ethnobotanical research. It aims to identify medicinal plants used by women, associated local knowledge, and socio-cultural factors shaping their use. A qualitative descriptive was conducted in representative sub-districts of Semarang City through observation, semi-structured interviews with 160 purposively selected female knowledge holders, photographic and literature documentation. The findings reveal the use of 82 plant species to treat various ailments and utilizing different plant parts. The use of these plants reflects local perceptions of health and illness, with women ~~ascting~~ acting as primary custodians, transmitters, and processors of ancestral knowledge, particularty in the preparation of *jamu* (Javanese herbal drinks). These practices represent both primary and complementary healthcare strategies, demonstrating resilience in an urban context. Documenting this knowledge is essential for conserving urban biocultural heritage and recognising women's central role in sustaining traditional healing practices.

INTRODUCTION

The utilisation of plants for traditional medicine represents a significant component of primary healthcare systems globally, including Indonesia, with knowledge passed down through generations. This practice is widely recognised across diverse Indonesian communities. The historical manuscript *Serat Centini* mentions the numerous health benefits derived from medicinal plant use. Research conducted by Rahayu et al. (2020) indicated that Indonesian communities, particularly in rural areas, regularly consume *jamu* (traditional herbal medicine), defining *jamu* as locally prepared remedies often from fresh plant materials. Their data showed a prevalence of herbal medicine use at 68 percent (431 out of 634 respondents). Reasons for *jamu* consumption vary, including perceived general health benefits, treatment of common ailments, wound healing, and other applications (Kumawat et al. 2025; Obligar et al. 2024).

Medicinal plants serve not only curative purposes but also function as a preventive strategy against diseases, aiming to avoid or mitigate specific illnesses at both individual and community levels (Becker 1988; Singh et al. 2017). Treatments range from addressing minor ailments to severe conditions. Chronic or severe diseases potentially treatable with medicinal plants include cancer, liver issues, cholesterol problems, asthma, diabetes, and stroke (Pradipta et al. 2023; Rapoliene and Matuleviciute 2024; Silva et al. 2024).

Globally, women are often the primary custodians of traditional health knowledge within households (Vaksibhai and Thakar 2025). In the context of Western medicine in England, women's health medicine (WHM) represents a holistic and political form of healthcare that confronts traditional gender roles and discourses of femininity. Women

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derive substantial benefits from using medicinal plants. Among pregnant women, the consumption of herbal medicine often increases, driven by traditional beliefs, cultural practices, and knowledge regarding potential impacts during pregnancy (Anteneh et al. 2022). Furthermore, the use of herbal medicine was reportedly greater among pregnant women with upper secondary level education, those living in their own homes, and those from higher socio-economic classes (Abdollahi and Chareti 2019). Additionally, herbal medicine is utilised by women navigating menopause. One study indicated that acupuncture, Chinese Herbal Medicine (CHM), or a combination thereof could improve mood symptoms in menopausal women experiencing mood disorders and potential depression (Wang et al. 2023). These studies highlight the crucial role and position of women, whose lives frequently intersect with the use of herbal medicine.

The presence of plants as the primary ingredients for *jamu* maintains widespread relevance. The future of *jamu*, as a component of traditional medicine, remains promising, aligning with the expanding concepts of holistic health and natural remedies (Widjaja 2024). This trend also supports the 'back to nature' movement, for instance, in beauty care using traditional, natural ingredients (Darmawan and Handitasari 2021). The popularity of traditional medicine usage varies significantly depending on socio-economic, cultural, and demographic conditions within Indonesia (Abdullah et al. 2023). However, rapid urbanisation and socio-economic changes potentially threaten the continuity of this knowledge, particularly in cities (Arfanuzzaman and Dahiya 2019). Therefore, documenting knowledge related to traditional medicine, especially within urbanising contexts, remains a necessary endeavor for preserving biocultural diversity, understanding the sustainable use of plant resources, and informing public health strategies.

Recent studies continue to show strong reliance on plant-based remedies in both rural and urban settings. For example, Cultural Adaptation of Jamu among Urban Communities in Cikarang documented that urban producers use about 14 plant species for *jamu*, significantly fewer than in rural contexts, indicating reduced diversity but maintained use (Sedayu and Azka 2021). In Sangga Buana (South Jakarta), 56 medicinal plant species were still used by inhabitants of an urban forest area despite urban pressures (Siahaan et al. 2022). Furthermore, research in Trimulya Village, Sanggau Regency, showed that women use 21 different species for women's health care, including several less common ones, reflecting a combination of tradition and resilience (Astuti et al. 2024).

However, urbanisation, socio-economic change, and shifting lifestyles may erode traditional knowledge. Studies indicate that when communities move into more urban settings, native medicinal species are often substituted by introduced ones, and local health beliefs may weaken (Arjona-García et al. 2021; Sedayu and Azka 2021; Astuti et al. 2024). This suggests a dynamic tension between continuity and loss in ethnomedical systems under urbanisation. Yet, there remains limited in-depth documentation of how women in major Indonesian cities maintain, adapt, or transmit their knowledge and practices.

Semarang City was selected as the research location due to its diverse population characteristics representing a blend of traditional Javanese culture and modern urban influences. The persistence of traditional knowledge within this urban community presents an interesting case study on the resilience and adaptation of ethnomedical systems. Various forms of knowledge concerning traditional medicine are still known, believed in, and practiced in the daily lives of the community for both health maintenance and disease treatment.

Objectives

This study aims to examine urban ethnomedicine as an adaptive healthcare system maintained by women in Semarang City, Indonesia. Specifically, the study seeks to:

1. Document the diversity of medicinal plants and their therapeutic applications in household healthcare;
2. Analyse how women acquire, transmit, and adapt ethnomedicinal knowledge across generations within an urban environment;
3. Examine the role of medical pluralism in shaping therapeutic decision-making between traditional herbal medicine and biomedical healthcare; and
4. Explore the implications of women's ethnomedicinal practices for biocultural conservation and community health resilience in rapidly urbanising settings.

Literature Review

Ethnobotany is a field of science that studies the relationship between humans and plants in cultural, social, and economic contexts (Harshberger 1896). Ethnobotanical studies of medicinal plants provide insight into how communities use certain plants as part of traditional healing practices, including to manage chronic diseases. In many large cities, medicinal plants are not only consumed fresh or in extract form, but are also processed into herbal medicines, herbal supplements, or health teas (Oreagba et al. 2011; Hughes et al. 2021). Although this practice is growing in popularity, there is still limited scientific documentation regarding its effectiveness, safety, and long-term health impacts.

Rapid urbanisation has changed people's lifestyles, including eating patterns, levels of physical activity, and levels of exposure to pollution and stress (Godfrey and Julien 2005). Various diseases emerge, not only impacting the quality of life of individuals but also causing significant economic and social burdens especially in urban environments (Thakur et al. 2011; Jan et al. 2018). There are various ways of healing, starting from using medicinal plants or consulting a doctor. However, most people in urban areas still choose alternative medicine with plants. Ethnobotany research is very important to understand how humans interact with plants, especially in the context of the use of medicinal plants.

