












Journal of Experimental Biology and Agricultural Sciences

<http://www.jebas.org>

ISSN No. 2320 – 8694

Potential benefits and therapeutic applications of "Panchgavya" therapy (Cowpathy) for human and animal health: Current scientific knowledge

Deepak Chandran^{1†*} , Ankitha Indu J^{2†}, Sivasabari K^{2†}, Meenakshy S^{2†},
Sreelakshmi M², Amrithendhu V R², Khanza Ahamed², Gopika Ram², Devika Mohan²,
Anamika P², Sandip Chakraborty³ , Hitesh Chopra⁴ , Shopnil Akash⁵ , Ruhul Amin⁶ ,
Sirwan Khalid Ahmed⁷ , Abhijit Dey⁸ , Anil K Sharma⁹ , Kuldeep Dhama^{10*} 

¹Department of Animal Husbandry, Government of Kerala, India – 679335.

²Amrita School of Agricultural Sciences, Amrita Vishwa Vidyapeetham University, Coimbatore, Tamil Nadu – 642109, India

³Department of Veterinary Microbiology, College of Veterinary Sciences and Animal Husbandry, R.K. Nagar, West Tripura, Tripura, Pin-799008, India

⁴Chitkara College of Pharmacy, Chitkara University, Punjab - 140401, India

⁵Faculty of Allied Health Science, Department of Pharmacy, Daffodil International University, Daffodil smart city, Ashulia, Savar, Dhaka-1207, Bangladesh

⁶Faculty of Pharmaceutical Science, Assam down town University, Panikhaiti, Gandhinagar, Guwahati, Assam-781026, India

⁷Independent Researcher, Kurdistan Region, 46012, Iraq

⁸Department of Life Sciences, Presidency University, 86/1 College Street, Kolkata-700073, West Bengal, India

⁹Department of Biotechnology, Maharishi Markandeshwar University (Deemed to be University) Mullana-Ambala-133207, Haryana, India

¹⁰Division of Pathology, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh - 243122, India

† Authors contributed equally

Received – May 23, 2023; Revision – June 25, 2023; Accepted – June 26, 2023

Available Online – June 30, 2023

DOI: [http://dx.doi.org/10.18006/2023.11\(3\).520.533](http://dx.doi.org/10.18006/2023.11(3).520.533)

KEYWORDS

Cowpathy

Panchgavya

Cow urine

Milk

Dung

ABSTRACT

Cow's milk, urine, dung, ghee, and curd (together known as "Panchgavya") have incomparable medicinal value in Ayurveda and ancient Indian clinical methods. Panchgavya is also known as Cowpathy in Ayurveda. In India, the cow is revered as a goddess known as "Gaumata" because of its nurturing qualities similar to those of a mother. Almost no adverse effects are associated with using Panchgavya, which is why it is recommended in Ayurveda for treating disorders affecting numerous body systems. Its possible antimicrobial effects have piqued the curiosity of medical researchers and practitioners. Cow milk is widely regarded as a nutritious diet and has been shown to effectively treat various medical conditions, including high body temperature, pain, cancer, diabetes, kidney diseases, and weakness. Milk can prevent the growth of microorganisms, has erotic qualities when combined with the

* Corresponding author

E-mail: drdeepakchandran24@gmail.com (Deepak Chandran);

kdhama@rediffmail.com (Kuldeep Dhama)

Peer review under responsibility of Journal of Experimental Biology and Agricultural Sciences.

Production and Hosting by Horizon Publisher India [HPI]
(<http://www.horizonpublisherindia.in/>).
All rights reserved.

All the articles published by [Journal of Experimental Biology and Agricultural Sciences](http://www.jebas.org) are licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License](https://creativecommons.org/licenses/by/4.0/) Based on a work at www.jebas.org.



Ghee

Curd

Human health and diseases

leaves of medicinal herbs, and the fat in milk has anticancer characteristics. Toned and skim milk, lassi, yoghurt, cottage cheese, and khoa all come from milk and have important medicinal characteristics. Curd (dahi) is recommended as a blood purifier for conditions such as hemorrhoids, piles, and gastrointestinal issues. Ghee made from cows has been shown to boost immunity. It is important to highlight the use of cow dung as an antifungal and for treating malaria and tuberculosis. It has the potential to aid in the development of a populace free from disease, the creation of sustainable energy systems, the fulfilment of all nutritional needs, the elimination of poverty, the promotion of organic farming culture, and the like. Cow urine is a powerful remedy for numerous medical conditions, including but not limited to epileptic convulsions, diabetes, hepatitis, inflammation, fever, and anaemia. The current review article explores how the Panchgavya ingredients can be employed to safeguard human and animal health.

1 Introduction

India is steeped in ancient scientific practices that link social rituals to their scientific underpinnings. The Indians give the cow the names "Gaumata" and "Kamadhenu" because of its nurturing role, similar to that of a mother. Kamadhenu is the name of the sacred cow that is thought to bestow wishes upon their devotees. The healing and preventative effects of Panchgavya are priceless. In the Ayurvedic system of medicine, cow products like milk, ghee, curd, urine and dung are revered for their curative and preventative properties (Arumugam et al. 2019). Ingredients and uses for these items in medicine, agriculture, and other sectors might vary considerably. 'Panch' means five, and 'gavya' means gained from 'Gau,' so together, these two words indicate the five products that may be made from a single cow, hence the name 'Panchgavya.

Different 'gavya' have varying curative effects on different ailments. Like allopathy, homeopathy, and naturopathy, "Cowpathy" refers to Panchgavya therapy or treatment. Each 'gavya' has multiple applications, including use as a standalone treatment or in synergy with other medicines. The five products are also versatile since they can be used singly or in tandem with others of synthetic, herbal, or mineral origin (Dhama et al. 2005a; Dhama et al., 2014; Dhama et al. 2015; Arumugam et al. 2019; Bajaj et al. 2022; Sathiyaraj et al. 2022). These five components of Panchgavya are mentioned in Figure 1.

Clinical trials of the therapy have shown promising results in patients with advanced stages of cancer, acquired immunodeficiency syndrome (AIDS), diabetes, tuberculosis, rheumatoid arthritis, leukoderma, flu, asthma, allergies, heart

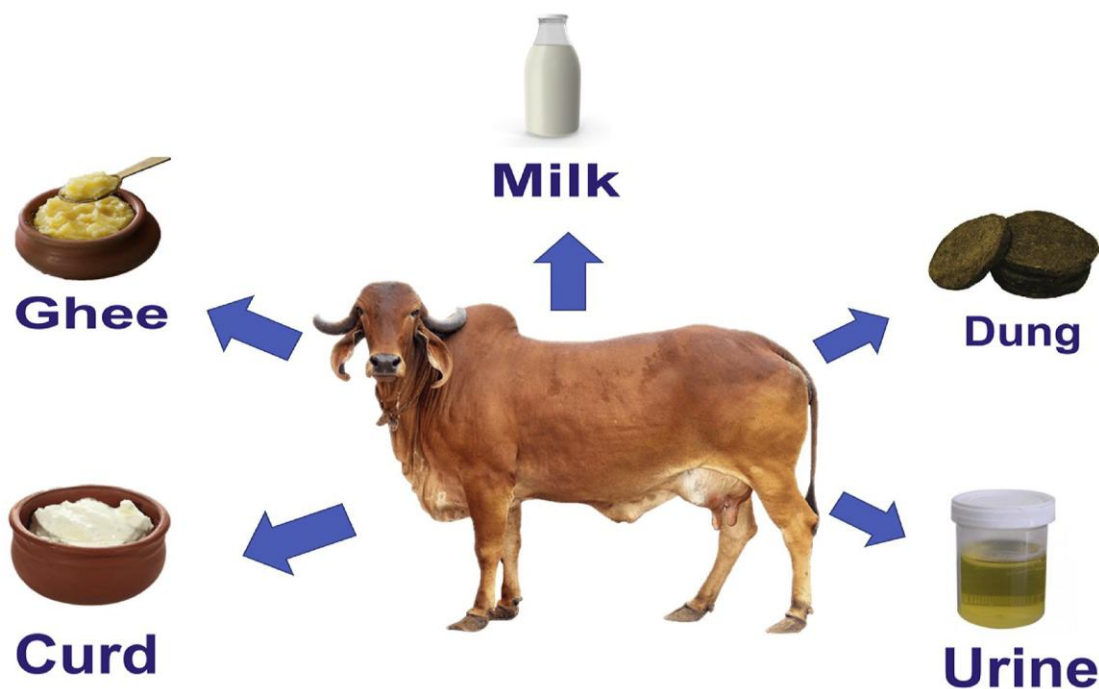


Figure 1 Five elements of "Panchgavya"

