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PANCHAGAVYA IN HUMAN LIFE AND HEALTH: A REVIEW

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ABSTRACT

Gomutra (cow ghee), gomaya (cow dung), ksheera (cow milk), dadhi (cow curd) and sarpi (cow ghee) cumulatively known as Panchagavya. In India, the cow is worshipped as mother and commonly known as 'Gaumata'. The ratio of ksheera, dadhi, ghrita, gomutra and gomaya is 16:10:8:2:1 according to Shastra yoga, and in Rastargini, it is 1:1:1:1:1 in panchagavya. panchagavya holds traditional as well as ritual values in human life. Each component of panchagavya also has medicinal properties individually. To assess the role of panchagavya and its therapeutic benefits in our day-to-day life and health and to untapped hidden areas mentioned about panchagavya in Ayurveda. Different Ayurvedic classical textbooks, research papers and journals were referred to. After a review of many Ayurvedic literatures and other data sources, the importance of panchagavya was seen. In Ayurveda, panchagavya has a great role in GIT and skin disorders. Panchagavya is also used in havan karma, which also purifies the environment and devotees. Panchagavya products serve irreplaceable medicinal importance in Ayurveda. It is also used in traditional Hindu rituals. During a pandemic, the importance of panchagavya was noticeable. In Ayurveda, there are many Ayurvedic formulations where gomutra and sarpi are used. For example, gomutra is used as bhavana dravya in Sanjeevani vati.

Keywords: Panchagavya, Ayurveda, Gaumata, Health

INTRODUCTION

India is rich in traditions, many of which have direct scientific connections between social rituals and their underlying causes. Due to their nurturing qualities like a mother, cows in India are referred to as "Gaumata" or "Kamadhenu"[1] The medical and therapeutic benefits of panchagavya are innumerable. The importance of using 'gavya' substances such as cow milk, ghee, urine, dung and curd for treating various diseases has been discussed in relation to the Ayurvedic medical system. Each product has unique ingredients and applications in agriculture, human health, and other fields. The name "Panchagavya" is derived from two words: "panch", which means "five", and "gavya", which means "obtained from," or "from a cow". It collectively refers to five items made from cows.

Each "gavya" has a unique therapeutic effect against specific ailments. Like other modalities, panchagavya therapy or treatment is called "cowpathy" (allopathy, homoeopathy, and naturopathy). Each "gavya" can be used on its own and other goods or therapies. Additionally, all five items can be used singly or in combination with other artificial, herbal, or mineral-based products[2,3]. Several illnesses, including obesity, dietary and gastrointestinal tract abnormalities, leukoderma, wound healing, leucorrhoea, hepatitis, TB, ulcer, chemical intoxication, as well as other bacterial, fungal, and viral infections, are advised for panchagavya therapy.

The treatment has shown therapeutic promise in treating pathological severe illnesses such as cancer, AIDS, and diabetes[4,5]. As the best organic manure for agricultural areas, panchagavya is essential to organic farming techniques. Its use assures that dangerous synthetic fertilisers, herbicides, insecticides, and antibiotics are never used. Panchagavya is the only manure that can be advantageous and cost-effective. By functioning as an organic fertiliser, it can boost soil fertility, the calibre of earthworms, and crop health. Cow urine and dung are also excellent energy sources for producing biogas and power [6-8]. Although panchagavya is mentioned in traditional Indian literature as having a wide range of medical benefits, there is little scientific basis for this claim. The Ministry of Science and Technology, Government of India, has announced a nationwide programme called Scientific Validation and Research on Panchagavya (SVAROP) for the scientific validation of panchagavya products. The programme covers research on panchagavya, and other products made from cows in terms of their activity, efficacy, safety profile, toxicity, and acceptability. According to the available scientific evidence[9,10] the current study concentrates on the ingredients of each panchagavya product, their therapeutic capabilities, and their health benefits.

Curd

Due to its excellent nutritional content and beneficial effects on health, curd, also known as "yoghurt" or "dahi", is consumed worldwide. It is made by fermenting cow milk with the help of the microorganisms *Lactobacillus, Acidophilus,* and *Streptococcus*[11]. Probiotics, or healthy living organisms, are abundant in curd and have various health benefits when taken orally. Metabolites produced by lactic acid-producing bacteria include cyclic dipeptides, phenyl lactic acid, and antifungal properties. A 3-hydroxylated fatty acid and naturally occurring protein substances are also present in these bacteria. When recommending curd eating, Ayurveda considers a person's health, the surrounding environment, and climatic factors. Water, proteins, vitamins A, B, D, and E, and minerals, including

calcium, phosphorus, magnesium, zinc, and others, are all found in curd. It also contains several micronutrients. Curd contains probiotics that support the immunological and digestive systems and several vitamins, minerals, and proteins that aid in the battle against viruses like HIV[12]. As it can inhibit the growth of pathogenic microorganisms and encourage healthy gut flora to enhance digestion, it treats digestive disorders.