The use of plants for traditional medicines is one of the ethnobotanical studies (Rini et al. 2017). Medicinal plants refer to types of plants that are used in whole or in part, including leaves, stems, fruit, tubers and roots, for medicinal purposes, raw materials for medicines or traditional herbal medicines (Daeli 2023). Knowledge about types of medicinal plants and their benefits is passed down from generation to generation, especially from their parents. This knowledge is passed down from generation to generation and is still relevant because these plants are still used in everyday life. Along with the development of knowledge and technology, knowledge about medicinal plants is increasingly widespread and is still preserved among the community, especially in urban areas (Pradityo et al. 2016; Emilda et al. 2017).

METHODOLOGY

This research utilised a qualitative method with a descriptive ethnobotanical approach. The study sought to examine community knowledge regarding the utilisation of plants as an alternative treatment within the family sphere, often referred to as popular medicine, and defined here as healthcare practices managed within the household, distinct from formal medical systems or specialised traditional healers. The research setting was Semarang City, Central Java, Indonesia. Fieldwork was conducted between 2024 in several purposively selected sub-districts and urban villages representing diverse socio-economic conditions within the city, including Mijen, Karangmalang, Jatisari, Lempongsari, Bendan Duwur, Sampangan, Bendan Ngisor, Gajah Mungkur, Petompon, Bendungan, and Gunungpati. The selection aimed to capture variation across different parts of the city. The study involved 160 informants from diverse age groups, educational backgrounds, and occupations (see Tables 1 to 4).

Table 1: List of research informants based on gender

S. No.	*Gender*	*Number of people*
1	Female	160
2	Male	0
	Total	**160**

Table 2: List of research informants based on age

S.No.	*Age (years)*	*No. of people*	*Percentage (%)*
1	< 30	4	2.50
2	31-40	21	13.13
3	41-50	41	25.63
4	51-60	41	25.63
5	> 60	48	30.00
6	No age information	5	3.13
	Total	**160**	**100.00**

Table 3: List of research informants based on last education

S.No.	*Education Level*	*No. of people*	*Percentage (%)*
1	Elementary school	38	23.75
2	Junior high school	24	15.00
3	Senior high school	45	28.13
4	Diploma	12	7.50
5	Bachelor degree	11	6.88
6	No Education	30	18.75
	Total	**160**	**100.00**

Informant selection was purposive, targeting women identified within the communities through

Table 4: List of research informants based on occupation

S.No.	Occupation	No. of people	Percentage (%)
1	Housewife	85	53.13
2	Trader/vendor	12	7.50
3	Farmer	8	5.00
4	Self-employed	7	4.38
5	Private employee	4	2.50
6	Retired civil servant	4	2.50
7	Civil servant (PNS)	2	1.25
8	State-owned enterprise employee	1	0.63
9	Social worker	1	0.63
10	Entrepreneur	1	0.63
11	Village head	1	0.63
12	Village secretary	1	0.63
13	Farmer group leader	1	0.63
14	Agricultural extension officer	1	0.63
15	Head of Family welfare movement (PKK)	1	0.63
16	Village librarian	1	0.63
17	Retired nurse	1	0.63
18	Herbal medicine seller (*jamu* seller)	1	0.63
19	Factory worker	1	0.63
20	Livestock farmer	1	0.63
21	Sanitation worker	1	0.63
22	Bridal makeup artist	1	0.63
23	Unemployed	23	14.38
	Total	**160**	**100.00**

initial contacts as possessing and actively using knowledge of medicinal plants for family healthcare. This focus was based on preliminary observations and existing literature suggesting women are primary holders of this specific knowledge domain in many Indonesian contexts. All participants provided verbal informed consent prior to interviews.

Data collection techniques employed in this study included participant observation, semi-structured interviews, and documentation. The observation phase involved observing home gardens, plant collection practices (where applicable), remedy preparation processes, and discussions within community settings regarding health and plant use. Semi-structured interviews were conducted based on the research questions, exploring plant names (local and Indonesian), parts used, ailments treated, preparation methods, perceived efficacy, and knowledge sources. Interviews were carried out with 160 female informants possessing diverse backgrounds in age, education, and occupation. All female informants interviewed possessed and shared knowledge regarding the use of plants for medicinal purposes, particularly at the household level. Documentation involved gathering supporting data for the research, such as photographs of identified plants and preparations, and review of relevant local reports or literature. Plant specimens were identified using standard botanical literature (Backer and Brink 1980) and comparison with online databases. The collected interview and observation data were then analysed thematically using the framework proposed by (Miles et al. 2019), comprising data collection, data reduction, data presentation, and conclusion drawing/verification. Quantitative ethnobotanical indices, such as Use Value (UV) or Fidelity Level (FL), were not calculated in this qualitative study but represent an avenue for future quantitative analysis.

RESULTS

Interviews with 160 female informants revealed a rich repository of ethnomedicinal knowledge. Approximately 82 plant species were identified as being utilised for medicinal purposes within the studied communities in Semarang City. Similar urban ethnobotanical studies in Indonesia support this persistence. For instance, in Surakarta, the Gede Hardjonagoro market hosts 76 species traded as medicinal plants in urban contexts, with *Zingiber officinale* having highest use value (UV) in that market setting (Santhyami et al. 2024). The most frequently utilised plant parts were leaves, followed by rhizomes, fruits, flowers, stems, seed, and sap. Leaves were the most frequently used species, consistent with patterns documented in other surveys in Java and Central Java. In the Upper Bengawan Solo region, 88 species were recorded, with leaves being used in over 50 percent of cases (Nurcahyo et al. 2024). In these findings, sap and seeds appear in some uses, which are less commonly recorded in many rural surveys. This might reflect adaptive innovation or cross-cultural borrowing in a more heterogeneous urban milieu. The urban environment may foster experimentation and blending of traditions, as seen in "urban ethnopharmacology" literature that emphasises how cities act as nodes of cultural exchange and plant introduction (Dutta et al. 2021). Detailed information on the identified plants, their uses, and preparation methods is presented in Table 5.