Source: Bajaj et al. (2022)

disorders, kidney disorders, healing of wounds, nutritional and digestive disorders, chemical poisoning and other bacterial, viral, and fungal illnesses (Cimmino et al. 2023). As the best organic manure, Panchgavya is essential to sustainable agriculture. Its use guarantees that no artificial inputs will be required, such as fertilizers, herbicides, insecticides, or antibiotics. Panchgavya is the most cost-effective and useful manure on the market. As an organic fertilizer, it helps boost soil fertility, increases earthworm quality, and benefits crop health. Cow manure and dung are valuable energy resources for producing biogas and power (Borghain et al. 2020; Bajaj et al. 2022). Several recent pandemic infections have occurred, including COVID-19 (coronavirus). Efforts to defend and protect the Indian population from coronaviruses using natural means and Ayurveda are continuing. An investigation into using Panchgavya as a treatment for the coronavirus has recently begun. Panchgavya medication was tested on 19 patients with COVID by Tijare et al. (2020) and Ganesh (2021), who confirmed the preliminary findings. Treatment with Panchgavya and *Gomutra arka* for coronavirus is effective, and those sickened by the virus have been shown to recover from it. They determined that Panchgavya and Gomutra arka treatment is a viable therapeutic option. Products derived from cows contain more minerals, carbolic, succinic, and citric acids, vitamins and hormones. They improve cellular metabolism in prokaryotes in aerobic and anaerobic circumstances, paving the path for synthesizing novel secondary metabolites (such as pharmaceuticals and enzymes) (Raut and Vaidya 2018).

There are a wide variety of additional advantages to using Panchgavya products. Organic farmers can benefit from the urine and dung of cows as high-quality natural manure, and these byproducts can also be turned into vermicompost, biofertilizers, and biopesticides—all of which are excellent and cost-effective agricultural uses that boost soil fertility, increase crop yields, and protect consumers from the potentially harmful effects of chemical fertilizers and pesticides. The nutritional content of cow milk, curd, and ghee is exceptionally high. Alternative and cheaper energy sources, fuel, biogas, and electricity, can be produced from cow dung and urine using Panchgavya products, which can help light every home without any ongoing costs by providing cheap fuel widely available to the masses and solving electricity problems. Since cow manure is resistant to sun radiation and cow ghee can protect the human body from the detrimental effects of radioactive waves, Panchgavya is said to possess the capability to improve the financial status of farmers and landless labour (González et al. 2018; Arumugam et al. 2019; Chandra et al. 2019; Joshi et al. 2022; Rathi and Khan 2023).

Safer and more novel remedies, including herbal medicine, bacteriophage therapy, and others like Cowpathy and dietary

immunomodulatory methods, are gaining popularity and should be widely disseminated as a reaction to the growing problem of drug-resistant bacteria and infections (Chandra et al. 2019; Bajaj et al. 2022; Rathi and Khan 2023). This article reviews the panchgavya elements and discusses their medicinal applications and human and animal health benefits.

2 Properties of "Panchgavya"

Panchgavya is a mixture of five different herbs used in Ayurvedic medicine for thousands of years. Chakara Samhita, Chaukambha Sanskrit Pratistana, and other ancient texts detail how Panchgavya can be prepared on its own or in combination with other herbs. *Swapla Panchgavya ghrita*, *Panchgavya ghrita* (which translates to "Panchgavya ghee"), and *Mahapanchgavya ghrita* (which translates to "Panchgavya ghee" with the addition of 18 or 24 herbs) are the many Panchgavya preparations available. Human ailments such as skin disorders, vitiligo, cough, cold, chronic illness, etc., are treated with these varied formulations. Cowpathy, known as Panchgavya chikitsa, therapy, or treatment, employs Panchgavya to heal human illness (Rai et al. 2022). It has been suggested that Panchgavya therapy could be an effective preventative and curative measure for the health of cattle, poultry, and humans. Cow urine, milk, ghee, curd, and dung are the five components that make up the Panchgavya. These items are used either alone or in combination with other plants for therapeutic purposes due to their medicinal characteristics (Ganesh 2021; Anand et al. 2022). Cow products like milk, curd, and ghee have a high nutritional value, and byproducts like urine and dung can be used to generate biogas, fuel, and electricity at a lower cost. Panchgavya is good for humans and is made from indigenous cow breeds. As per the Ayurvedic literature, Panchgavya consists of five items, including cow urine, cow dung, cow milk, curd, and ghee in a ratio of 2:1:6:12:2 (urine, dung, curd, milk, and ghee). Carbolic, succinic, and citric acids; vitamins like A, B, C, D, and E; minerals like iron, copper, zinc, and chromium; and hormones like testosterone and estrogen can all be found in plenty in Panchgavya products (Bajaj et al. 2022). Inducing immunological modulation by boosting cellular and humoral immune responses, up-regulating lymphocyte proliferative activity, and decreasing lymphocyte apoptosis, these products are effective in treating a wide range of human diseases. They combat ageing by halting the production of free radicals and fixing damaged DNA. Studies on the antibacterial, antifungal, anticancer, immunological, pharmacological, and other effects of Panchgavya's five components individually and in combination have been conducted by several researchers (Mahajan et al. 2020; Joshi et al. 2022; Sathiyaraj et al. 2022; Rathi and Khan 2023). Figure 2 depicts the many Panchgavya variants, their therapeutic features, and their usefulness in agricultural contexts.

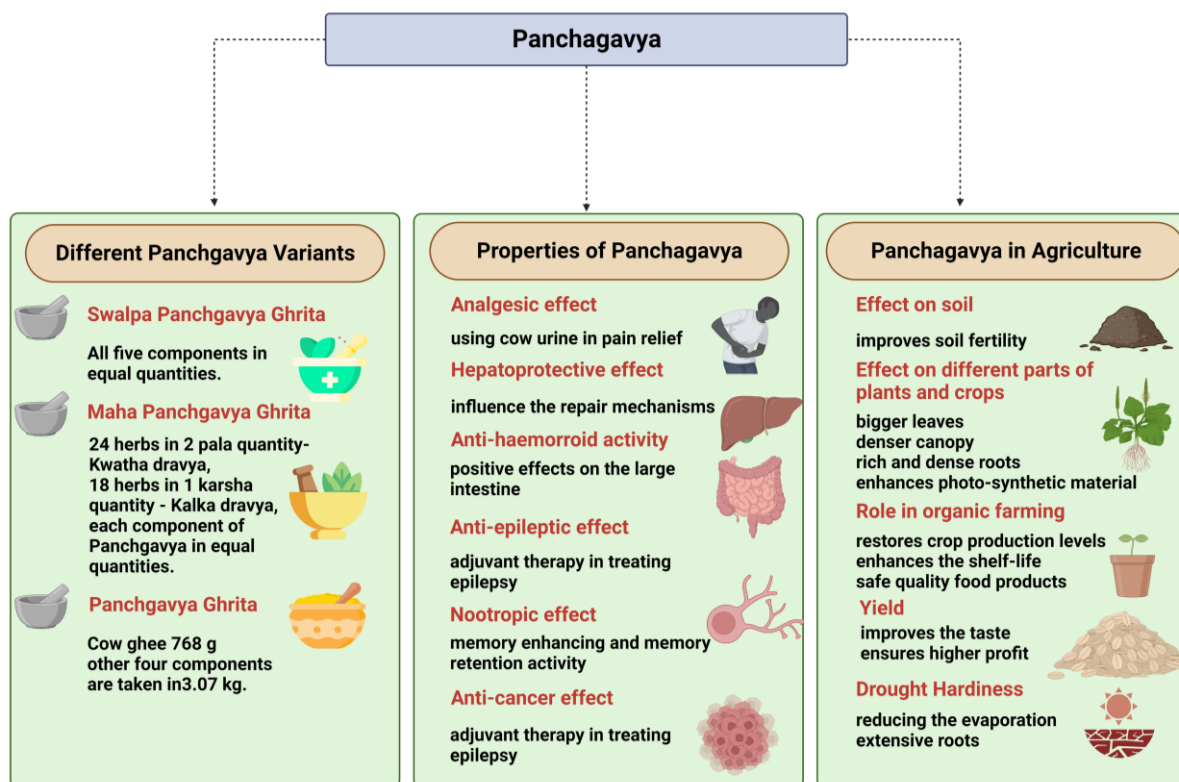


Figure 2 Various variants of Panchagavya, their therapeutic characteristics, and usefulness in agricultural contexts

3 "Panchgavya" therapy

Alternative preventative and therapeutic methods, such as "Panchgavya" treatment (Cowpathy), have been advocated for maintaining healthy cattle and poultry and protecting human health. Multiple illnesses can be treated using Panchgavya products, and the body's natural defences against disease are strengthened. By inhibiting the production of free radicals and speeding up the repair of damaged DNA, cowpathy functions as an anti-ageing agent. It also induces immunomodulation by enhancing antibody-mediated (humoral) and cellular immune responses. This is accomplished by increasing cytokine secretion, lymphoproliferation and macrophage activity and decreasing apoptosis in lymphocytes. Environmental pollution, agrochemical use in agriculture, and the presence of pesticides, fungal toxins, heavy metals, etc., in the food chain, are all reasons why Cowpathy may be beneficial (Tharmaraj et al. 2011; González et al. 2018; Bajaj et al. 2022).

