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Formulation and evaluation Herbal antihypertensive powder of ashwagandha

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1.Abstract

Hypertension is a major risk factor for cardiovascular diseases, requiring long-term management. Herbal medicines offer a promising alternative to synthetic drugs due to their safety and efficacy. Withania somnifera (Ashwagandha) has been traditionally used for its adaptogenic and cardioprotective properties, making it a potential antihypertensive agent. This study focuses on the formulation and evaluation of an herbal antihypertensive powder using Ashwagandha. The powder was prepared by drying and pulverizing Ashwagandha roots, followed by quality assessment, including physicochemical characterization, phytochemical screening, and in-vitro antihypertensive activity. The formulation exhibited good stability, flow properties, and significant potential in managing hypertension. Further research and clinical trials are necessary to confirm its therapeutic efficacy and safety.

2.Keywords: Ashwagandha, herbal antihypertensive powder, Withania somnifera, hypertension, phytochemicals.

3.Introduction -:

3.1 Defination of hypertension -: current definition of hypertension (HTN) is systolic blood pressure (SBP) values of 130 mm Hg or more and/or diastolic blood pressure (DBP) of more than 80 mm Hg. Hypertension ranks among the most common chronic medical condition characterized by a persistent elevation in arterial pressure.[1]

High blood pressure (hypertension) is a significant cause of preventable mortality in the UK. It is a major risk factor for various diseases, including heart disease and cognitive disorders. Blood pressure levels vary across the population without a definitive cut-off for defining hypertension. Each increase of 2 mmHg in blood pressure raises the risk of mortality related to heart disease. Hypertension is prevalent in the UK, with age being a key factor; it

typically affects younger individuals with diastolic pressure and becomes more pronounced in older individuals due to

arterial stiffness. At least one-fourth of the population and more than half of those over 60 have hypertension. Managing hypertension is a common focus in primary care.[2]

Table 1:Different stages of Hypertension

Classification	Systolic (MmHg)	Diastolic (MmHg)
Normal	< 120	<80
Prehypertension	120-139	80-89
Stage 1	140-159	89-99
Stage 2	>160	

3.2 Type of hypertension

A.Essential (primary) hypertension

a. The main form of high blood pressure accounts for around 90-95% of cases

b. Has no single identifiable cause

c. Potential causes include genetic and environmental factor

B.Secondary hypertension

a. Rare forms of high blood pressure

b. Caused by another medical condition or treatments [2]

The plant Withania somnifera (L.) Dunal, commonly known as “Ashwagandha” is well known for its therapeutic use in the ayurvedic system of traditional medicine. It has been used as an antibacterial, antioxidant,adaptogen, aphrodisiac, liver tonic, anti-inflammatory agent [3]. It is a reputed health food and herbal tonic and used for cardiovascular diseases in ethnomedicine. It is available for human use either as a single herb or an ingredient of polyherbal or herbomineral formulations. The human doses of Ashwagandha are generally in the range of 4-6 g/day and expected to be safe and non-toxic. Withania contains active ingredients like steroidal alkaloids and lactones known as “withanolides”. Withaferin A and withanolide D are the two main withanolides that contribute to most of the biological actions of withania [4,5]. Stress, as a major cardiovascular risk factor leads activation of sympathoadrenal and hypothalamic pituitary adrenal (HPA) axis and causes oxidative stress. Withania possesses a potent anti-stressor effect and is reported to alleviate stress induced changes and provides cardio protection in ischemic rats similar to the properties ascribed to adaptogens like Panax ginseng. It also increases heart weight and glycogen in myocardium and liver indicating intensification of the anabolic process and enhances the duration of contractility as well as coagulation time [6,7]. So, this study was planned to assess the effect of Ashwagandha on hypertensive subject [8].

4.Objective -:

1.To formulate and evaluate Ashwagandha powder for hypertension.

2.To develop and assess the antihypertensive potential of Withania somnifera.

3.To investigate Ashwagandha powder for hypertension management.

4.To standardize and evaluate Withania somnifera for antihypertensive use.

5. Material and method

The present study was conducted in nandakumar shinde college of pharmacy vaijapur . This study was based on the action of Ashwagandha root powder in stress- oriented hypertension. The roots of Ashwagandha were collected from an authorized Ayurvedic shop and sorted out, washed and dried in oven at 60ºC for 4 to 6 hours till all the moisture is lost and is then ground to a fine powder in a flour mill. The powders are then filled in small bottles. 2g of powder was administered to subjects of group I and group II with milk and water respectively.