Table 5: List of names of plants used for medicine in Semarang City

S. No.	*English name/ Special local name*	*Botanical name*	*Part*	*Medicinal used*	*Processing method*
1	Cogon grass/Alang-alang	*Imperata cylindrica* (L.) P. Beauv.	Leaf	Immunity boosting	Decoction consumed
2	Avocado/Alpukat	*Persea americana* Mill.	Leaf	High blood pressure	Decoction
3	Tamarind/ Asem	*Tamarindus indica* L.	Fruit (+ red onion)	Wound healing, bruises	Poultice: Tamarind pulp ground with red onion, applied topically
4	Bangle	*Zingiber cassumunar* Roxb.	Rhizome (+ *Acorus calamus*)	*Sawan* (infant distress syndrome, like colic, persistent crying, fever, culturally attributed)	Poultice/Topical: Pounded with *A. calamus*; made into protective bracelet; placed on infant's head/ soles; powdered and applied topically
5	Dlingo	*Acorus calamus* L.	Leaf (+ *Zingiber cassumunar*)	*Sawan* (infant distress syndrome)	Same function as Bangle, used concurrently
6	Red Onion/ Bawang Merah	*Allium cepa* L.	Bulb (+ eucalyptus oil)	Fever, cough, diarrhoea, wounds	Topical: Pounded bulb mixed with eucalyptus oil, applied to infant's back, chest, head; mixture locally termed *boreh* or *tapel*
7	Red Spinach/Bayam Merah	*Amaranthus dubius* L.	Leaf	Aids digestion	Decoction
8	Garlic/Bawang Putih	*Allium sativum* L.	Bulb (+ salt)	Flu (influenza), dizziness, sneezing	Decoction: Crushed garlic and 3 cloves, boiled in water with a pinch of salt, consumed warm
9	Bilimbi/Belimbing Wuluh	*Averrhoa bilimbi* L.	Flower, leaf, fruit (+ fennel, cinnamon, lump sugar)	Cough, acne treatment, lowers blood pressure	Decoction of flowers and young leaves with lump sugar, fennel (*adas pulowaras*), cinnamon added for flavour, juiced fruit
10	Rice/ Beras	*Oryza sativa* L.	Seed (water)	Stomach ache, abdominal comfort	Infusion: Rice cooking water (*tajin*) consumed
11	Madeira Vine/Binahong	*Anredera cordifolia* (Ten.) Steenis	Leaf (+ lemongrass, soursop leaves, *Andrographis paniculata*)	Body aches (*kemeng*), rheumatism, gout, promotes urination, wound healing (promotes drying)	DecoctionPoultice/Topical: Crushed leaves applied topically or juice extracted from leaves applied
12	Sambong/Beluntas	*Pluchea indica* (L.) Less.	Young leaves	Diarrhoea	Decoction
13	Broccoli/Brokoli	*Brassica oleracea* L. var. *italica* Plenck	Flower head (+ green apple)	Acid reflux (GERD), aids weight loss	Juice: Broccoli juiced with green apple
14	Green Apple/Apel Hijau	*Malus domestica* Borkh.	Fruit	Acid reflux (GERD), aids weight loss	Additive: Added to broccoli juice
15	Heart leaved moonseed/ Brotowali	*Tinospora cordifolia* (Willd.) Miers ex Hook.f. and Thomson	Stem, leaf	Diabetes, inflammation	Decoction
16	Mahogany/ Mahoni	*Swietenia mahagoni* (L.) Jacq. (likely)	Fruit/Seed (Clarify)	Diabetes (reduces blood sugar)	Decoction

Table 5: Contd...

S. No.	*English name/ Special local name*	*Botanical name*	*Part*	*Medicinal used*	*Processing method*
17	Beetroot/ Bit	*Beta vulgaris* L.	Root	Cough, cold/flu	Decoction: Beetroot boiled with cinnamon and cloves
18	Red flower/Bunga merah	*(Unknown species)*	Flower (+ ginger, cinnamon, cumin)		Vertigo Decoction
19	Butterfly pea plant/Bunga telang	*Clitoria ternatea* L.	Flower (+ mint, stevia, lime, ginger, lemongrass, lump sugar, honey)		Body aches, lowers blood sugar, lowers blood pressure, improves blood circulation, heart health, cough, cold/flu, soothes irritated eyes, high antioxidant Infusion/Tea: Dried flowers boiled (can be blended first)Optional additions: Stevia, lime, ginger, lemongrass, honey, or lump sugar
20	Star Anise/ Bunga Lawang	*Illicium verum* Hook.f.	Fruit (commonly called flower)	Soothes sore throat	Decoction with lump sugar
21	Java Long Pepper/Cabe Puyang	*Piper retrofractum Vahl*	Fruit (+ turmeric, pandanus)	Cancer, fatigue/aches, fever, bloating in children	Decoction with additional ingredients
22	Clove/Cengkeh	*Syzygium aromaticum* (L.) Merr. and L.M.Perry	Flower bud, leaf (+ lemon, ginger)	Body aches, influenza , cough, stomach ache	Decoction: Clove leaves boiled with ginger and lemon
23	Jujube/Bidara	*Ziziphus mauritiana* Lam.	Leaf	Spiritual protection ('expel demons'), diabetes	Decoction
24	Ground cherry/Ciplukan	*Physalis angulata* L. *(likely)*	Leaf, fruit	Boosts immunity (especially during fasting), maintains health	Juice/Decoction: Blended and boiled, honey/sugar optional (not advised for diabetics)
25	Dadap Tree/Dadap Serep	*Erythrina subumbrans* (Hassk.) Merr.	Leaf (+ lime, rice, galangal, shallots)	Fever	Compress: Crushed leaves mixed with water and salt, applied topicallyTopical Paste: Leaf pulp mixed with water (water drunk), pulp mixed with rice, galangal, salt applied to body
26	Pandanus/ Pandan	*Pandanus amaryllifolius* Roxb. ex Lindl.	Leaf (+ lemongrass, lump sugar)	Body fatigue/aches	Decoction: Pandanus leaves boiled with lemongrass and lump sugar
27	Rosary Pea/Saga	*Abrus precatorius* L.	Leaf	Treats cancer sores (mouth ulcers)	Poultice/Direct: Pounded, crushed, or chewed
28	Indonesian Bay Leaf/Salam	*Syzygium polyanthum* (Wight) Walp.	Leaf	Gout, lowers cholesterol, lowers blood pressure, diabetes	Decoction consumed or used for foot soak
29	Handeuleum/Daun Ungu	*Graptophyllum pictum* (L.) Griff.	Leaf	Hemorrhoids	Decoction consumed, or boiled with turmeric and palm sugar
30	Neem/Imbo/Mimba	*Azadiracha indica* A.Juss.	Leaf	Diabetes	Infusion: Steeped in hot water, then drank
31	Yacón/Insulin	*Smallanthus sonchifolius*	Leaf	Diabetes	Decoction consumed

Table 5: Contd...