Panchgavya, when appropriately diluted, has been discovered to be a promising growth enhancer of microorganisms; as a result, it increases soil fertility without resorting to chemical fertilizers, and its marked antifungal qualities also make it a useful microbiological growth medium. Panchgavya, when diluted further, shows promise as a simple, naturally generated, and

inexpensive bacteriological media with added antifungal action and growth encouragement (Chandra et al. 2019; Borgohain et al. 2020). Although Panchgavya has no direct antibacterial activity, the fermented version of the herb (after 30 days) can be used as a growth stimulator thanks to its improved chemical and microbiological composition (Borgohain et al. 2020). Diseases such as the common cold, allergies, asthma, alopecia, hyperlipidaemia, rheumatoid arthritis, leucoderma, cardiovascular disease, high blood pressure, renal disorders, hepatitis, peptic ulcer disease, acid reflux, esophagitis have all been linked to the use of Panchgavya products for both preventative and curative purposes (Dhama et al. 2013; Khan et al. 2015). Figure 3 provides a detailed summary of panchgavya therapy, including its health benefits and therapeutic potential in protecting animal and human health.

4 "Gaumutra"/ Cow urine

"Gaumutra", sometimes known as cow urine, is a non-hazardous liquid byproduct of the dairy industry. Cow urine, or distillation of it, has been shown to have many positive health effects, including increased longevity and improved quality of life for those suffering from life-threatening illnesses (Dhama et al., 2005a; Dhama et al., 2005b; Meena et al. 2019). Cow urine has been used for many medical purposes for centuries, although little scientific evidence

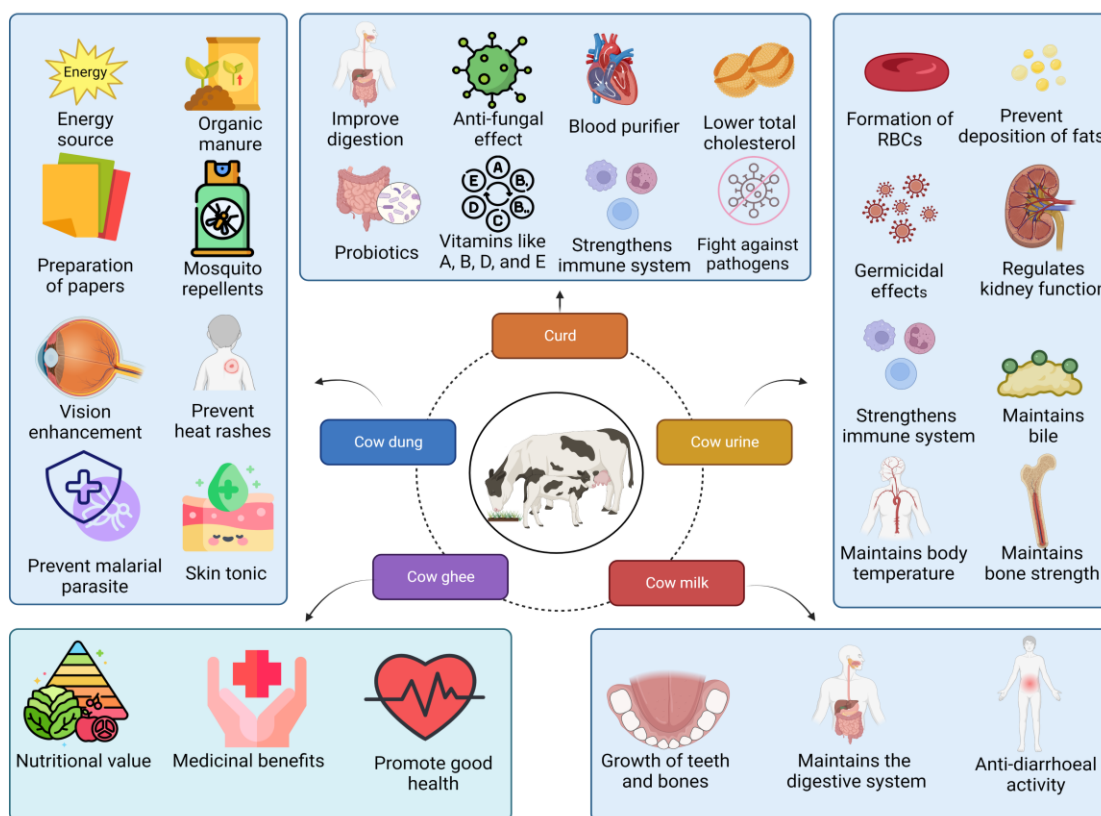


Figure 3 Incorporation of "Panchgavya" to increase productivity in farming and therapeutic outcomes for humans and animals

supports its practice. More research should be done to encourage using time-tested treatments with fewer adverse outcomes. Several formulas in the Ayurvedic medical system call for cow urine. The Ayurvedic texts highlight the many uses of cow urine for health and medicine. Cow urine is a potent nephroprotective agent and diuretic in its own right. Weight loss, digestive problems, edema, and a reverse action against multiple cardiovascular and kidney disorders are all possible benefits. It's also effective against vitiligo, diarrhoea, gastrointestinal infections, jaundice, piles, anaemia, and other skin conditions (Mahajan et al. 2020; Sathiyaraj et al. 2022).

The composition of cow urine consists of 95% water, 2.5% urea, and the remaining 2.5% comprises various components such as enzymes, hormones, salts, and minerals. Cow urine also contains several digestive and immune-boosting enzymes. Cow urine is an excellent source of vitamins A, B, C, D, and E (Khan et al. 2015). The antimicrobial and disease-eradicating properties of copper are well established. The amino acids and cytokines may help boost the immune system. The chemical qualities, potentialities, and ingredients of 'gaumutra' alone are sufficient to correct all imbalances in the body (Dhama et al. 2013; Joshi et al. 2022). Table 1 shows the chemical makeup of cow urine and its therapeutic uses.

Cancer is the most frightening and incurable disease in the world, but "Cow Urine Therapy" demonstrates another, more effective, and less expensive way to prevent and treat this disease. Urinary tract cancer is one of the most common types of cancer in humans, and cow urine has direct implications in this situation, as its use promotes the reduction of medicine doses and, at the same time, functions as a bioenhancer. Common antibacterial, antifungal, and anticancer medications have benefited from "Ark", a bioenhancer that increases their efficacy while decreasing necessary dosage and treatment time. Together, they can stop bacteria from becoming antibiotic-resistant if given simultaneously (Dhama et al. 2013; Khan et al. 2015; Arumugan et al. 2019). Because it contains quinolones and flavoquinolones, cow urine has been discovered to be highly effective against fungus. Multiple fungal agents, including *Claviceps purpurea*, *Fusarium oxysporum*, *Rhizopus oligosporus*, *Alternaria helianthi*, *Aspergillus oryzae*, *Cladosporium* spp., and *Curvularia* spp., are susceptible to the plant's antifungal properties (Chandran 2021; Prakash et al. 2021a; Kamei et al. 2022). Cow urine has excellent value as a bioenhancer and for boosting the effectiveness of medications against infectious pathogens. In addition to ampicillin and isoniazid, clotrimazole and cyanocobalamine have also been linked to enhancement. Bioenhancer activity has been linked to shorter treatment times and lower antibiotic need for tuberculosis patients (Meena et al. 2019; Joshi et al. 2022).

