



Review Article

## Mode of Action of *Trikatu Ghrita Yukt Swarnabhasma* in *Pandu Roga* (Anaemia) Arti<sup>1\*</sup>, Agrawal Neeraj<sup>2</sup>, Chandravanshi Lowkesh<sup>3</sup>, Rathia Satyawati<sup>4</sup>, Bhatt Lalit Mohan<sup>1</sup>, Dushyant<sup>1</sup>

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### ABSTRACT

*Pandu roga*, an ancient *Ayurvedic* term used to describe a specific disease, has been recognized and discussed by various *Ayurvedic* scholars. According to their teachings, *Pandu roga* is considered a type of *Rasa pradoshaj vikara*, with *Pitta dosha* playing a prominent role in its manifestation. The key characteristic of this disease is *Panduthwa*, or Pallor, which exhibits clinical features similar to modern-day Anaemia. A condition in modern medicine, involves a deficiency in red blood cells or hemoglobin percentage due to decreased production. It is often associated with poor nutrition and overall health. The problem is commonly observed in low birth weight infants, overweight children who lack energy for physical activity, school-going children, adolescents, and pregnant women. In traditional *Ayurvedic* medicine, there are various formulations suggested for managing Anaemia, one of which is *Trikatu Ghrita Yukt Swarnabhasma*. This herbal preparation contains *Trikatu*, a combination of three spices - *Shunthi* (*Zingiber officinale*), *Marich* (*Piper nigrum*), and *Pippali* (*Piper longum*). These spices are renowned for their digestive and metabolic properties. Additionally, *Swarnabhasma*, derived from gold, has been utilized in *Ayurveda* for its rejuvenating and tonic effect.

### INTRODUCTION

The ancient science of *Ayurveda* has long recognized a disease known as *Pandu roga*, which can be traced back to the earliest references found in the *Vedas*. This ailment has been mentioned with various names in different ancient texts. In the *Rigveda* and *Atharvaveda*, it is referred to as *Vilohita*, *Halima*, and *Harima*, while *Acharya Sushruta's* texts mention it as *Panaki*, *Laghavaka*, and *Kumbhahwa*<sup>1</sup>. In *Ayurveda*, *Pandu roga* is distinguished by alterations in skin color, displaying shades of *Panduthwa* (*Sweta*), Yellowish (*Pita*), or Greenish (*Harita*). This condition falls under the category of "*Varnopalakshita Roga*," denoting diseases characterized by changes in color. *Amarkosha* describes *Pandu* as a blend of *Panduthwa* color with a hint of yellowish tinge<sup>2</sup>. Mixture of *Panduthwa* and yellow color which resembles with the pollen grains of *Ketaki* flowers by *Vachaspatya*<sup>3</sup>.

*Acharya Charak* described the prodromal symptoms of disease include palpitations, dryness of skin and mucosal surfaces, loss of sweating and malaise<sup>4</sup>. The prevalence of *Panduta* (pallor) throughout the body allows for a correlation between this disease and Anaemia in modern science. Anaemia is a condition when the Haemoglobin level is more than two standard deviations below the mean for child's age and sex<sup>5</sup>. In modern science, Anaemia, caused by an insufficient supply of iron for Haemoglobin synthesis, is the most prevalent hematological disorder during infancy and childhood<sup>6</sup>. According to *Ayurveda*, *Pitta dosha* and its effects on *Rasa* and *Rakta Dhatu* (plasma and blood tissue) are the main causes of *Pandu*. Due to the consumption of *Pitta-Prakopaka Ahara* (foods aggravating *Pitta*), Consequently, the vitiated *doshas* affect *Twak* (skin) and *Mamsa* (muscle tissue), resulting in *Pandu* (anaemia) and *Haridra varna* (yellowish discoloration) of the skin<sup>7-8</sup>. Pathologically disease involves *Agnimandhya* that leads to decrease in *Abhyavaharana shakti*, *Jaranashakti* and *Kayagni*. As a result there is formation of immature *dhatu* and malnutrition occurs due to impaired *Kayagni* along with *Varnahani*, *Prabhahani*, *Utsahahani* and *Krishata*<sup>8-10</sup>.