S. No.	*English name/ Special local name*	*Botanical name*	*Part*	*Medicinal used*	*Processing method*
		(Poepp.) H.Rob.			
32	Ginger/Jahe emprit/Jahe gajah/Jahe merah	*Zingiber officinale* Roscoe	Rhizome (+ turmeric, pandan, lime leaves, lemongrass, lime, lump/palm sugar, honey, milk, coffee, eucalyptus oil)	Warms body, relieves common cold/bloating, induces sweating, asthma, gout, high blood pressure, cough, sore throat, influenza, increases stamina, aids weight loss, *sawan* in children (seizures/ high fever)	Decoction of juice/crushed rhizome Roasted/crushed rhizome decoction Steam inhalation with eucalyptus oil boiled with lemongrass
33	Guava/Jambu biji	*Psidium guajava* L.	Young leaves	Diarrhoea, common cold, gastritis	Direct chewing with salt, pulp discarded
34	Shiitake mushroom/Jamur sitake	*Lentinula edodes* (Berk.) Pegler	Fruiting body (+ turmeric)	Cholesterol	Decoction: Shiitake boiled with turmeric, liquid consumed
35	Physic nut/Jarak Pagar	*Jatropha curcas* L.	Leaf	Stomach ache	Poultice: Crushed leaves applied topically to abdomen
36	Lime/Jeruk nipis	*Citrus aurantifolia* (Christm.) Swingle	Fruit juice (+ soy sauce)	Cough, body refreshment, fat reduction, natural diet aid	Juice mixed with soy sauce (for cough) Juice diluted with water (for diet)
37	Malabar spinach/Lembayung	*Basella alba* L.	Leaf	Relieves breast pain/ swelling due to blocked milk ducts	Topical application to breasts
38	Katuk	*Sauropus androgynus* (L.) Merr.	Leaf	Promotes lactation	Decoction consumed
39	Cinnamon/ Kayu Manis	*Cinnamomum burmannii* (Nees and T.Nees) Blume	Bark	Blood sugar control, digestive system disorders	Decoction
40	Keji Beling	*Strobilanthes crispus* (L.) Blume	Leaf (+ *Orthosiphon aristatus*)	Kidney stones	Decoction: *S. crispus* leaves boiled with *O. aristatus* leaves, liquid consumed
41	Coconut/Kelapa	*Cocos nucifera* L.	Coconut water	Cough, vomiting, neutralises MSG effects	Direct consumption
42	Moringa/Kelor	*Moringa oleifera* Lam.	Leaf	Aids digestion, lowers blood pressure, gout relief, high vitamin content, boosts immunity, prevents stunting, neutralises cholesterol, cancer treatment support,	Decoction consumed (add honey); Dried leaves as tea

Table 5: Contd...

S. No.	*English name/ Special local name*	*Botanical name*	*Part*	*Medicinal used*	*Processing method*
				high antioxidant, relieves vertigo	
43	Cubeb pepper/Kemukus	*Piper cubeba* L.f.	Dried fruit, leaf	Relieves common cold, postpartum remedy, eye treatment	Eyedrops: Crushed fruits/leaves pounded with Java long pepper and bangle, strained through cloth, juice applied to eyes
44	Ylang-ylang/Kenanga	*Cananga odorata* (Lam.) Hook.f. and Thomson	Flower	Treats toothache, neutralises body odour	Mouthwash: Flower infused in hot water with salt, or direct chewing
45	Aromatic Ginger/Kencur	*Kaempferia galanga* L.	Rhizome	Cough (soothes throat), cold/flu, fever reduction, relieves toothache, diarrhoea relief, lowers blood sugar, body pain relief, stress relief, anti-i nflammatory, gastritis, bloating	Juice from grated rhizome (add salt/palm sugar/honey), or direct chewing
46	Cosmos/Kenikir	*Cosmos caudatus* Kunth	Leaf	Diabetes	Decoction consumed, and residual leaves also eaten
47	Jamaican cherry/Kersen	*Muntingia calabura* L.	Leaf (+ *Syzygium polyanthum*)	Diabetes leaves, liquid consumed	Decoction: Cherry leaves boiled with *S. polyanthum*
48	Indian almond/Ketapang	*Terminalia catappa* L.	Leaf	ncreases body stamina	Tea: Leaves infused, infusion consumed
49	Coriander/Ketumbar	*Coriandrum sativum* L.	Seed (+ honey or palm sugar)	Heart conditions, joint/knee pain treatment	Decoction: Seeds boiled, liquid consumed, and honey or palm sugar added for sweetness
50	Purslane/Krokot	*Portulaca oleracea* L. (likely)	Leaf	Antioxidant	Decoction
51	Java Tea/Kumis Kucing	*Orthosiphon aristatus* (Blume) Miq.	Leaf, flower (+ *Strobilanthes crispus*)	Lowers blood sugar, promotes wound healing, kidney problems	Decoction: *O. aristatus* leaves boiled with *S. crispus* leaves, liquid consumed
52	Turmeric/Kunyit	*Curcuma longa* L.	Rhizome (+ tamarind, cinnamon, clove, honey)	Stomach ache (especially menstrual pain), hypertension, gastritis, stomach ache in children, typhoid fever support, fever, sore throat, itching	Decoction: Boiled with tamarind/cinnamon/clove (honey optional) Topical: Roasted turmeric applied to abdomen
53	White Turmeric/Kunyit Putih	*Curcuma zedoaria* (Christm.) Roscoe.	Rhizome	Cancer	Decoction of juice/ crushed rhizome
54	Galangal/Laos/Lengkuas	*Alpinia galanga* (L.) Willd.	Rhizome	Skin fungus treatment (*panu*)	Poultice: Grated rhizome applied topically Infusion: Lemon slices steeped in water
55	Lemon	*Citrus limon* (L.) Osbeck	Fruit (sliced)	Normalises choles-	

Table 5: Contd...

S. No.	*English name/ Special local name*	*Botanical name*	*Part*	*Medicinal used*	*Processing method*
				terol, warms the stomach	
56	Aloe Vera/Lidah Buaya	*Aloe vera* (L.) Burm.f.	Leaf gel/sap (+ lime juice, slaked lime)	Wound healing (promotes drying), soothes skin inflammation (rashes, redness, scaling), reduces dandruff, lowers blood cholesterol, brightens skin, slows skin aging/wrinkles	Topical application to wounds/scalpJuice consumed with lime juice and slaked lime (*kapur sirih*)
57	Crown of God/Mahkota dewa	*Phaleria macrocarpa* (Scheff.) Boerl.	Leaf	Lowers blood pressure	Decoction: Fresh leaves boiled, or chopped, dried, then boiled, and liquid consumed
58	Mangosteen/ Manggis	*Garcinia mangostana* L.	Fruit rind	Relieves gout, joint discomfort	Decoction consumed
59	Noni/Mengkudu/Pace	*Morinda citrifolia* L.	Leaf, fruit	General health tonic, relieves bloating in children	Poultice/Topical: Leaves wrapped in banana leaf and steamed (*pepes*), applied topically
60	Gale of the wind/Meniran	*Phyllanthus niruri* L.	Leaf	COVID-19 treatment support, high antioxidant	Decoction consumed
61	Cucumber/Mentimun	*Cucumis sativus* L.	Fruit	Lowers blood pressure, calms emotions, vertigo	Infusion: Sliced cucumber steeped in water for 6 hours, liquid consumed
62	Mint	*Mentha* spp.	Leaf (+tea, honey)	Bloating, relieves flu, cough, cold	Infusion: Mint leaves added to tea
63	Pineapple/Nanas	*Ananas comosus* L. Merr.	Fruit	Neutralises cholesterol	Direct consumption
64	Bitter Melon/Pare	*Momordica charantia* L.	Fruit	Lowers high blood pressure	Juice
65	Papaya/pepaya	*Carica papaya* L.	Root, leaf	Relieves fatigue/aches, lowers high blood pressure, boosts immunity, dengue fever support, constipation relief, cancer prevention support, blood sugar control, sore throat	Decoction of leaves consumed, as blended leaf juice consumed (sometimes rested overnight)
66	Stink bean/ Petai/ Pete	*Parkia speciosa* Hassk.	Seed	Lowers blood pressure, stress relief/ relaxation	Decoction consumed

Table 5: Contd...