Table 1 Composition of cow urine and respective health advantages

Constituents	Health advantages and therapeutic benefits
Water	Body temperature and fluidity of blood are both kept at a steady state
Urea	Have a bactericidal effect and stimulate the production of more urine
Uric acid	Promote healthy kidney function and aid with heart maintenance
Creatinine	Exert a bactericidal effect
Hippuric acid	Assists the kidneys in flushing out harmful substances
Ammonia	Promotes healthy bile and mucus production; and stimulates the production of red blood cells
Lactose	Suppress anxiety and fortify the cardiovascular system
Carbolic acid	Antiseptic and gangrene preventative
Aurum hydroxide	Boosts immunity, acts as an antibiotic, and is non-toxic
Sodium	Function as an antacid and exhibits blood cleansing property
Nitrogen	Controls blood pressure, maintains normal renal function, and promotes diuresis
Iron	Promotes red blood cell and hemoglobin production.
Calcium	Cleansing the blood and preserving bone density
Copper	Avoid accumulation of fat
Phosphate	Reduce the risk of urinary stone development
Manganese	Antibacterial and gangrene prevention properties
Potassium	Cure inherited rheumatism, improve appetite, and strengthen muscles
Sulphur	Improves bowel regularity and blood purification

Source: Bajaj et al. (2022); Randhawa and Sharma (2015); González et al. (2018); Arumugam et al. (2019); Bajaj et al. (2022)

Cow urine is one of the most effective substances/secretions of animal origin due to its ability to boost immunocompetence and improve general health. The macrophages are stimulated, increasing their bactericidal and engulfing abilities. It enhances the body's innate and adaptive immune responses (Dhama et al. 2013). Cow urine boosts IgG, IgA, and IgM antibody titres in mice and stimulates the Growth of T and B cells. Interleukins 1 and 2 are also secreted at a higher rate. According to its antibacterial and immunologically modifying qualities, cow urine has been used successfully in wound healing in dogs and rats. Lymphocytes are kept alive and not killed off using cow urine as a survival mechanism. It can also fix broken DNA. Indian cow urine is more potent than any other type of urine. Through cow domestication, it may be gotten for free, has curative properties, and is non-toxic (Raut and Vaidya 2018; Bajaj et al. 2022). Cow urine improves vaccinated birds' immune responses, making them more disease-resistant. Along with boosting egg production and quality, it also stimulates lymphocyte proliferation. Positive benefits on body weight increase, haematological profiles, and immunomodulatory effects in layer poultry birds have been documented. Because it inhibits the production of free radicals, an anti-ageing agent, daily use can restore a person's youthful radiance and vitality (Khan et al. 2015). Taking cow urine in the middle of the morning is an

excellent prophylactic measure and tonic for minor ailments. A sore throat or cold might be alleviated by gargling with pee. A vaginal douche can aid in the recovery from an infection. Along with its usage as a pest repellent, it has many cosmetic and therapeutic applications. It works well as a footbath for conditions including athlete's foot, ringworm, and other fungal nail and skin infections (Arumugam et al. 2019; Mahajan et al. 2020).

Cow urine concoction (CUC) is a well-liked herbal remedy that is effective against a wide variety of ailments, including as an anticonvulsant, a hypoglycemic, a liver tonic, a fever reducer, a pain reliever, and a blood builder. CUC has been validated for treating conditions brought on by pathogenic bacteria, opportunistic fungi, and helminthes. Adequate focus must be placed on the positive aspects of cow urine, and strategic promotion and support are required in this regard (Kuleep et al. 2013; Bajaj et al. 2022; Joshi et al. 2022). Moreover, cow urine helps control the level of sugar in youngsters who have diabetes in nature. When warm cow urine is provided at daily doses of 1 to 2 ounces, it helps treat liver cirrhosis. Malignant jaundice can be cured by internal uptake of cow urine and antimony sulphide. Interestingly, people who are engaged in cleaning the milk barn with bare feet do not usually suffer from athlete's foot. The urine of

cows has also got immunostimulant activities not only in animals but also in plants as well. In the case of sebaceous cysts washing with the cow's urine following incision is suggested. As cow urine acts as a disinfectant and prophylactic agent, it can purify the atmosphere (Khan et al. 2015; Prakash et al. 2021b).

By the use of an excision wound model of Wistar albino rats (both sexes) examination of the activity of wound healing of cow urine has been done. The reference standard used in the study was nitrofurazone. The experiment has revealed a significant ability to heal wounds with cow urine. When cow urine is applied externally for 2 weeks on the damaged area, 50 per cent of wound healing has been noticed. It has also been shown that the efficacy of cow urine compared to nitrofurazone as far as wound healing is concerned is greater (Sanganal et al. 2011).

Recently, it has been suggested that synthesized copper oxide nanoparticles (CuO NPs) (cow urine mediated) can be helpful in therapy against neoplasm. Likewise, CuO NPs and cow urine-mediated palladium and silver oxide nanoparticles show significant antimicrobial activity against several bacterial and fungal strains (Prasad and Kothari, 2021).

5 Cow dung

Various beneficial microorganisms can be found in cow manure, such as *Saccharomyces*, *Lactobacillus*, *Bacillus*, *Streptococcus*, *Candida*, etc. Additionally, cow excrement contains a wide variety of cellulose, hemicellulose, vitamins, minerals (like potassium, nitrogen and carbon), mucus, and lignin (Dhama et al. 2005a). Cow dung is utilized to break down municipal and medical garbage because it contains many microorganisms that break down trash. Dried cow dung cakes are used to prepare food in rural areas of India. This reduces reliance on non-renewable energy sources, is entirely eco-friendly, and assures air cleaning by killing the microorganisms in the surrounding environment. Energy from biogas plants is also vital. Methane gas produced from cow manure is used for cooking and power generation. When most cow manure is turned into methane gas, the leftover residue is the best organic manure (Prakash et al. 2021a; Prakash et al. 2021b; Anand et al. 2022).

A cow's manure can generate enough biogas to power a city for a year—the same as burning 6,80,000 metric tons of wood. This would prevent the needless destruction of the environment by preventing the needless destruction of 14 crore trees. Soil, water, and air pollution can all be effectively mitigated using cow dung fertilizers (Chandra et al. 2019).

To keep soil healthy, farmers must use cow manure. Cow manure boosts earthworm populations and increases and controls soil fertility by improving nitrification when combined with the *Eisenia andrei* earthworm species. One of the most significant issues in

farming is fungal diseases. Cow dung has been shown to inhibit the Growth of *Fusarium solani*, *Fusarium oxysporum*, and *Sclerotinia sclerotiorum*, three common types of plant-infecting fungi (Chandran 2021; Kamei et al. 2022). Agricultural chemicals like fertilizers, pesticides, weed killers, and antibiotics have been linked to hypersensitivity reactions, immunosuppression, and autoimmune illnesses. The lack of potentially dangerous chemicals in organic farming means the resulting products are in higher demand. Cow dung has a high microbiological count and nutritional value; thus, organic farmers have turned to it as manure. The best alternative to toxic poisons is cow dung, which protects the health of both humans and animals. Cow manure is a source of the fibrous material needed to make paper. Cow dung-based mosquito repellents have recently emerged as a viable alternative to chemical repellents. Cow dung toothpaste has been shown to effectively prevent the spread of oral infections and enhance oral health. Human operations can be made more efficient and less damaging to the natural world by using cow manure (Dhama et al. 2005a; Pal and Patel 2020).

There is no question about the purity of fresh cow dung, but once laid in the ground, changes in its properties become evident. Waste obtained from cows can act as antiseptic and has features of prevention of disease. Microorganisms cause disease; putrefaction as well as fermentation is destroyed by cow dung. The antifungal activity of cow dung is enhanced when combined with cow urine (Kulkarni 2009; Khan et al. 2015). Cow dung and cow urine are widely used in manufacturing formulations of Ayurvedic medicine. Two commonly used preparations are *Sanjeevani vati* and *Punarnava-mandur*. '*Bhasmas*' are still traditionally manufactured by application of heat to cakes of cow dung by fire (Raut and Vaidya 2018).

There is evidence that cow manure can kill bacteria and fungi. It's a skin tonic that helps with conditions including eczema and psoriasis. Crushed neem leaves combined with cow manure effectively treat boils and heat rash. Malaria parasites and *Mycobacterium tuberculosis* can both be eradicated with the use of cow manure. The antifungal activity is seen when tested on Coprophilous yeasts (Dhama et al. 2014; Kamei et al. 2022). The smoke released from burning cow dung irritates the eyes, leading to tears that wash away debris and improve eyesight. *Eupenicillium bovisimosum*, a bacterium found in cow dung, generates chemicals with antifungal action, specifically CK2108A and CK2801B. Cow dung is an applicable model ecosystem for drug degradation and elimination research. The discovery that the basidiomycete strain NRRL6464 can break down lignocellulose and that *Cyathus stercoreus* can degrade drugs like enrofloxacin led to the isolation of these two species of fungi. Immunosuppression, autoimmunity, and hypersensitivity reactions are some of the many adverse effects of biopesticides, making this an urgent problem in countries like India. Because of its rich nutrient content and huge

microbial population, cow dung is useful for bioremediating various pesticides (Bajaj et al. 2022; Sathiyaraj et al. 2022; Rathi and Khan 2023).