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**Causes of Pandu Roga (According to Ayurveda)**

<b>Aaharaj Nidana</b>	<b>CH.S.</b>	<b>SU.S</b>	<b>A.H.</b>	<b>M.N.</b>
<i>Amla, Lavana Rasa</i>	+	+	+	+
<i>Atiushana</i>	+	-	-	-
<i>Virudhasana</i>	+	-	-	-
<i>Atitikshana</i>	+	+	+	+
<i>Asatmaya Bhojana</i>	+	-	-	-
<i>Nishpav, Mash, Pinyaak Sevana</i>	+	-	-	-
<i>Vidagdha Anna Sevana</i>	+	-	-	-

<b>Viharaja Nidana</b>	<b>CH.S.</b>	<b>SU.S</b>	<b>A.H.</b>	<b>M.N.</b>
<i>Divaswapna</i>	+	+	+	+
<i>Ativyayama</i>	+	+	+	+
<i>Vegdharana</i>	+	-	+	-
<i>Pratikarma</i>	+	-	-	-
<i>Ritu Veshymata</i>	+	-	-	-
<i>Mansika Nidana- Chinta, Bheya, Krodha</i>	+	-	-	-

**According to Modern**

Anaemia is an indicator of both poor nutrition and poor health. It is problematic on its own, but it can also impact other global nutritional concerns such as stunting and wasting, low birth weight, childhood overweight and obesity due to lack of energy to exercise. School performance in children and reduced work productivity in adult due to Anaemia can have further social and economic impact for the individual and family<sup>11-12</sup>.

**Need of Study**

The prevalence of Anaemia in developing countries is 39% in children below 5 years of age, and 48% in children between 5-14 years of age group<sup>13</sup>. In developing countries like India, because of population explosion, poor economic status, lower hygiene & sanitation care, children are more prone to various infections, parasitic infestations & nutritional disorders<sup>14</sup>.

**Swarnabhasma**

The utilization of metals in medicinal practices dates back to ancient times, not only in *Ayurveda* but also in Chinese and Egyptian civilizations as early as 2500 B.C. In *Ayurveda*, one of the preparations involving metals and minerals is known as *Bhasma*. This involves burning the original material, followed by an extensive purification process and subsequent reaction phase, which includes the addition of various minerals and herbal extracts. The end result is an ash-like substance created for specific *Ayurvedic* purposes<sup>15</sup>.

Throughout various ancient medical texts, including the *Charak Samhita* (1500 BC), *Sushruta Samhita* (1000 BC), and *Astanga Hridaya* (400 AD), the medicinal properties of *Swarna*, or gold, are widely documented. Among all metals, *Swarna* holds a prominent and distinguished position. It is classified as part of the Sara Loha group, a category of metals representing "essence" or noble metals<sup>16</sup>.

*Acharya vagbhatta* in *Ras Ratana Samuchya* 5/19 has explained the benefit of administration of 250 mg (2 *Ratti*) *Swarnabhasma* along with *Katu Ghrita* in Various disease such as *Swasha*, *Kasha*, *Aruchi*, *Kshya*, *Aganimandhya*, *Pandu*, *dusta grahani* etc, and also beneficial in *Ojovardhan*, *Balavardhan* and *Saptadhatuwardhan*<sup>17</sup>.

**Trikatu**

The term "*Trikatu*" in Sanskrit derives its meaning from "*tri*" which represents three, and "*katu*," indicating acrids. *Trikatu*, therefore, is a blend of three acrid herbs: *Marich* (Black pepper), *Pippali*, and *Shunthi* (Ginger). When combined in equal proportions, these herbs form the miraculous formulation known as *Trikatu*. In *Ayurveda*, *Trikatu* is extensively mentioned for its numerous beneficial properties and uses.

**MATERIAL AND METHOD**

A literary review of *Charak Smhita*, *Sushruta Samhita*, *Yogratnakar*, *RasratnaSamuchchya*, and Modern textbooks, Previous papers was done in a parallel way to understand this topic in depth.