A) Ashwagandha

Synonyms -: Withania somnifera (9)

Biological source -: Ashwagandha consists of the dried roots and occasionally the leaves of Withania samni fera(9)

Family -: Solanaceae (9)

Chemical Constituents: Withanolides, Alkaloids (Withanine, Somniferine), Saponins, Flavonoids, and tannin (10)

Pharmacological action -: Ashwagandha lowers blood pressure by reducing stress, improving vasodilation, and modulating key cardiovascular pathways.(11)

b) **Arjuna -:**

Synonyms -: Terminalia arjuna (9)

Biological source -: Arjuna consists of the dried stem bark of Terminalia Arjuna (9)

Family -: Combretaceae (9)

Chemical Constituents -:

1. Triterpenoids – Arjunic acid, Arjunolic acid, Arjungenin, Arjunglucoside

2. Flavonoids – Kaempferol, Quercetin

3. Glycosides – Arjunetin, Arjunolone

4. Tannins – Ellagic acid, Gallic acid, Chebulagic acid

5. Saponins – Triterpenoid saponins

6. Minerals – Calcium, Magnesium, zinc (9)

Pharmacological action -: Arjuna lowers blood pressure by promoting vasodilation, improving heart function, reducing cholesterol, and acting as an antioxidant .(9)

c) Sarpagandha

Synonyms -: Rauwolfia serpentina (9)

Biological source -: It consists of the dried roots of Rauvolfia serpentina Benth. ex Kurz.(9)

Family: Apocynaceae (9)

Chemical Constituents -: reserpinne, ajmalin,serpentine, yohimbine,rescinnammin,desepidin (9)

Pharmacological action -: Sarpagandha (Rauvolfia serpentina) exhibits antihypertensive, sedative, antiarrhythmic, antipsychotic, uterine stimulant, and anti-inflammatory properties due to its alkaloid content. (9)

d) Funnel seed

Synonyms -: Foeniculum vulgare (9)

Biological source -: Fennel seeds are the dried ripe fruits of Foeniculum vulgare Mill.(9)

Family -: Apiaceae (Umbelliferae**). (9)**

Chemical Constituents -:anethole, fenchone,estragol,Limonene,camphene (9)

Pharmacological action -: Fennel seed lowers blood pressure through diuretic, vasodilatory, antioxidant, and potential calcium channel blocking actions.(9)

e) **Bramhi**

Synonyms -: Bacopa monnieri (9)

Biological source -: Brahmi consists of the whole plant of Bacopa monnieri (L.) Wettst.(9)

Family -: Plantaginaceae (9)

Chemical Constituents -:

1.Saponins (Major active components)

Bacosides A & B – responsible for memory-enhancing effects

Bacopasaponins – other glycosidic Saponins (9)

2. Alkaloids

Brahmine,Herpestine

3. Flavonoids

Luteolin,Apigenin

4. Sterols

B-sitosterol,Stigmasterol (9)

Pharmacological action -: Brahmi acts as a supportive herb in hypertension due to its anxiolytic, antioxidant, and mild cardiotonic properties.(9)

f) Garlic

Synonyms -: AlliumBiological(9)

Biological source -: Garlic consists of the dried or fresh bulbs of Allium sativum Linn.(9)

Family -: Amaryllidaceae (earlier classified under Liliaceae) (9)

Chemical Constituents -: Allicin (main bioactive compound),Diallyl disulfide,Diallyl trisulfide,S-allyl cysteine,Methyl allyl di sulfide(9)

Pharmacological action -: Garlic lowers blood pressure by promoting vasodilation, inhibiting angiotensin-converting enzyme (ACE), and improving nitric oxide availability.(9)

g) Ginger

Synonyms-: Adrak,Shunthi (9)

Biological source -: Ginger consists of the dried rhizomes of Zingiber officinale Roscoe. (9)

Family -: Zingiberaceae(9)

Chemical Constituents -: Volatile Oils (1–3%),Zingiberene (major component,Bisabolene,Farnesene,Pungent Principles (responsible for the spicy taste),Gingerol,Shogaol,Zingerone (9)

Pharmacological action -: Ginger helps reduce blood pressure by promoting vasodilation, blocking calcium channels, and improving blood circulation.(9)

h) Black pepper

Synonyms - : Piper ,Black pepper ,Kali mirch (Hindi)(11,12)

Biological source -: Black pepper consists of the dried unripe berries of Piper nigrum Linn.(11,12)

Family -: Piperaceae (11,12)

Chemical Constituents -:

Alkaloids: Piperine (major active constituent)