6 Cow milk

Cow milk was praised for its curative properties in ancient Indian medical texts. Milk is consumed for its medicinal, health-enhancing, and protective benefits (Chandran et al. 2021a; Lejaniya et al. 2021a; Lejaniya et al. 2021b). The milk produced by purebred Indian cows is A2, while the milk produced by hybrid or alien cows is A1. The seven-membered peptide b-casomorphin-7 (BCM-7) is extracted from the *Bos taurus* cow, and more specifically from the HF cow, and is known as the "devil ingredient" in A1 milk (Turck 2013; Chandran et al. 2021b). Beta-casein's digestion produces BCM-7 when histidine replaces a proline residue in the polypeptide chains. The side effects of BCM-7 are numerous. BCM-7 in the bloodstream can lead to schizophrenia and atherosclerosis in persons with leaky gut syndrome (Chandran et al. 2021b). The interaction of BCM-7 with opioid receptors and the inhibition of regular binding and activity of endorphins in breastfeeding infants has been linked to developing type 1 diabetes and autism. Autism spectrum disorder in newborns and schizophrenia in adults is connected to a lack of functioning endorphins. Type 1 diabetes and immune system damage results from BCM-7's activation of opioid receptors. In addition to asthma and heart issues, drinking A1 milk might trigger allergic reactions (Cimmino et al. 2023).

In contrast, the A2 kind of milk produced from the Indian cow breed has been shown to have multiple positive effects on human health and a wide range of therapeutic applications. Cow's milk was traditionally combined with medicines in Ayurveda to improve the therapeutic benefit-to-harm ratio (Dhama et al. 2005a; Dhama et al. 2014; Kaushik et al. 2016). Nutritionally, Indian cow milk scores high, with a breakdown of roughly 4.6% lactose, 4.65% fat, 0.54% minerals, 3.4% proteins, and 86% water. Proteins in cow's milk consist of four different types: alpha-casein (36%), beta-casein (27%), kappa-casein (9%) and peptides (27%). Colloidal casein, which makes up roughly 3% of milk, is present, along with pigments including xanthophyll, carotene, and riboflavin. In addition to being a good source of calcium and phosphorus, milk also has a good amount of important fatty acids. Milk also contains the vitamins A, B2, B3, and K and the phospholipids cephalin, lecithin, and sphingomyelin (Chandran et al. 2021b).

Several health benefits are associated with drinking milk from cows. Infants are fed cow milk as a substitute for breast milk. The development of teeth and bones and regulating cardiac functions rely on it. The low cholesterol fat in milk is crucial for healthy growth in all areas of the body and mind, including the

immunological system, nervous system and digestive tract. Lactose is a vital source of fuel. Vitamin A in milk helps you see well, while vitamin K prevents blood clotting too quickly (Pereira 2014; Chandran et al. 2021a; Kamei et al. 2022).

Milk has a wealth of potential health benefits. Milk is effective in treating infant anaemia. Cow milk inhibits the growth of pathogenic gut bacteria while encouraging the spread of good bacteria (Lejaniya et al. 2021a). Enzymes in milk have antibacterial effects (xanthine oxidase, lactoperoxidase, and lysozyme), while peptides (beta-casomorphins, exorphin, and serorphin) have antidiarrheal effects. Patients with gallbladder disease, diabetes, or high cholesterol should drink milk regularly. The cis-isomer of linoleic acid found in milk has been shown to have anticancer effects in animal studies. Cancer growth suppression was seen. Cancers of the skin, colon, and breast are all targets of milk's anticancer properties. The Government of India recognized the importance of increasing indigenous cow breeds to boost the production of A2-type milk, so they established the "Rashtriya Gokul Mission" in 2014 (Sathiyaraj et al. 2022).

7 Cow ghee

Traditional cow ghee has many health benefits and is an excellent source of nutrients because of the way it is made. Butter made from cow milk is heated to a very high temperature until all the moisture evaporates, resulting in ghee. The health benefits of ghee made with milk from an Indian breed cow are greater than those made with the milk of any other kind of cow. Some have speculated that ghee's high fatty acid content makes it a risk factor for dyslipidemia and cardiovascular disease. As a result of myths like this, ghee was primarily avoided in India (Dhama et al. 2014; Kaushik et al. 2016; Patange et al. 2022a). Many scientific researches have been done, and the health benefits of ghee have been re-established, even though Ayurveda has long recommended its use. The antioxidant activity of ghee is enhanced by the presence of linoleic acid (conjugated) in it, and the presence of this acid in conjugated form is responsible for preventing atherogenesis in experimental animals (Chinnadurai et al. 2013; Patange et al. 2022a; Patange et al. 2022b). Traditional preparation of cow ghee is found to be beneficial for therapeutic purposes and the promotion of health. Studies have revealed that docosahexaenoic acid (DHA) is present in greater concentration in ghrta manufactured by the traditional method of Ayurveda. Importantly DHA is beneficial to the health of humans (Joshi 2014; Patange et al. 2022a; Patange et al. 2022b). In therapeutics based on Ayurveda, ghee coadministration with other remedies is done. For target indications development of special formulations based on ghee has been done. Examples include *Adhatoda vasica*/ *Vasa-ghrita* (for diseases of the respiratory system); *Bacopa monnieri*/ *Bramhi-ghrita* (for cognitive effects); washed with water hundred times/ *Shatadhauta ghrta* (for ailments of skin) etc. (Raut and Vaidya 2018).

Ghee is an essential component in Ayurvedic medicine, serving as both a delivery mechanism for the active substance and a foundation upon which to build the dose forms. Ayurveda also recommends using ghee in conjunction with other healing methods. To improve the transport and bioavailability of hydrophobic herbs, ghee-based formulations like Ghrita have been developed. To name only a few examples, there is *Brahmi ghrita* for the brain, *Vasa ghrita* for the lungs, *Shatadhautva ghrita* for the skin, *Bhallatakadi ghrita* for wounds, *Kaamdev ghrita* for erection problems, etc. (Dhama et al. 2005a; Sathiyaraj et al. 2022; Rathi and Khan 2023).

The blood-purifying properties of cow's butter are responsible for the cosmetic benefits. Cow ghee's immunostimulant capability in Panchgavya formulations is demonstrated by increased haemagglutination titre, neutrophil adhesion, and delayed-type hypersensitivity (DTH) reactions in rats. Cow ghee, when blended with honey and specific herbs, can treat skin conditions and speed the healing of wounds. *Embllica officinalis*, *Glycyrrhiza glabra*, and cow's ghee are components of the calming Ayurvedic compound known as Panchgavya. The hepatoprotective effect against carbon tetrachloride (CCl₄) poisoning in the rat liver is also observed with *Panchgavya ghrita* (Dhama et al. 2013; Raut and Vaidya 2018).

Cow ghee improves memory, decreases "bad" cholesterol, prevents skin and cardiovascular problems, boosts skin health, keeps digestion going strong, produces energy, cleans the blood, shields the liver, and much more. Several studies have shown that ghee has therapeutic effects, including the ability to reduce inflammation and tumour growth, improve eyesight, and speed up the healing of wounds. It has been used successfully in the treatment of a variety of skin and gastrointestinal disorders due to its immunostimulant, anticholinergic activity, anti-asthmatic impact, and anti-paralytic properties (Arumugam et al. 2019; Mor et al. 2022).

Cow ghee has also demonstrated activity in wound healing potentially. The high content of saturated and unsaturated fatty acids is attributed to the property of healing wounds. The ability to wound heal cow ghee was examined through a study wherein cow ghee is combined with the extract of leaves of *Aegle marmelos*. Evaluation of several parameters, viz., decrease in the wound area, closure and contraction of the wound, and tissue regeneration in the damaged parts, have been done. The combination of cow ghee and leaf extract of *Aegle marmelos* has demonstrated rapid wound healing within eight days (Biyani et al. 2011; Shaikh et al. 2019). Evaluation of the wound-healing activity of cow ghee is also done in combination with *Aloe vera*. 0.5 g of the formulated gel has been applied. It has been found that there is the cessation of wound contraction between 3 weeks and 24 days, an increase in epithelialization, tensile strength is provided, and the formation of

collagen has been promoted by such combination therapy (Nandanwar et al. 2010).

Across the globe, a common problem is computer vision syndrome (CVS). This condition is characterized by dryness of the eyes; sensation of burning; redness, and itching. For the treatment, lubricating eye drops are used. But unfortunately, regular use of such eye drops can damage the eyes due to the preservative presence. Interestingly due to the lubricating effect of cow ghee, it can be used for the treatment of CVS without any deleterious effect. Vitamin A in cow ghee helps maintain moisture in the lining (outer) of the eyeball, thereby preventing eye dryness and loss of vision (Mulik et al. 2013).