**Properties of Swarnabhasma<sup>18</sup>, Shunthi<sup>19</sup>, Pippali<sup>20</sup>, Marich<sup>21</sup>**

Property	Swarnabhasma	Shunthi (Zingiber Officinal Roscoe.)	Pippali (Piper Longum Linn.)	Marich (Piper Nigrum Linn.)
Rasa	Madhura	Katu	Katu	Katu
Guna	Snigdha, Laghu	Laghu, Snigdha	Laghu, Snigdha, Trikshna	Trikshna, Laghu
Virya	Shita	Ushna	Anushna, Shita	Ushna
Vipaka	Madhura	Madhura	Madhura	Katu
Karma	Tridoshashamak	Kapha, Vatashamak	Kaphahara	Kaphavatahara

**Pharmacological Review of Ingredients of Trikatu Ghrita Yukt Swarnabhasma Swarnabhasma****Ingredients of Swarnabhasma<sup>16</sup>**

Sulfur	<3.33% w/w
Calcium	<1.625% w/w
Sodium	<0.922% w/w
Potassium	<0.370% w/w
Sulfate	<3.00% w/w
Copper	<17.2% w/w
Iron oxide (ferric)	<85.0% w/w
Iron oxide (ferrous)	<5.7% w/w
Phosphate	<1.101% w/w
Silica	<3.8% w/w
Acid insoluble	<11.93% w/w
Ash value	<98.20% w/w
Acid-insoluble ash value	21.20-31.18% w/w

Anaemia, characterized by a decrease in red blood cells or their ability to carry oxygen, is a common blood disorder. *Swarnabhasma*, an *Ayurvedic* preparation containing processed gold, has been used in traditional medicine to address various health conditions, including Anaemia. This article aims to explore the potential mechanisms by which *Swarnabhasma* may work in managing Anaemia.

**Enhancement of Red Blood Cell Production:** *Swarnabhasma* is believed to stimulate the production of red blood cells in the body. The presence of gold in *Swarnabhasma* is thought to play a role in promoting hematopoiesis, the formation of blood cells. Gold is believed to enhance the production and maturation of red blood cells, thereby. Increasing their numbers in the bloodstream<sup>22</sup>.

**Improvement of Blood Circulation:** Another way in which *Swarnabhasma* may aid in managing Anaemia is by improving blood circulation. It is believed that *Swarnabhasma* can strengthen and invigorate the

blood vessels and microcirculation<sup>23</sup>. This improved blood flow facilitates the delivery of oxygen and nutrients to the body's tissues, including the bone marrow where red blood cells are produced. By optimizing blood circulation, *Swarnabhasma* may contribute to a healthier red blood cell population<sup>24</sup>.

**Enhanced Oxygen-Carrying Capacity:** The presence of gold in *Swarnabhasma* is believed to enhance the oxygen-carrying capacity of red blood cells. Gold is thought to improve the affinity between hemoglobin and oxygen, enabling red blood cells to transport oxygen more efficiently<sup>25</sup>. By enhancing oxygen delivery to various tissues, *Swarnabhasma* may help alleviate the symptoms associated with Anaemia, such as fatigue and weakness.

**Supporting Immune Function:** Anaemia can weaken the immune system, making individuals more susceptible to infections and illnesses. *Swarnabhasma* is known for its immune-modulating properties, which may help strengthen the body's defense mechanisms<sup>26</sup>.

By supporting immune function, *Swarnabhasma* may contribute to overall health improvement in individuals with Anaemia.

### **Chemical Composition of *Shunthi* (*Zingiber Officinalis* Roscoe.)**

Exhaustive chemical screening of *shunthi* reveals that it contains over 450 compounds. The major composition of *shunthi* rhizomes is carbohydrates (50–70%), lipids (3–8%), terpenes, phenolic compounds, amino acids, raw fiber, ash, protein, phytosterols, vitamins, and minerals. zingiberene,  $\beta$ -bisabolene,  $\alpha$ -farnesene,  $\alpha$ -curcumene, and  $\beta$ -sesquiphellandrene. Phenolic compounds include gingerol, paradols, and shogaol. 6-paradol, 1-dehydrogingerdione, 6-gingerdione and 10-gingerdione 4-gingerdiol, 6-gingerdiol, 8-gingerdiol, and 10-gingerdiol, polyphenol and diarylheptanoids<sup>27</sup>.