Additionally, curd has antifungal properties for treating dandruff from hair[13], purifies blood, lowers total cholesterol and low-density lipoproteins, reduces the risk of obesity[14], and treats piles. For Vata prakriti, green gramme or moong should be consumed with the curd; for Pitta prakriti, sugar; and Kapha prakriti, cumin powder. Consuming curd while taking all the required ayurvedic precautions may positively impact your health[15].

Cow Dung

Numerous helpful microorganisms, including *Saccharomyces, Lactobacillus, Bacillus, Streptococcus, Candida*, and others, are abundant in cow manure. It also contains various nutritious ingredients, such as cellulose, hemicellulose, mucus, lignin, minerals, vitamins, potassium, nitrogen, oxygen, and carbon. Cow dung is used to break down garbage produced due to the prevalence of several microorganisms beneficial for waste degradation in cities and hospitals[16]. A dried cow dung cake is an energy source in India's rural communities. Utilising less energy when preparing food reduces reliance on other energy sources, is entirely eco-friendly[17] and guarantees air cleansing by eradicating nearby bacteria air. Gobar gas (biogas) plants are another vital source of energy. Methane gas, used as a source of energy for cooking and power production, is created by converting cow manure. The leftover residue is the best organic manure after most cow dung is converted into methane gas. Papers are prepared using fibrous material derived from cow manure[17].

The most excellent alternatives to synthetic insect repellents recently have been those based on cow dung[18]. Additionally, toothpaste made from cow dung enhances dental health and offers defence against oral infections. The utilisation of cow manure provides more economical and environmentally friendly human activities[19,20]. To keep soil quality high, cow manure is a necessity in agriculture. With the presence of the earthworm species *Eisenia andrei*, cow dung aids in worm population growth and encourages and manages fertile soil, demonstrating an improvement in the nitrification process[21]. One of the main issues in agricultural settings is fungus illnesses. Utilising cow dung can prevent the growth of several fungi, including *Sclerotinia sclerotiorum*, *Fusarium oxysporum*, and *Fusarium solani*[22].

It is dangerous for humans and animals to use pesticides, fertilisers, weed killers, and antibiotics in farming since they can cause severe illnesses such as immunosuppression, hypersensitivity reactions, and autoimmune disorders. Because toxic chemicals are not used in organic farming procedures for crop production, products from these practices are in higher demand. Cow dung was used as manure for farming operations in organic farms due to its high microbiological count and nutritional value. The most incredible substitute for these compounds that protects both human and animal health is cow dunge[23,24]. Additionally, the antibacterial and antifungal properties of cow dung have been found. It works as a skin toner and successfully treats eczema and psoriasis. Neem leaves that have been crushed, and cow dung treat boils and heat rashes well. The ability of cow dung to eradicate *Mycobacterium tuberculosis* and the malarial parasite has been proven. It is possible to see the antifungal activity against *Coprophilous fungi*[25,26]. Tears and eye irritation are produced when cow dung is burned, which can improve vision[27]. The characteristics of cow manure and their applications are outlined. Traditional preparations of cow ghee have significant nutritional content and therapeutic advantages and support overall health. Butter made from cow's milk is heated to become ghee, and the heating process must be continued at a high temperature until all moisture has been lost.[28]

Cow Ghee

Conventional Techniques for Making Ghee
Ghee can be made in four different ways, which are described below:

Method 1: Making Creamery Butter Ghee
This technique involves separating the milk's cream and storing it to achieve the required acidity. The butter is then produced by churning this cream. Buttermilk and creamery butter are separated after stirring. The butter is then cooked to the appropriate temperature, making molten ghee. After that, the ghee is decanted and put into containers[29].

Method 2: The Second Method is to make Desi Ghee
To make curd, milk is first heated, then allowed to cool at room temperature before being added to lactic acid culture and incubated for 10 to 16 hours. To create the butter known as "desi butter," water is added to the curd and then churned. When the butter reaches the desired temperature, it becomes molten desi ghee. Ghee needs to be hot before being decanted and put into a container[30].

Method 3: Making Ghee Directly from Cream
The proper temperature is maintained while the milk's cream is separated and heated to drive out moisture. Ghee is obtained when it is molten, let to settle, then further decanted and put into containers[31].