8 Cow curd/ Dahi

Worldwide, people drink curd—also known as yoghurt and Dahi—because of its high nutritional value and health advantages. To create this product, cow milk is fermented with microorganisms including *Acidophilus*, *Streptococcus*, and *Lactobacillus*. Curd contains a high concentration of probiotics, which are beneficial microorganisms that have been shown to have a variety of health advantages when taken orally (Dhama et al. 2014; Kaushik et al. 2016; Saleena et al. 2022a; Saleena et al. 2022b). Bacteria that produce lactic acid create metabolites, including cyclic dipeptides, phenyl lactic acid, and compounds with antifungal properties. They also have naturally occurring 3-hydroxylated fatty acid and proteinaceous substances. Ayurvedic guidelines for eating curd are conditional on factors like a person's overall health, the surrounding environment, and the weather (Dhama et al. 2005a; Borgohain et al. 2020; Lejaniya et al. 2021a; Lejaniya et al. 2021b; Saleena et al. 2022a; Saleena et al. 2022b).

Curd is a good source of water, vitamins, proteins, and minerals, among other nutrients and micronutrients. Curd's probiotics are excellent for the immunological and digestive systems, and its other vitamins, minerals, and proteins have antimicrobial and antiviral effects. As it inhibits the growth of dangerous germs and encourages the development of beneficial gut flora, it also treats digestive disorders (Kumar et al. 2020). It also has antifungal effects against dandruff from hair and piles. People with *Vata Prakruti* should eat curd with green gram or moong, those with *Pitta Prakruti* should eat it with sugar, and those with *Kapha Prakruti* should eat it with cumin powder. Ayurvedic guidelines suggest that consuming curd with all the necessary safeguards may have considerable health benefits (Dhama et al. 2013; Dhama et al. 2014; Kaushik et al. 2016).

Curd and buttermilk contain many lactic acid bacteria, which produce several antifungal metabolites (Saleena et al. 2022a; Saleena et al. 2022b). Curd has been consumed with either sugar (powdered sugar) or black salt and zira since ancient times. Whey

supplemented with salts treats diarrhoea and eliminates parasites in neonatal calves, a practice common in animal medicine. It's being administered to mature animals to boost their output, especially milked buffaloes. Bulls' work capacity is improved when fed both concentrate and whey (Raut and Vaidya 2018; Kumar et al. 2020). Probiotics have been shown to have positive effects when added to livestock feed. Antibiotic-free illness management may be possible with the use of probiotics. It will also lessen the need for antibiotics in livestock farming. Allergies and antibiotic resistance are just two negative impacts linked to antibiotic residues in milk, eggs, and poultry. Using probiotics, especially in the form of cow curd, will help alleviate these issues. However, much more research is needed to confirm or reaffirm the indigenous cow curd's efficacy as a probiotic in the scientific community (Dhama et al. 2014; Borgohain et al. 2020).

9 Contribution of Panchgavya to Agriculture

9.1 Impact on soil

Soil fertility is enhanced by panchgavya, which encourages the growth and reproduction of microorganisms, increases organic matter and macro and micronutrient levels, and increases plant uptake of nutrients. Application of panchgavya has several effects, such as soil porosity is improved, aggregate stability normalized, soil pH maintained, and the soil's nutrient profile is improved (Jain et al. 2014; Kumar et al. 2020; Prakash et al. 2021a; Prakash et al. 2021b; Kumar et al. 2022). Panchgavya, as confirmed by Bajaj et al. (2022), dramatically affects growth and crop productivity by encouraging beneficial soil bacteria surrounding the roots.

9.2 Impact on the Growth of Plants and Crops

Panchgavya, when sprayed on leaves, causes the plant to produce larger leaves and a denser canopy, as well as more photosynthetic material, allowing for a higher yield of metabolites and photosynthates. It has abundant and high branching, and its roots penetrate deep into the soil, where it can support the largest quantity of fruits as they mature. Moreover, the increased uptake of nutrients and water helps plants and crops maintain their freshness for longer (Tharmaraj et al. 2011; Jain et al. 2014; Pal and Patel 2020; Kumar et al. 2022; Kumari et al. 2022).

9.3 Relevance to organic farming

Synthetic pesticide-free food can be created with the aid of Panchgavya. When a field switches from conventional to organic farming methods within a year, it keeps crop production at the same level or even increases it. It improves the quality and safety of the food produced, extends the storage life of agricultural products, and makes them taste better. The 15-day harvest boost and the ensuing savings in chemical costs for agrarian production mean a healthier bottom line (Dhama et al. 2014; Kaushik et al.

2016; Borgohain et al. 2020; Prakash et al. 2021b; Bajaj et al. 2022; Kumari et al. 2022).

10 Nanotechnology based on the Panchgavya

Nanotechnology is a growing field of study in the field of drug delivery because it promises to provide medication exactly when and where it is needed (Dhama et al. 2013; Dhama et al. 2014; Kaushik et al. 2016; Bajaj et al. 2022). Synthesis of Panchgavya-mediated copper nanoparticles was performed by Arumugam et al. (2019) utilizing Panchgavya filtrate and copper sulphate solution (25 mM) as substrate. Scanning electron microscope (SEM), ultraviolet spectrophotometer, Dynamic light scattering, X-ray fluorescent microscopy, X-ray diffraction analysis, Fourier transmission infrared spectroscopy, high-resolution transmission electron microscope, and so on were all used to characterize copper nanoparticles. They have also been tested for antioxidant and cytotoxic efficacy (Raut and Vaidya 2018; Sathiyaraj et al. 2022; Rathi and Khan 2023). A 1mM AgNO₃ solution containing 4 mL of Panchgavya filtrate was used in the synthesis of silver nanoparticles by Govarthanan et al. (2014). Antibiotic-resistant bacteria, including *Aeromonas* sp., *Citrobacter* sp., and *Acinetobacter* sp., were successfully inhibited by the produced nanoparticles, which showed antimicrobial action in a concentration-dependent manner.

Conclusion and future prospects

Cows have an essential role in our culture and our survival. Its offspring and the Panchgavya it yields are versatile and hold great promise for the future of agriculture, human health and nutrition, biofertilizer production, alternative energy generation, and biodiversity preservation. The area's full potential has yet to be realized. Food grain production levels have been attained at a higher cost by using chemical fertilizers, pesticides, and exploiting groundwater, but at the expense of the fertility and health of the soil and the quality of the food produced. Organic farming, with the cow and her offspring among the potential solutions, is the only way to restore equilibrium. Raising cows and their offspring is one key to alleviating poverty and creating potential for long-term economic growth in rural and semi-urban areas.

In addition to the unavailability of branded "Cowpathy" products, few people know the cow's importance to the economy and the therapeutic and scientific benefits of Panchgavya. The country's incredible cattle riches can be better disseminated with the help of future initiatives and measures. Efforts should be made to educate the public about the "virtues of cow" and the "Panchgavya" it provides. Now more than ever, people require research-based knowledge and facts. Most of the tried-and-true methods of cow therapy, Panchgavya, Agnihotra, and milk miracles are dismissed as fantastical tales. That's why it's crucial to incorporate spirituality

and wisdom into scientific inquiry. Patents in the United States have been issued due to this fusion, and many more are undoubtedly on the horizon. Panchgavya products have received the highest possible validation from the Indian government by granting U.S. patents. Future research in the livestock sector should be prioritized highly due to the sector's potential impact on poverty reduction. Godhan (the cow and its offspring) has excellent potential as a medical, agricultural, pharmacological, nutritional, environmental, technological, and socio-economic resource, so it's essential to construct research and development institutes to study these aspects. Ayurveda's Panchgavya theory deserves to win over adherents from all walks of life, from traditional households to those with advanced degrees in the hard sciences. Panchgavya has many benefits and uses, but it needs an all-encompassing strategy to get the word out about them. Because of this, we can conclude that Panchgavya therapy or Cowpathy, a modernized form of traditional knowledge, is an approach worth further exploring. So, if we can get the word out about how beneficial cows and Panchgavya are, we can alleviate issues like food grain scarcity, fuel scarcity, housing scarcity, poor health and nutrition, poverty and unemployment, and a lack of alternative energy sources.