#### **1. Iron Metabolism and Absorption**

*Shunthi* contains various bioactive compounds that may influence iron metabolism and absorption in the body. Studies have suggested that *can* increase the expression of iron transport proteins, such as divalent metal transporter 1 (DMT1), in the intestines, thereby enhancing iron absorption<sup>28</sup>. Adequate iron absorption is crucial for the production of healthy red blood cells, and by promoting iron uptake, *Zingiber officinale* may help address iron-deficiency Anaemia.

#### **2. Anti-Inflammatory and Antioxidant Effects**

Chronic inflammation and oxidative stress can contribute to Anaemia by disrupting red blood cell production and function. *Zingiber officinale* possesses potent anti-inflammatory and antioxidant properties attributed to its bioactive compounds, including gingerols and shogaols<sup>29</sup>. These compounds help reduce inflammation and neutralize harmful free radicals, protecting red blood cells from damage and preserving their functionality.

#### **3. Hematopoietic Stimulation**

*Zingiber officinale* has been reported to possess hematopoietic properties, meaning it can stimulate the production of blood cells, including red blood cells. It is believed that ginger's bioactive components can promote the proliferation and differentiation of hematopoietic stem cells, leading to increased red blood cell production<sup>30</sup>. By supporting hematopoiesis, *Zingiber officinale* may contribute to addressing Anaemia.

#### **4. Improved Digestion and Nutrient Assimilation**

Digestive health plays a vital role in nutrient absorption, including iron. *Zingiber officinale* has been traditionally used to support digestion and alleviate gastrointestinal discomfort. By improving digestion and nutrient assimilation, *Shunthi* may indirectly

enhance iron absorption and utilization, aiding in the management of Anaemia.

### ***Pippali* (*Piper Longum* Linn.)**

#### **Chemical composition of *Pippali* (*Piper Longum* Linn.)**

Piperine, methyl piperine, iperonaline, piperettine, pellitorine, piperlongumine, piperlonguminine, asarinine, piperundecalidine, refractomide A, pipericide, piperderidine, longamide and tetrahydropiperine, terahydro piperlongumine, dehydropiperonaline piperidine, pregumidiene, brachystamide, brachystamide-A, brachystine, terahydropiperlongumine, and trimethoxy cinnamoylpiperidine. Lignans Sesamin, pulvuatilol, fargesin<sup>31</sup>.

#### **1. Iron Uptake and Absorption**

*Piper longum* is rich in various bioactive compounds, including piperine, which is known to enhance iron uptake and absorption in the body<sup>31</sup>. Iron is a crucial element for the synthesis of hemoglobin, the protein responsible for carrying oxygen in red blood cells. By promoting the absorption of dietary iron from the intestines, *Piper longum* may contribute to improving the iron status in individuals with Anaemia.

#### **2. Hematopoiesis Stimulation**

Studies have shown that *Piper longum* possesses hematopoietic properties, meaning it can stimulate the formation of blood cells, including red blood cells<sup>32</sup>. The active compounds in *Piper longum* are believed to enhance the production and maturation of red blood cells in the bone marrow. This effect may help in increasing the red blood cell count and improving oxygen-carrying capacity.

#### **3. Antioxidant Activity**

*Piper longum* is a rich source of antioxidants, such as piperine and other bioactive compounds, which help neutralize harmful free radicals in the body<sup>33</sup>. Free radicals can damage red blood cells and impair their function, leading to Anaemia. The antioxidant properties of *Piper longum* may protect red blood cells from oxidative stress and preserve their integrity and functionality.

#### **4. Anti-Inflammatory Effect**

Inflammation is known to be a contributing factor to Anaemia, as chronic inflammation can lead to a decrease in red blood cell production and an increased breakdown of red blood cells. *Piper longum* has demonstrated anti-inflammatory properties, attributed to its bioactive compounds like piperine and piperlonguminine<sup>34</sup>. By reducing inflammation, *Piper longum* may help in maintaining a healthy red blood cell count and function.



## 5. Immune System Regulation

Anaemia can weaken the immune system, making individuals more susceptible to infections and illnesses. *Piper longum* has immunomodulatory effects, meaning it can regulate the immune system's response<sup>35</sup>. By supporting immune function, *Piper longum* may help in maintaining overall health and preventing secondary infections that can worsen Anaemia.