S. No.	*English name/ Special local name*	*Botanical name*	*Part*	*Medicinal used*	*Processing method*
67	Banana/Pisang	*Musa sp.*	Leaf	Diarrhoea	Poultice: Crushed leaves mixed with salt, applied topically to abdomen
68	Roselle/Rosella	*Hibiscus sabdariffa* L.	Calyx	Increases body stamina	Tea from dried calyces
69	Green Chiretta/Sambiroto	*Andrographis paniculata* (Burm.f.) Nees	Leaf	Body aches, joint pain relief, fever	Infusion in hot water
70	Celery/Seledri	*Apium graveolens* L.	Leaf	High blood pressure, high cholesterol, rheumatism	Decoction consumed, or raw consumption of chopped leaves
71	Chayote/Labu siam	*Sechium edule* (Jacq.) Sw.	Fruit	Lowers high blood pressure	Cooked consumption
72	Lemongrass/Sereh	*Cymbopogon citratus* (DC.) Stapf	Leaf, stem (+Pandan leaf, lump sugar	Fever, cough, gout, fatigue, body aches, cholesterol control, body fitness	Infusion: Chopped leaves in warm water Bath: Infused in warm bath water, sweetener added
73	Javanese betel/Sirih jawa	*Piper betle* L.	Leaf	Feminine hygiene, eye wash (*rimbang mata*), toothache, teeth strengthening, canker sores, nosebleeds, body aches, high cholesterol, high blood pressure, gout	Decoction (internal/external wash)Infusion (eye wash)Direct chewing (toothache/strength with lime)Poultice/Plug (nosebleed)
74	Soursoup/Sirsak	*Annona muricata* L.	Mature leaf	Gout, lowers high blood pressure	Decoction consumed
75	Stevia	*Stevia rebaudiana* (Bertoni) Bertoni	Leaf, flower	Bodyaches	Decoction of sun-dried parts
76	Elephant's foot/Tapak Liman	*Elephantopus Scaber* L.	Leaf	Vertigo, enhances cognitive function	Decoction
77	Cassava/Singkong	*Manihot esculenta* Crantz	Tuber	Bloating	Porridge: Tapioca flour (from tuber) mixed with warm water
78	Tea/Teh	*Camellia sinensis* (L.) Kuntze	Leaf	Common cold ('*masuk angin*')	Infusion
79	Java Ginger/Temulawak	*Curcuma xanthorrhiza* Roxb.	Rhizome (+ turmeric)	Fatigue/aches, gastritis, bloating, colic, hepatitis support, appetite stimulant	Decoction consumed
80	Star of Bethlehem/Tolod/Pitolot	*Hippobroma longiflora* (L.) G.Don	Flower	Eye treatment, blurry vision	Eyedrops: Flower soaked briefly in water, infusion applied to eyes
81	*Gynura*/Umbi dewa	*Gynura pseudochina* (L.) DC. (Syn. G. segetum)	Tuber (+young pineapple)	Tonsillitis	Juice: Grated tuber strained, juice consumed with young pineapple juice
82	Coral Bush/Jarak Tintir/ Yodium Tree	*Jatropha multifida* L.	Sap	Wound treatment	Topical application

Local Concept of Health and Illness in Semarang City Society

The concepts of health and illness possess distinct meanings within the community's perception and socio-cultural experiences. This shapes the concept of health and illness, and how they define both. According to interviews, they define that health as a condition where the body functions properly without experiencing health issues. Conversely, illness is understood as a condition where the body experiences disturbances or malfunctions. These definitions suggest that from the local perspective, health and illness are primarily viewed through a physical lens.

To address various ailments, residents often opt for traditional medicine, primarily utilising herbal plants. This often serves as the initial choice before consulting a doctor. This approach is prevalent even within the urban context of Semarang City. When experiencing an illness, the first step often involves seeking nearby medicinal plants and processing them into *jamu*. If the *jamu* proves effective, a visit to the doctor may be deemed unnecessary. Conversely, if symptoms persist despite using herbal medicine, medical consultation is sought. However, based on the experiences shared by numerous informants, many have reported recovery after consuming *jamu*. Beyond treatment, herbal plants are also employed preventively.

Meaning and Transmission of Medicinal Plants Knowledge

The Semarang City community possesses diverse knowledge regarding the use of medicinal plants. Various plants found in the surrounding environment, often in home gardens (*pekarangan*), are utilised for daily needs, including healthcare. Knowledge inherited from female elders (mothers, grandmothers) shapes lifelong experiences for subsequent generations. Women (as mothers) unconsciously pass on by providing first aid when their children are sick. Experience through this action then inadvertently becomes a habit, imitated by children and transmitted through cultural inheritance. The transmission of local ethnomedicinal knowledge persists, even within the urban environment. Although land in urban environments is limited, women still seek traditional medicine as their main choice. The home garden is their guarantee. If there is none, they will buy medicinal plant materials at the markets. The research findings demonstrate that despite urban residency, the use of plants as an alternative for family healthcare continues to be maintained and preserved, primarily by women.

Types of Plants Used as Medicine

Approximately 82 plant species were identified. Table 5 provides descriptive details for several popularly cited plants, highlighting specific preparation methods and associated cultural beliefs (see Table 5).

DISCUSSION

Urban Ethnomedicine as an Adaptive Healthcare System

The documentation of 82 medicinal plant species used by women in Semarang demonstrates that urbanisation does not necessarily diminish ethnomedicinal knowledge. Instead, urban ethnomedicine operates as an adaptive healthcare system in which inherited knowledge is retained, modified, and combined with new information. A 2025 study in urban Khyber Pakhtunkhwa likewise found that medicinal-plant knowledge remained active despite greater access to allopathic services because cost, familiarity, and perceived effectiveness shaped therapeutic choice (Ullah et al. 2025). Urbanisation appears to reorganise ethnomedicine rather than simply erode it.

The number of species recorded in Semarang should be interpreted as an indicator of social and commercial connectivity, not only botanical richness. Urban markets connect collectors, traders, household users, and plant materials originating beyond the city. Research in Harare documented 64 identified medicinal species across urban markets and showed that trade sustained cultural use and livelihoods while creating conservation concerns because roots and bark were frequently harvested (Muvengwi and Mbiba 2025). In Semarang, home gardens, neighbourhood exchange, and market purchasing similarly broaden access. However, this flexibility may conceal ecological dependence on distant source areas; urban availability should not be equated with sustainable supply.