With its wide range of biomedical and other therapeutic applications, Panchgavya is a promising treatment for various human and animal disorders. Its use would grow through scientific confirmation, research funding, clinical trials, commercialization, and public and societal acceptance. The lack of food grains, fuel, shelter, health, nutrition, poverty reduction, employment, and energy, as well as the lack of awareness about the benefits of Panchgavya, can all be addressed by spreading information about its many uses. The health advantages of Panchgavya need to be maximized to effectively combat the myriad maladies and diseases that plague modern society and the dietary shifts accompanying it. However, there is a lack of literature to support the use of Cowpathy in treating animal diseases; thus, much work needs to be done to establish scientific evidence and validation. Scientists, researchers, and physicians must work together to increase public trust in this alternative low-cost therapy. Extensive testing is necessary for every product to ensure the active components are what they claim to be in terms of composition, pharmacological activity, chemical behaviour, toxicity profile, safety, and mechanism of action. Bringing international attention to India's extensive body of traditional culture and literature necessitates public education and the promotion of Panchgavya products.

Acknowledgement

All the authors acknowledge and thank their respective Institutes and Universities.

Author's contribution

All the authors contributed significantly.

Funding

This compilation was written by its authors and required no substantial funding.

Disclosure statement

All authors declare that there exist no commercial or financial relationships that could, in any way, lead to a potential conflict of interest.

References

- Anand, T.S., Vahab, H., Chandran, D., Shanavas, A., Kumar, M., Nainu, F., Bagath, M., Mohankumar, P., Mohapatra, R.K., Chakraborty, S., & Alagawany, M. (2022). Dairy waste management: A narrative review on current knowledge. *The Indian Veterinary Journal*, 99(8), 7-19.
- Arumugam, D.G., Sivaji, S., Dhandapani, K.V., Nookala, S., & Ranganathan, B. (2019). Panchagavya mediated copper nanoparticles synthesis, characterization and evaluating cytotoxicity in brine shrimp. *Biocatalysts in Agricultural Biotechnology*, 19, 101132. <https://doi.org/10.1016/j.bcab.2019.101132>
- Bajaj, K.K., Chavhan, V., Raut, N.A., & Gurav, S. (2022). Panchgavya: A precious gift to humankind. *Journal of Ayurveda and Integrative Medicine*, 13, 100525. <https://doi.org/10.1016/j.jaim.2021.09.003>
- Biyani, D.M., Verma, P.R.P., Dorle, A.K., & Boxey, V. (2011). Wound healing activity of cow ghee: a veterinary case report. *International Journal of Ayurvedic Medicine*, 2(3). <https://doi.org/10.47552/ijam.v2i3.71>
- Borgohain, L., Borgohain, H., Konwar, B., Dutta, A.K., & Panging, U. (2020). Panchagavya: A multidimensional review article through the lens of an agriculture scholar. *Asian Soil Research Journal*, 3(4), 32-38.
- Chandra, M.S., Naresh, R.K., Lavanya, N., Varsha, N., Chand, S.W., Chandana, P., Kumar, B.N., Kumar, R., & Navsare, R.I. (2019). Production and potential of ancient liquid organics panchagavya and kunapajala to improve soil health and crop productivity: A review. *Journal of Pharmacognosy and Phytochemistry*, 8(6), 702-713.
- Chandran, D. (2021). Veterinary phytomedicine in India: A review. *International Journal of Scientific Research in Science & Technology*, 8(3), 598-605.

- Chandran, D., Rojan, P.M., Venkatachalapathy, T., & Lejaniya, A.S. (2021a). Mortality and morbidity pattern in goats under organized farm conditions of Kerala. *Journal of Veterinary and Animal Sciences*, 52(2): 175-179. <https://doi.org/10.51966/jvas.2021.52.2.178-182>
- Chandran, D., Lejaniya, A.S., Yattoo, M.I., Mohapatra, R.K., & Dhama, K. (2021b). Major Health Effects of Casein and Whey Proteins Present in Cow Milk: A Narrative Review. *The Indian Veterinary Journal*, 98(11), 9-19.
- Chinnadurai, K., Kanwal, H.K., Tyagi, A.K., Stanton, C., & Ross, P. (2013). High conjugated linoleic acid enriched ghee (clarified butter) increases the antioxidant and antiatherogenic potency in female Wistar rats. *Lipids in Health and Disease*, 12, 121. <https://doi.org/10.1186/1476-511X-12-121>
- Cimmino, F., Catapano, A., Villano, I., Di Maio, G., Petrella, L., Traina, G., Pizzella, A., Tudisco, R., & Cavaliere, G. (2023). Invited review: Human, cow, and donkey milk comparison: Focus on metabolic effects. *Journal of Dairy Science*, 106(5), 3072-3085. <https://doi.org/10.3168/jds.2022-22465>
- Dhama, K., Rathore, R., Chauhan, R.S., & Tomar, S. (2005a). Panchgavya (Cowpathy): An overview. *International Journal of Cow Science*, 1(1), 1-15.
- Dhama, K., Chauhan, R.S., & Singhal, L.K. (2005b). Anticancer Activity of Cow Urine: Current Status and Future Directions. *International Journal of Cow Science*, 1(2): 1-25.
- Dhama, K., Khurana, S.K., Karthik, K., Tiwari, R., Malik, Y.P.S., & Chauhan, R.S. (2014). Panchgavya: Immune-enhancing and therapeutic perspectives. *Journal of Immunology and Immunopathology*, 16, 1-11 <https://doi.org/10.5958/0973-9149.2014.01071.5>.
- Dhama, K., Saminathan, M., Jacob, S.S., Singh, M., Karthik, K., Amarpal, Tiwari, R., Sunkara, L.T., Malik, Y.S., & Singh, R.K. (2015). Effect of immunomodulation and immunomodulatory agents on health with some bioactive principles, modes of action and potent biomedical applications. *International Journal of Pharmacology*, 11(4): 253-290. DOI: 10.3923/ijp.2015.253.290
- Ganesh, P. (2021). All about Panchgavya for human usage—A review. *Indian Journal of Natural Sciences*, 11(64), 29173-29181.
- González, L.A., Kyriazakis, I., & Tedeschi, L.O. (2018). Review: Precision nutrition of ruminants: approaches, challenges and potential gains. *Animal*, 12(s2), s246-s261. <https://doi.org/10.1017/S1751731118002288>
- Govarthanam, M., Selvakumar, T., Manoharan, K., Rathika, R., Shanthi, K., & Lee, K.J. (2014). Biosynthesis and characterization of silver nanoparticles using panchakavya, an Indian traditional farming formulating agent. *International Journal of Nanomedicine*, 9, 1593e9. <https://doi.org/10.2147/IJN.S58932>
- Jain, P., Sharma, R.C., Bhattacharyya, P., & Banik, P. (2014). Effect of new organic supplement (Panchgavya) on seed germination and soil quality. *Environmental Monitory Assessment*, 186(4), 1999-2011. <https://doi.org/10.1007/s10661-013-3513-8>
- Joshi, K.S. (2014). Docosaheptaenoic acid content is significantly higher in ghrita prepared by traditional Ayurvedic method. *Journal of Ayurveda and Integrative Medicine*, 5(2), 85-88. <https://doi.org/10.4103/0975-9476.131730>
- Joshi, T., Kuchewar, V., & Chhabra, A. (2022). Multidimensional use of cow urine (Gomutra), one of the ingredients of Panchgavya—A narrative review. *International Journal of Ayurvedic Medicine*, 13(3), 606-612.
- Kamei, D., Singh, A.U., & Gangmei, G. (2022). Effect of storage of botanical extracts and modified Panchgavya against radial Growth of *Fusarium oxysporum*. *World Journal of Advanced Research and Reviews*, 13(2), 219-224. <https://doi.org/10.30574/wjarr.2022.13.2.0110>
- Kaushik, R., Jain, J., & Rai, P. (2016). Therapeutic potentials of cow derived products—a review. *International Journal of Pharmaceutical Sciences and Research*, 7(4), 1383. [https://doi.org/10.13040/IJPSR.0975-8232.7\(4\).1383-90](https://doi.org/10.13040/IJPSR.0975-8232.7(4).1383-90)
- Khan, M.Y., Roy, M., Saroj, B.K., Dubey, S., & Sharma, V.K. (2015). A Review-Benefits of Panchgavya therapy (Cowpathy) for health of humans. *Asian Journal of Research in Pharmaceutical Science*, 5(2), 115-125.
- Dhama, K., Sandip, C., & Ruchi, T. (2013). Panchgavya therapy (Cowpathy) in safeguarding health of animals and humans—a review. *Research Opinions in Animal and Veterinary Sciences*, 3(6), 170-178.
- Kulkarni, S.K. (2009). *Hand book of experimental pharmacology*. 3rd edition. Vallabh Prakashan, New Delhi.
- Kumar, K., Verma, G., Veer, R., Kumar, S., & Kumar, P. (2020). Exploitation of Panchgavya, benefits and eco-friendly management of plant diseases: A review. *Journal of Entomology & Zoologic Studies*, 8, 2360-2364.
- Kumar, M., Tomar, M., Punia, S., Dhakane-Lad, J., Dhumal, S., Changan, S., Senapathy, M., Berwal, M.K., Sampathrajan, V., Sayed, A.A., & Chandran, D. (2022). Plant-based proteins and their multifaceted industrial applications. *Lebensmittel-Wissenschaft & Technologie*, 154, 112620. <https://doi.org/10.1016/j.lwt.2021.112620>