### *Maricha (Piper Nigrum Linn.)*

#### Chemical Composition of *Marich (Piper Nigrum Linn.)*

*Piper nigrum* (Black pepper) comprises lignans, alkaloids, flavonoids, amides, and other aromatic compounds, accompanied by approximately 3.5% of volatile oil. Components of essential oil include sabinene, pinene, linalool, limonene, and phellandrene. Piperine is an alkaloid and the chemical marker of *P. nigrum*. Chavicine which is an isomer of piperine is also present<sup>36</sup>.

### 1. Enhanced Iron Absorption

*Marich* contains a bioactive compound called piperine, which has been shown to enhance the absorption of nutrients, including iron, from the gastrointestinal tract<sup>37</sup>. Iron plays a crucial role in the synthesis of hemoglobin, the oxygen-carrying component of red blood cells. By promoting iron absorption, *Piper nigrum* may help improve iron levels in individuals with Anaemia, supporting the production of healthy red blood cells.

*Swarnabhasma*, an Ayurvedic preparation containing processed gold, shows promising potential in managing Anaemia. Through various mechanisms, *Swarnabhasma* may positively impact red blood cell production, blood circulation, and oxygen-carrying capacity. These effects may help alleviate the symptoms associated with Anaemia, such as fatigue and weakness. One of the key strengths of *Swarnabhasma* is its immune-modulating properties, which can also support the overall health of individuals with Anaemia by strengthening their immune system. *Shunthi*, helps in managing Anaemia or low hemoglobin levels. It contains compounds that enhance iron absorption, essential for the production

## 2. Antioxidant Properties

*Piper nigrum* exhibits significant antioxidant activity due to the presence of various phenolic compounds, such as piperine, flavonoids, and alkaloids<sup>38</sup>. Oxidative stress, characterized by an imbalance between free radicals and antioxidants, can damage red blood cells and impair their function. The antioxidant properties of *Piper nigrum* may help protect red blood cells from oxidative damage, contributing to their proper functioning and longevity.

## 3. Anti-Inflammatory Effects

Chronic inflammation can disrupt red blood cell production and promote their destruction, leading to Anaemia. *Piper nigrum* possesses anti-inflammatory properties attributed to its bioactive compounds<sup>39</sup>. These compounds help reduce inflammation by inhibiting pro-inflammatory mediators. By reducing inflammation, *Piper nigrum* may support healthy red blood cell production and prevent their premature destruction.