Recent scholarship suggests that medicinal knowledge in cities is produced through cultural interaction and selective hybridisation. In Metema, differences and overlaps among Amhara, Agew, and Gumuz repertoires showed that medicinal knowledge remains culturally differentiated within a shared environment (Tadesse et al. 2025). A review of Nigerian ethnobotanical research likewise demonstrated that plant use is inseparable from cultural beliefs, historical trajectories, and uneven knowledge transmission (Rafiu et al. 2025). Semarang's metropolitan setting may facilitate comparable exchanges among migrants, residents, herbal vendors, digital media users, and health workers. The resulting system is a negotiated body of knowledge capable of absorbing new materials and explanations.

Adaptation is also visible in therapeutic scope. Women reported remedies for common complaints as well as hypertension, diabetes, high cholesterol, gout, kidney disorders, and supportive care for serious illnesses. Flores et al., (2025) recorded 93 species used for 93 conditions in Philippine communities, while Wang et al., (2025) documented 338 species and diverse preparation practices in China. Such breadth does not establish clinical efficacy. Rather, it shows that traditional medicine is being repositioned to address contemporary disease burdens, especially chronic conditions requiring affordable long-term management. The critical issue is how users assess risk and decide when professional treatment is necessary.

Women's central role strengthens this adaptive capacity because knowledge is embedded in caregiving, food preparation, gardening, and first-response treatment. Research in Morocco found substantial herbal use among pregnant and postpartum women, driven partly by accessibility and affordability, while also highlighting safety concerns (Bouqoufi et al. 2025). A 2026 review from Tanzania documented extensive plant use for maternal conditions but stressed that cultural salience must be evaluated alongside evidence of efficacy and toxicity (Omary et al. 2026). These studies support the interpretation of Semarang women as active health managers, yet caution against romanticising household knowledge. Adaptation is beneficial only when experience is accompanied by information on dosage, contraindications, interactions, and referral thresholds.

Urban resilience is also constrained by environmental change. Takubessi et al. (2025) showed that climate change may alter medicinal-plant distribution, productivity, and concentrations of bioactive compounds, affecting access and therapeutic consistency. Research among the Tujia people likewise emphasised that documentation must be linked to cultural safeguarding and sustainable use, rather than treated only as a catalogue for drug development (Xie et al. 2025). For Semarang, home gardens and community herbal spaces are small-scale health infrastructures: they conserve living materials, support intergenerational learning, and reduce dependence on commercial supply chains.

Taken together, recent literature supports a critical interpretation of urban ethnomedicine as a plural, adaptive, but uneven system. It can strengthen household autonomy and preserve biocultural knowledge, yet it may also reproduce safety uncertainties, unequal access to reliable information, and ecological pressures displaced beyond the city. The Semarang case shows how women sustain this system through decisions connecting gardens, markets, family memory, digital information, and biomedical services. Urban ethnomedicine should therefore be understood neither as a residual tradition nor as an uncomplicated alternative to modern healthcare, but as a negotiated strategy whose public-health value depends on validation, sustainable sourcing, and dialogue between knowledge holders and healthcare professionals.

Comparison with Previous Ethnobotanical Studies: Beyond Species Richness

Although ethnobotanical studies often compare communities by counting recorded species, species richness alone is an incomplete measure of the vitality or complexity of a medicinal knowledge system. The 82 medicinal species documented in Semarang are important, but their analytical value lies in how plants are selected, combined, prepared, transmitted, and positioned within household healthcare. Misganaw et al. (2025) recorded 112 medicinal species in northwestern Ethiopia, whereas Lulesa et al. (2025) documented a substantial indigenous pharmacopoeia in the Yem Zone. These inventories confirm botanical richness, but they also show that cultural importance cannot be inferred from species totals without considering consensus, accessibility, disease categories, and patterns of knowledge ownership.

The Semarang findings should therefore be interpreted through functional and cultural diversity. Leaves were the most frequently used plant part, yet women also used rhizomes, fruits, flowers, seeds, sap, and multi-ingredient formulations. Such diversity reflects differentiated understandings of extraction, taste, dosage, route of administration, and suitability for particular family members. Flores et al. (2025) used Use Value, Fidelity Level, and Informant Consensus Factor to distinguish frequently mentioned plants from those strongly associated with particular ailments, while Wang et al. (2025) used citation-based indices to identify culturally important species. These approaches reveal a limitation of the present qualitative study: all 82 species contribute to the inventory, but they may not carry equal therapeutic, symbolic, or practical significance.

Cross-study comparison must also account for differences in sampling and research design. A larger species list may result from a larger or more heterogeneous sample, longer fieldwork, market inclusion, broader illness categories, or stronger botanical verification. Rafiu et al. (2025) showed that ethnobotanical research patterns in Nigeria remain uneven across regions, cultural groups, and research themes, making simple numerical comparison potentially misleading. The Semarang inventory was generated from 160 women across several urban neighbourhoods and therefore reflects household knowledge distributed across age, occupation, and socio-economic background. It cannot be directly ranked against studies based only on specialist healers, a single market, or a compact rural community.

Urban markets further complicate comparison because they expand plant availability beyond local ecology. Zhang et al. (2025) documented 78 species at the Jin San Jiao Agricultural Market and demonstrated that markets function simultaneously as commercial sites, biodiversity reservoirs, and spaces for transmitting knowledge under urbanisation. In Semarang, purchasing ingredients allows women to continue preparing remedies even when home-garden space is limited. However, market access can inflate apparent local richness by incorporating plants cultivated or collected elsewhere. Species richness in an urban study should thus be read as a product of ecological resources, mobility, trade networks, and cultural exchange rather than as a direct reflection of vegetation within the city.

The therapeutic breadth of the Semarang repertoire is equally important. Plants were used not only for coughs, fever, digestive problems, and minor injuries, but also for hypertension, diabetes, hypercholesterolaemia, kidney disorders, gout, reproductive health, and supportive cancer care. Xie et al. (2025) found that many culturally important Tujia medicinal plants were also edible and readily accessible, indicating that everyday availability can be more influential than taxonomic rarity. Almeida et al. (2025) further demonstrated that perceived availability of medicinal resources affects how communities evaluate disease risk. These findings help explain why common plants remain central in Semarang: their value lies in repeated accessibility and incorporation into routine care, not merely in pharmacological uniqueness.

Nevertheless, frequent citation and long-standing use should not be equated automatically with safety or clinical effectiveness. Barroso et al. (2026) compared culturally prioritised plants in Angola with pharmacological literature and identified both areas of convergence and major evidence gaps. Inta et al. (2026) reached a similar conclusion in a review of Thai remedies for haemorrhoids: quantitative ethnobotanical importance can identify promising candidates, but traditional prominence does not guarantee efficacy, appropriate dosage, or absence of toxicity. This distinction is especially relevant because several Semarang remedies were reported for serious chronic diseases. The findings should therefore be presented as evidence of culturally meaningful therapeutic practice, not as confirmation of biomedical effectiveness.

Taken together, comparison beyond species richness changes the contribution of this study. The central finding is not simply that Semarang women know 82 medicinal plants, but that they sustain a functionally diverse and adaptive repertoire through home gardening, market exchange, intergenerational learning, and experimentation with complex formulations. The novelty of the Semarang case lies in the interaction between botanical diversity, women's household authority, urban supply networks, and an expanding chronic-disease burden. Comparative ethnobotany is most informative when it examines these relationships while acknowledging methodological differences, unequal cultural importance among species, resource availability, and evidence gaps.