- Kumari, N., Kumar, M., Mekhemar, M., Lorenzo, J.M., Pundir, A., Devi, K.B., Prakash, S., Puri, S., Thakur, M., Rathour, S., & Rais, N. (2022). Therapeutic uses of wild plant species used by rural inhabitants of Kangra in the western Himalayan region. *South African Journal of Botany*, *148*, 415-436. <https://doi.org/10.3390/horticulturae7100343>
- Lejaniya, A.S., Chandran, D., Venkatachalapathy, T., Bashir, B.P., Kumar, M., Shanavas, A., Sureshkumar, R., Kumar, P.N., Sabareeshwari, V., Kumar, K.K., & Mohankumar, P. (2021a). Analysis of milk production performance of Attappadi Black, Malabari and cross-bred goats under organized farm conditions of Kerala. *The Indian Veterinary Journal*, *98*(05), 13-19.
- Lejaniya, A.S., Chandran, D., & Geetha, R. (2021b). Recent trends in application of lactic acid bacteria (LAB) in dairy and biomedical industry: A critical review. *World Journal of Pharmaceutical Research*, *10*(12), 577-591. <https://doi.org/10.20959/wjpr202112-21749>
- Mahajan, S.P., Chavan, S.A., Shinde, S.A., & Narkhede, M.B. (2020). Miraculous benefits of cow urine: A review. *Journal of Drug Delivery and Therapeutics*, *10*(4-s), 275-281.
- Meena, M., Patel, P., Saini, S., Gurjar, T., Gogoi, R., & Meena, O.P. (2019). Gomutra (cow urine) and its uses: An overview. *Journal of Entomology & Zoologic Studies*, *7*, 1218-1222.
- Mor, S., Sharma, V., Arora, S., & Minz, P.S. (2022). Physico-chemical and color parameters to distinguish cow ghee from buffalo ghee. *Journal of Food Science & Technology*, *59*(8), 3231-3236. doi: 10.1007/s13197-022-05496-z
- Mulik, S.S., & Bhusari, D.P. (2013). Conceptual study of goghrita eye drops (aschyotana) in computer vision syndrome. *Asian Journal of Multidisciplinary Studies*, *1*(3), 1-6.
- Nandanwar, R., Gurjar, H., Sahu, V.K., & Saraf, H. (2010). Studies on wound healing activity of gel formulation containing cow ghee and Aloe vera. *International Journal of Pharmaceutical Sciences and Research*, *1*(3), 50-54.
- Pal, S., & Patel, N. (2020). Importance of soil microbes on panchagavya based fertilizer for sustainable agriculture: A review. *Journal of Pharmacognosy and Phytochemistry*, *9*(3), 2277-2284.
- Patange, D.D.D., Virshasen Vinayak, D., Chandran, D., Kumar, M., & Lorenzo, J.M. (2022a). Comparative effect of cooling on the physico-chemical-sensory properties of ghee from cow and buffalo milk, and evaluation of the low-fat spread prepared from cow and buffalo milk ghee. *Food Analytical Methods*, *15*, 2513-2523. <https://doi.org/10.1007/s12161-022-02312-4>
- Patange, D.D., Pansare, K.S., Kumar, M., Kumari, A., Kamble, D.K., Chandran, D., Gaikwad, N.B., Waghmare, R., & Lorenzo, J.M. (2022b). Studies on utilization and shelf life of *Piper betel* leaves added ghee-based low-fat spread. *Food Analytical Methods*, *16*, 143-154. <https://doi.org/10.1007/s12161-022-02400-5>
- Pereira, P.C. (2014). Milk nutritional composition and its role in human health. *Nutrition*, *30*(6), 619-27. <https://doi.org/10.1016/j.nut.2013.10.011>
- Prakash, P., Kumar, M., Pundir, A., Puri, S., Prakash, S., Kumari, N., Thakur, M., Rathour, S., Jamwal, R., Janjua, S., & Ali, M. (2021a). Documentation of commonly used ethnoveterinary medicines from wild plants of the high mountains in Shimla District, Himachal Pradesh, India. *Horticulturae*, *7*(10), 351. <https://doi.org/10.3390/horticulturae7100351>
- Prakash, P., Kumar, M., Kumari, N., Prakash, S., Rathour, S., Thakur, M., Jamwal, R., Janjua, S., Ali, M., Pundir, A., & Puri, S. (2021b). Therapeutic uses of wild plants by rural inhabitants of Maraog region in district Shimla, Himachal Pradesh, India. *Horticulturae*, *7*(10), 343. <https://doi.org/10.3390/horticulturae7100343>
- Prasad, A., & Kothari, N. (2021). Cow products: boon to human health and food security. *Tropical Animal Health and Production*, *54*(1), 12. <https://doi.org/10.1007/s11250-021-03014-5>
- Rai, S., Rao, P.S., Sharma, V., Pradhan, D., & Singh, R., 2022. Antimicrobial potential of panchagavya formulation from Indian cow breeds. *International Journal of Bio-resource and Stress Management*, *13*(6), 613-621.
- Randhawa, G.K., & Sharma, R. (2015). Chemotherapeutic potential of cow urine: A review. *Journal of Intercultural Ethnopharmacology*, *4*(2), 180-186. <https://doi.org/10.5455/jice.2015022210032>
- Rathi, B., & Khan, M. (2023). Report on international conference: recent advances in Panchagavya research and innovations. *Journal of Indian System of Medicine*, *11*(1), 65.
- Raut, A.A., & Vaidya, A.D.B. (2018). Panchgavya and cow products: A trail for the holy grail. *Journal of Ayurveda & Integrative Medicine*, *9*(1), 64-66. <https://doi.org/10.1016/j.jaim.2017.12.005>
- Saleena, L.A.K., Chandran, D., Geetha, R., Radha, R., & Sathian, C.T. (2022a). Optimization and identification of lactic acid bacteria with higher mannitol production Potential. *Indian Journal*

- of *Animal Research*, 56 (1), 1-8. <https://doi.org/10.18805/IJAR.B-4759>
- Saleena, L.A.K., Chandran, D., Rayirath, G., Shanavas, A., Rajalingam, S., Vishvanathan, M., Sharun, K., & Dhama, K. (2022b). Development of low-calorie functional yoghurt by incorporating mannitol producing lactic acid bacteria (*Leuconostoc pseudomesenteroides*) in the standard yoghurt culture. *Journal of Pure and Applied Microbiology*, 16(1), 729-736. <https://doi.org/10.22207/JPAM.16.1.78>
- Sanganal, J.S., Jayakumar, K., Jayaramu, G.M., Tikare, V.P., Paniraj, K.L., & Swetha, R. (2011). Effect of cow urine on wound healing property in Wister Albino Rats. *Veterinary World*, 4(7), 317-321. <https://doi.org/10.5455/vetworld.4.317>
- Sathiyaraj, S., Suriyakala, G., Babujanathanam, R., & Kaviyarasu, K. (2022). Therapeutic Importance of Panchagavya. In K. Kasinathan, M.S. Elshikh, D.A.A. Al Farraj (Eds) *Nanomaterials for Energy Conversion, Biomedical and Environmental Applications. Materials Horizons: From Nature to Nanomaterials* (pp 339-356). Springer, Singapore. https://doi.org/10.1007/978-981-19-2639-6_16.
- Shaikh, S.S., Ukande, M.D., Murthy, K., Shete, R.V., & Solunke, R.S. (2019). Traditional remedies for wound healing: a review. *Journal of Drug Delivery and Therapeutics*, 9(4-s), 761-764. <https://doi.org/10.22270/jddt.v9i4-s.3263>
- Tharmaraj, K., Ganesh, P., Kumar, R.S., Anandan, A., & Kolanjinathan, K. (2011). A critical review on Panchagavya-a boon plant growth. *International Journal of Pharmaceutical and Biological Archives*, 2(6), 1611-1614.
- Tijare, P., Ambatkar, N., & Tiwari, V. (2020). Clinical improvement in COVID19 patients with timely intervention of Panchagavya medicine: a preliminary finding. *International Journal of Pharmacological Research*, 10(6), 5449.
- Turck, D. (2013). Cow's milk and goat's milk. *World Reviews in Nutrition & Diet*, 108, 56-62. <https://doi.org/10.1159/000351485>.