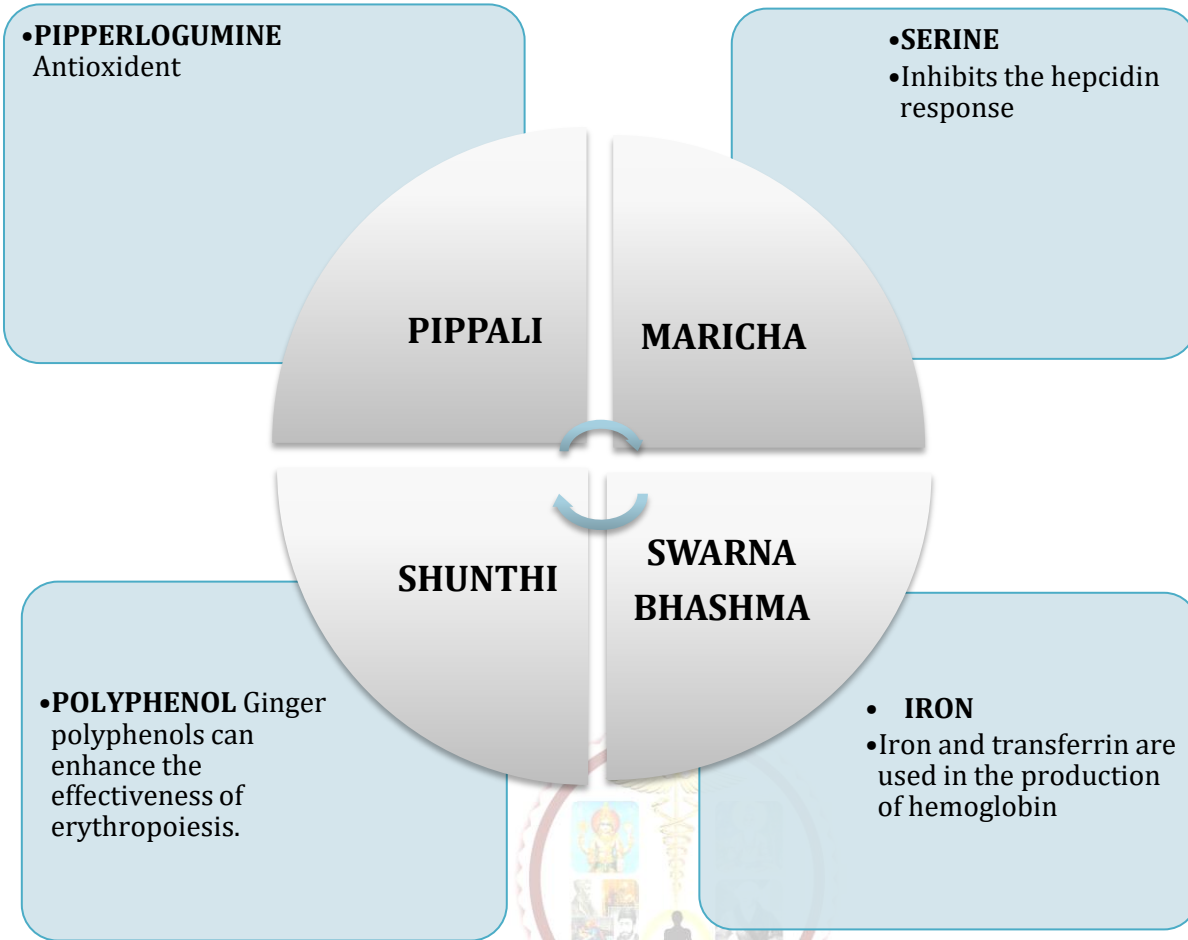
## 4. Immune System Support

Anaemia can weaken the immune system, making individuals susceptible to infections and other illnesses. *Piper nigrum* has been reported to have immunomodulatory effects, which can enhance immune function and resilience<sup>40</sup>. By supporting immune health, *Piper nigrum* may help individuals with Anaemia maintain overall well-being and prevent secondary infections that can worsen Anaemia.

## DISCUSSION

of healthy red blood cells. Its anti-inflammatory and antioxidant properties reduce inflammation and oxidative stress, protecting red blood cells from damage. *Piper longum*, also known as long pepper, offers several potential benefits in managing Anaemia. Its bioactive compounds, like piperine, contribute to enhanced iron uptake and absorption, essential for Haemoglobin synthesis. *Piper nigrum* (black pepper) shows potential in managing Anaemia through various mechanisms. The antioxidant properties protect red blood cells from oxidative damage, while anti-inflammatory effects promote proper red blood cell function.

## Probable Mode of Action of *Trikatu Ghrita Yukt Swarnabhasma* In *Pandu Roga* (Anaemia)



### CONCLUSION

As is well known, a healthy body places a priority on good health. Ayurvedic texts state that optimum health requires the balance of all *Doshas*, *Dhatus*, and *Mala*. *Swarnaprashna* is a *lehana dravya* mentioned by *Acharya Kashyapa* in *Kashyapa Samhita* it prepared with *Swarnabhasma*. mode of action of *Trikatu* and *Swarnabhasma* for Anaemia. *Trikatu* is a digestive stimulant that enhances the absorption of iron and other nutrients from food. It also improves the metabolism and reduces the accumulation of toxins in the body. *Swarnabhasma* is an antioxidant that protects the red blood cells from oxidative damage and increases their lifespan. It also stimulates the production of new red blood cells and enhances the oxygen-carrying capacity of the blood. *Trikatu* and *Swarnabhasma* have a synergistic effect in improving the Haemoglobin level and reducing the symptoms of Anaemia in rats. The study suggests that *Trikatu and Swarnabhasma* act by modulating the expression of genes involved in iron metabolism, erythropoiesis, inflammation, and oxidative stress.

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