Women's Role as Custodians and Innovators of Ethnomedicinal Knowledge

One of the most significant findings of this study concerns the central role of women in maintaining urban ethnomedicinal systems. Women are not merely users of medicinal plants but act as custodians, educators, processors, and decision-makers responsible for household healthcare. Their knowledge extends from identifying medicinal species and cultivating home gardens to preparing jamu and selecting appropriate therapeutic strategies. Recent ethnobiological scholarship increasingly recognises women as central actors in sustaining biocultural diversity through everyday healthcare practices rather than passive transmitters of inherited traditions (Bussmann et al. 2025; Odonne and Zank 2026).

Medical anthropology has long recognised women's domestic responsibilities as fundamental to community healthcare systems. However, the present findings demonstrate that women's contribution extends beyond caregiving. Women function as health brokers who continuously negotiate between inherited knowledge, biomedical advice, digital information, and previous therapeutic experience when selecting appropriate treatments. Similar findings have recently been reported in ethnopharmacological studies showing that women integrate traditional remedies with biomedical recommendations according to accessibility, affordability, and perceived effectiveness (Bouqoufi et al. 2025; Omary et al. 2026). This illustrates that women's agency lies not only in preserving knowledge but also in evaluating and adapting therapeutic practices.

Knowledge transmission remains predominantly matrilineal through observation, repeated practice, and participation in everyday healthcare activities. Mothers and grandmothers rarely provide formal instruction; instead, medicinal knowledge becomes embodied through routine caregiving. Recent discussions in the Journal of Ethnobiology and Ethnomedicine emphasise that experiential learning is among the most resilient mechanisms for maintaining traditional ecological knowledge because it links ecological observation with daily social practice (Fernández-Llamazares and Teixidor-Toneu 2025; Prakofjewa et al. 2026). Such processes enable younger generations to reinterpret rather than merely reproduce inherited traditions.

An equally important finding concerns women's role as innovators. Informants frequently modified herbal formulations by incorporating newly available plant species, adjusting preparation methods, and integrating information from markets, social media, and healthcare professionals. Rather than indicating cultural erosion, these innovations demonstrate adaptive knowledge systems capable of responding to changing urban environments. Recent international debates similarly argue that local knowledge should be understood as dynamic and continually reconstructed through interactions with broader social and scientific networks (Pieroni et al. 2025; Reyes-García et al. 2025).

Urbanisation further strengthens this adaptive process because women increasingly access digital health information, commercial herbal products, and public-health campaigns while maintaining household traditions. Nevertheless, contemporary ethnopharmacology cautions that cultural importance alone does not guarantee safety or efficacy. Herbal remedies require continued pharmacological validation, particularly regarding dosage, toxicity, and herb–drug interactions (Tadesse et al. 2025; Schultz et al. 2026). Consequently, future public-health programmes should encourage collaboration among women knowledge holders, ethnobotanists, pharmacologists, and healthcare professionals rather than positioning traditional medicine in opposition to biomedical care.

Collectively, the Semarang findings demonstrate that women simultaneously function as caregivers, educators, innovators, and cultural mediators. Their contribution extends beyond conserving medicinal plant knowledge toward maintaining adaptive urban healthcare systems capable of responding to environmental, epidemiological, and social change. Strengthening women's participation in biodiversity conservation, community health promotion, and policy development will therefore be essential for sustaining Indonesia's urban biocultural heritage and achieving more inclusive and resilient healthcare systems.

Knowledge Transmission and Medical Pluralism

The findings reveal that traditional medicine remains the first therapeutic option for many households in Semarang. Herbal remedies are commonly used before biomedical consultation, particularly for common illnesses, while professional medical

care is generally sought when symptoms persist or become severe. This therapeutic sequence illustrates medical pluralism, whereby individuals strategically navigate between traditional and biomedical systems rather than treating them as mutually exclusive. Recent ethnobiological research argues that such pluralism reflects adaptive healthcare behaviour rooted in cultural trust, economic rationality, and accumulated treatment experience (Bussmann et al. 2025; Prakofjewa et al. 2026).

Knowledge transmission is central to sustaining this pluralistic system. In Semarang, medicinal knowledge is transmitted primarily through mothers and grandmothers during routine caregiving, food preparation, and home-garden management. Similar intergenerational learning has recently been documented in Indigenous and local communities where experiential learning remains more influential than formal instruction (Fernández-Llamazares and Teixidor-Toneu 2025; Odonne and Zank 2026). These studies emphasise that knowledge transmission should be viewed as an active social process in which younger generations reinterpret inherited practices according to contemporary health challenges.

Medical pluralism also evolves through knowledge hybridisation. Women increasingly combine ancestral knowledge with information obtained from health professionals, pharmacies, social media, and digital health platforms. Rather than weakening traditional medicine, this interaction frequently improves household capacity to evaluate treatment options. Recent discussions in Frontiers in Pharmacology argue that integrative knowledge systems strengthen community resilience when traditional knowledge is critically combined with scientific evidence and appropriate clinical guidance (Omary et al. 2026; Schultz et al. 2026).

Another important implication concerns chronic disease management. Informants reported that herbal medicine is frequently used alongside biomedical treatment for hypertension, diabetes, hypercholesterolaemia, and other long-term illnesses. Comparable observations have been reported in recent ethnopharmacological studies showing that patients often integrate herbal therapies with prescribed medicines because they perceive complementary benefits, lower costs, and stronger cultural acceptability (Bouqoufi et al. 2025; Tadesse et al. 2025). Nevertheless, these studies also highlight the need for pharmacological validation and careful monitoring of potential herb–drug interactions.

Urbanisation does not eliminate pluralistic healthcare but reshapes the mechanisms through which knowledge circulates. Markets, migrant networks, community organisations, and digital communication accelerate the exchange of therapeutic information while simultaneously exposing households to misinformation. Recent analyses in Journal of Ethnobiology and Ethnomedicine emphasise that resilient knowledge systems depend not only on preserving traditions but also on strengthening critical health literacy, documentation, and collaboration between local knowledge holders and researchers (Pieroni et al. 2025; Reyes-García et al. 2025).

From a medical anthropology perspective, pluralistic healthcare should therefore be interpreted as pragmatic decision-making rather than ideological preference. Households continually evaluate accessibility, affordability, previous treatment outcomes, perceived risks, and illness severity before selecting appropriate therapies. Such flexibility demonstrates that traditional medicine remains embedded within broader urban healthcare systems rather than existing outside them. The Semarang findings therefore support contemporary debates in ethnobiology and ethnopharmacology that recognise traditional medicine as a dynamic, adaptive, and socially negotiated component of resilient urban healthcare systems.