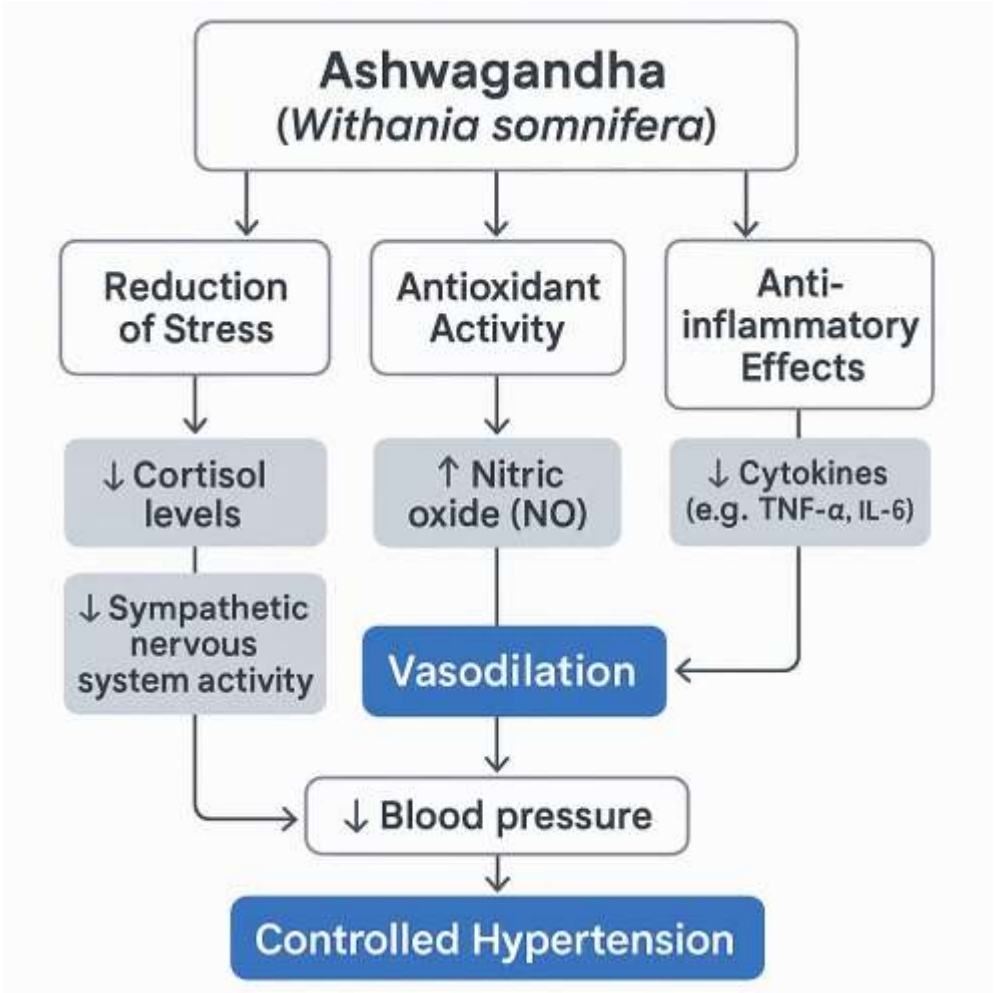
Chavicine (isomer of piperine, pungent)(11,12)

Essential oils: Pinene, Sabinene, Limonene, Caryophyllene

Resins Starch Proteins11,12)

Pharmacological action -: Black pepper (Piper nigrum) shows antihypertensive activity mainly due to piperine, which acts as a calcium channel blocker and vasodilator, reducing blood pressure. It also provides antioxidant effects that support cardiovascular health.(13)

6. Mechanism of actions of ashwagandha



(14,15,16)

Table 2 : Formulation table

Sr.no	Ingredient	Quantity (g)	Category
1	Ashwagandha	6.0	Adoptogen
2.	Sarpagandha	4.0	Natural hypotensive
3	Arjuna	3.0	Cardioprotective
4.	Brahmi	2.0	Neuroprotective
5.	Funnel seed	2.0	Mild diuretic
6.	Garlic	1	Low cholesterol
7.	Ginger	1	Improve blood circulation
8.	Black pepper	1	Bioavailability enhancers

7. Methods of preparation -:

Collection of raw material

Ashwagandha root, Arjuna bark, Sarpagandha root Funnel seeds, Brahmi leaves, Garlic (dried), Ginged)

↓

Drying Coarsely crush the herbs Pulverize separately into fine powder

↓

Sieving Pass the powder through 8-noa sive

↓

Weighing & Mixing Weigh each powder a formulat table Mix thoroughly, wite

↓

Packing Pack in airtight containers In airtight containers (17,18)

8.Evaluation test

A)organoleptic evaluation

a) colour

b) odor

c) taste

B) physicochemical Evaluation

1) Moisture content

To determine the amount of water and volatile matter present in the formulation.Excess moisture can lead to microbial growth, degradation, and reduced shelf life.(19,20,21,22,23)

Procedure:

- Weigh 2 g of powder in a crucible
- Dry in hot air oven at 105°C for 3 hours
- Cool in desiccator and te Weigh (24)

Calculate Moisture content

Moisture content % = (Initial weight – final Weigh / Initial weight) ×100

2) Partical size deterermination

To determine the fineness and uniformity of the powdered formulation using sieve analysis, which affects absorption, bioavailability, flow properties, and stability.(25,26,27,28,29)

Sample herbal powder (churna)

- Set of sieves (sieve #20, #40, #60, #80, #100)
- Mechanical sieve shaker or manual shaker
- Weighing balance
- Brush (to collect retained powders)
- Dry container for Collection (17,23)

Procedure:

- Pass the powder through #80 sieve
- Weigh retained and passed powder (17,23)

D) ash value

The Ash Value Test determines the total amount of inorganic matter (minerals) in herbal powders. It includes Total Ash (overall mineral content), Acid-Insoluble Ash (siliceous impurities like sand), and Water-Soluble Ash (soluble minerals). It involves incinerating the sample at 500–600°C and calculating ash residue percentage. This test helps detect adulteration and ensures purity of the formulation(30,31)

Formula-: Total ash (%) = [Weight of ash/Weight of sample taken]

E) Bulk Density

The Bulk Density Test measures the mass of powdered herbal material per unit volume, including air spaces. It is calculated by gently filling a graduated cylinder with the sample and measuring weight/volume (g/ml). This test

helps assess flow properties, packaging, and formulation efficiency. It is commonly used in herbal powder standardization.(30,31)

Formula

Bulk Density = weight of powder /Initial volume

Procedure

1. Weigh the powder: Take 20 g of the powdered drug accurately

2. Transfer to a graduated cylinder: Carefully pour the powder into a 100 mL graduated cylinder without tapping.

3. Note the volume: Record the initial volume (V_0) the powder occupied(23,32,33,34)

D) Tapped Density

Tapped Density is the density of a powder after it has been compacted by tapping. It reflects how well a powder can settle or pack under mechanical tapping, indicating its flow and compressibility.

Formula: Tapped Density = Mass of powder/Tapped volume

Procedure

1. Weigh 20 g of the powder.

2. Transfer it to a graduated cylinder (e.g., 100 mL).

3. Note the initial volume (V_0) without tapping.

4. Tap the cylinder 500 times using a tapped density tester or manually on a hard surface.

5. Note the new volume (Vf). If the volume change is >2%, tap up to 1250 times.(32,33,35,36)

E)PH deterermination test

To check if the powder is acidic or basic, which helps in knowing its stability and safety.

Method:

1. Take 1 g and 10 g of powder separately.

2. Mix each in 100 ml of distilled water.

3. Stir well and let it rest for 30 minutes.

4. Use a pH meter to measure the pH of both solutions.(37)

9. Result:

A) organoleptic properties

Sr.no	Test	Result
1.	Colour	Beownish-green
2.	Odour	Characteristic
3.	Taste	Slightly bitter

B) physicochemical Evaluation

Sr.no	Test	Result	Limit/standard
1.	Moisture content	3.2%	NMT 5%
2.	Ash Value	6.8%	NMT 10%
3.	Acid insoluble ash	0.9 %	NMT 1.5 %
4.	PH	6.2	5-7
5.	Bulk density	0.47 gm/ML	-
6.	Tapped Density	0.55 gm/mL	-
7.	Carrs index	14.5 %	Good flow (< 15%)
8.	Hausners ratio	1.17	Acceptable (<1.25)
9.	Angle of repose	29.8	Good flow (< 30)
10.	Partical size	85%	

C)Phytochemical Sreening

Sr.No	Phytochemical	Test performed	Result
1.	alkaloid	Dragondrop/Mayer	Positive
2.	Flavonoid	Shomnda test	Ppsitive
3.	Tannin	Ferric chloride test	Positive
4.	Saponin	Foam test	Positive
5.	Glycoside	Legal test	Positive
6.	Terpenoid	Salkowski test	Positive
7.	Phenolic	Lead acetate test	Positive

10. Conclusion

The antihypertensive polyherbal powder formulated with Ashwagandha as the primary ingredient, along with Arjuna, Brahmi, Fennel seed, Ginger, Garlic, Black pepper, and Sarpagandha, was successfully prepared and evaluated. The formulation showed acceptable organoleptic properties, good flow characteristics, and compliance with physicochemical parameters. Phytochemical screening confirmed the presence of bioactive compounds like alkaloids, flavonoids, tannins, and saponins, which are known to contribute to antihypertensive activity. The presence of multiple phytoconstituents with known cardiovascular and nervous system benefits supports the traditional use of these herbs in hypertension management. Therefore, this formulation can be considered a safe, stable, and natural alternative for antihypertensive therapy and can be explored further through pharmacological and clinical studies to validate its efficacy and safety.

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