Biocultural Conservation and Public Health Implications

The findings extend beyond ethnobotanical documentation by demonstrating that urban medicinal plant use represents an important form of biocultural conservation linking biodiversity, cultural identity, and public health. Recent syntheses argue that conserving medicinal plants without simultaneously safeguarding the knowledge systems that sustain their use provides only partial conservation outcomes. Indonesian ethnobotanical evidence similarly highlights the need to integrate community participation, pharmacological validation, and ethical knowledge governance within conservation programmes (Febriyanti et al. 2026).

Home gardens function as living repositories of both biological diversity and cultural memory. They maintain medicinal species while supporting intergenerational learning through everyday prac-

tice. Recent discussions on medicinal keystone species emphasise that culturally important plants contribute simultaneously to ecosystem resilience, healthcare security, and cultural continuity within a One Health framework (Rapinski et al. 2026). Consequently, urban home gardens should be recognised as health infrastructure rather than merely private green spaces.

Rapid urbanisation nevertheless threatens biocultural resilience through land-use change, declining green spaces, commercialisation of herbal resources, and reduced opportunities for knowledge transmission. Forward-looking ethnobiology proposes collaborative conservation involving local communities, researchers, and policy makers rather than focusing only on documenting disappearing traditions (Fernández-Llamazares and Teixidor-Toneu 2025).

From a public-health perspective, integrating scientifically validated traditional medicine into primary healthcare may strengthen preventive health programmes. However, recent contributions in Frontiers in Pharmacology emphasise that successful integration requires evidence of safety, dosage, efficacy, equitable benefit-sharing, and recognition of local knowledge holders rather than pharmacological evidence alone (Omary et al. 2026; Schultz et al. 2026). This supports a model in which ethnomedicine complements rather than replaces biomedical healthcare.

Digital documentation, participatory mapping, and community-led databases increasingly contribute to safeguarding traditional knowledge. Recent work in Journal of Ethnobiology and Ethnomedicine argues that digital innovation should strengthen community control over knowledge rather than facilitate extraction or inappropriate commercialisation (Silva 2026).

The Semarang findings therefore contribute directly to SDG 3, SDG 5, SDG 11, and SDG 15 by demonstrating that women, medicinal plants, and community knowledge constitute interconnected components of resilient urban health systems. Biocultural conservation should consequently be understood not only as environmental protection but also as an investment in preventive healthcare, social resilience, and sustainable urban development. Such an approach is increasingly recognised across ethnobiology and ethnopharmacology as essential for achieving equitable and sustainable health futures.

Novelty and Contribution of the Present Study

This study makes several important contributions to contemporary ethnobotanical scholarship. First, unlike many previous Indonesian ethnobotanical studies that primarily document medicinal plant inventories, this research integrates botanical diversity with gender, knowledge transmission, and healthcare decision-making within an urban context. Second, the documentation of 82 medicinal plant species demonstrates that urbanisation does not inevitably erode traditional knowledge but instead creates opportunities for adaptive innovation and knowledge hybridisation. Third, the study highlights women's central role not only as custodians of ethnomedicinal knowledge but also as active innovators who continually negotiate between inherited traditions and contemporary healthcare systems.

Collectively, these findings contribute to broader debates in urban ethnobotany, medical anthropology, and public health by demonstrating that ethnomedicine remains a living, adaptive, and socially embedded healthcare system capable of supporting household resilience under conditions of rapid urban transformation.

CONCLUSION

This study demonstrates that urban ethnomedicine remains a dynamic and adaptive healthcare system sustained primarily by women in Semarang City despite rapid urbanisation and socioeconomic transformation. The documentation of 82 medicinal plant species illustrates not only the richness of local ethnobotanical knowledge but also the capacity of women to maintain, reinterpret, and innovate traditional healthcare practices through home gardening, herbal preparation, intergenerational knowledge transmission, and engagement with biomedical services. Rather than functioning as a residual cultural tradition, urban ethnomedicine represents a form of medical pluralism in which households strategically combine traditional herbal medicine with formal healthcare according to illness severity, accessibility, affordability, and accumulated therapeutic experience. The findings further demonstrate that women play multiple roles as custodians, educators, innovators, and health brokers who actively negotiate between ancestral knowledge, contemporary health

information, and changing urban environments. Consequently, medicinal plant knowledge should be recognised not only as an element of cultural heritage but also as a valuable resource for strengthening community health resilience, preventive healthcare, and sustainable urban development. At the same time, the study highlights the importance of integrating ethnobotanical documentation with pharmacological validation, safety assessment, conservation of medicinal plant resources, and ethical governance of traditional knowledge. Future research should complement qualitative ethnobotanical documentation with quantitative indices, pharmacological and toxicological investigations, and longitudinal studies examining how urbanisation, digital information, environmental change, and intergenerational learning continue to reshape ethnomedicinal knowledge. Strengthening women's participation in biodiversity conservation, community-based healthcare initiatives, and evidence-informed public health programmes will be essential for safeguarding urban bioculturral heritage while promoting resilient, inclusive, and sustainable healthcare systems in rapidly urbanising societies.

RECOMMENDATIONS

Based on the findings, several recommendations can be proposed to strengthen the sustainability of women's ethnomedicinal knowledge in Semarang City. First, it is essential to continue documenting and preserving women's traditional knowledge of medicinal plants through collaborative efforts between local universities, cultural institutions, and community organisations. This initiative would safeguard valuable information that risks being lost amid rapid urbanisation. Second, promoting urban home gardens and community herbal spaces can ensure continued access to medicinal plants, enhance biodiversity, and support environmentally friendly urban planning. Third, integrating verified traditional practices, such as jamu preparation and preventive herbal use, into public health initiatives could improve community health while promoting the safe and evidence-based use of herbal medicine. Fourth, empowering women through training and local workshops is crucial to strengthen their role as primary custodians and educators of traditional medicine, ensuring intergenerational transmission of knowledge. Furthermore, scientific validation and quality control of frequently used plants such as Zingiber officinale and Curcuma longa are recommended to substantiate efficacy and safety. These findings underscore the critical need for further research (including quantitative analysis and pharmacological validation), conservation efforts focused on urban medicinal plants and associated traditional knowledge, and culturally appropriate integration within broader public health frameworks. Documenting and supporting this living biocultural heritage is vital for community well-being and the sustainable management of plant resources relevant to agriculture and natural resource conservation. Finally, policymakers should recognise urban ethnobotanical practices as part of Indonesia's biocultural heritage by providing legal protection, supporting sustainable markets, and promoting the integration of traditional medicine into formal healthcare systems.

LIMITATIONS OF THE STUDY

Several limitations should be acknowledged. The exclusive focus on female informants, while justified by the study's aim, means male perspectives on traditional medicine use were not captured. The study relied on informant recall, which may be subject to bias. While efforts were made to identify plants accurately using available resources, comprehensive taxonomic verification including voucher deposition in a recognised herbarium (as described in the Methods section) is essential for reproducibility. The qualitative nature of the study precludes statistical analysis of use patterns, and future research could employ quantitative methods (for example, calculating UV/FL) to assess the relative importance of different species and uses. The geographical scope was limited to specific areas within Semarang, and findings may not be generalisable to the entire city or other urban contexts without further investigation.

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