Method 4: Pre-Stratification in the preparation of Ghee
This procedure involves processing milk to produce creamery butter or desi butter. After that, the butter is cooked to roughly 80 ^{0}C and let 30 minutes to stand. The remaining material is cooked to the correct temperature to produce ghee after removing the bottom layer. The obtained molten ghee needs to be hotly decanted and poured into a container[32]. Ghee made from the milk of an Indian breed called a "desi" cow is healthier than ghee made from other alien cow types. People believe eating ghee could raise the risk of dyslipidaemia and lead to cardiovascular problems because of its high fatty acid content. These beliefs brought on the widespread avoidance of ghee in India.[33]

Numerous scientific research reaffirmed ghee's health benefits even though Ayurveda has long advocated its consumption[34,35]. Ghee is an essential component of the Ayurvedic medical system, serving as a delivery route for active ingredients and a platform for building dosage forms. The co-administration of ghee and other therapeutic measures is encouraged by Ayurveda. Hydrophobic botanicals are explicitly delivered, and their bioavailability increases using ghee-based formulations, such as ghrita. For instance, Vasa ghrita for the respiratory system, Bhallatakadi ghrita for wound healing, Kaamdev ghrita for sexual issues, and Brahmi ghrita for cognitive function[36,37].

According to the study, desi ghee is a good source of vitamins A, D, E, and K and omega 3 and omega 9 important fatty acids[38]. Cow ghee has been shown to improve memory, lower bad cholesterol, prevent skin and cardiovascular illnesses, promote skin health, regulate digestion, provide energy, purify blood, and protect the liver, among other health advantages[39]. Ghee has

several therapeutic benefits, including anti-inflammatory, anti-cancer, vision-improving, and wound-healing speed[40].

Cow Urine

Cow pee, or "Gaumutra," is a non-toxic liquid waste that the cow excretes. Cow urine or its distillate has several health advantages that can enhance survival rates and life quality in patients with severe conditions[41]. The modern world began to believe in the therapeutic benefits of cow urine after the Council of Scientific and Industrial Research (CSIR), India, and other Indian scientists revealed antineoplastic, antifungal, antibiotic, and bio-enhancing effects of cow pee distillate[42,43]. Cow urine has a wide range of known medical applications. However, little evidence supports these claims in the scientific community. More studies must be conducted to support conventional treatments with milder side effects. Cow urine is utilised in the Ayurvedic medical system to create several compositions. The Ayurvedic texts suggest that cow urine has many therapeutic properties. The diuretic and nephroprotective effects of cow urine are well established.

Additionally, it can aid in weight loss, gastrointestinal problems, edema, and the reversal of certain cardiovascular and kidney illnesses[44]. Further, it can treat conditions including vitiligo, piles, jaundice, GIT infections, diarrhoea, and more. Cow urine has been touted for its many health benefits in Indian literature. However, there isn't any supporting research.

The components of cow urine and their therapeutic effects

Cow pee is 95 percent water and 2.5 percent urea; the remaining 2.5% comprises enzymes, hormones, salts, and minerals[45]. In addition, cow urine has a variety of enzymes that help the digestive and immunological systems function better. Cow urine also contains vitamins A, B, C, D, and E[46].

Cow Milk

Ancient literature provided descriptions of the therapeutic properties of cow milk from traditional Indian medical systems. Milk is used for its vast therapeutic effects, including its ability to protect and promote health [47]. Indian cow breeds provide A2-type milk, while crossbreed or alien cow species produce A1-type milk. A1 milk contains b-casomorphin-7 (BCM-7), a seven-membered peptide derived from Bos Taurus cows, particularly HeF cows, a devil component. BCM-7, a digestive by-product of beta-casein, results from substituting histidine for proline residues in polypeptide chains. BCM-7 has several harmful consequences on the body.BCM-7 in the bloodstream has been linked to atherosclerosis and schizophrenia in patients with leaky gut syndrome. Due to the interaction of BCM-7 with opioid receptors and the inhibition of endorphins' typical binding and function in breastfeeding infants can result in type-1 diabetes and autism. When endorphins cannot fulfil their purpose, they cause dementia in adults and autism in infants.

Type 1 diabetes is brought on by the activation of opioid receptors by BCM-7, which also weakens the immune system. A1 milk consumption also contributes to allergic responses, asthma, and cardiac conditions[48]. On the other hand, milk from Indian cows is an A2 kind, which has many health benefits for people and various therapeutic uses. To improve the efficacy/toxicity ratio, an ancient Ayurvedic practice recommended mixing drugs with cow's milk [49,50]. The nutritional value of Indian cow milk is high; it contains roughly 4.6% lactose, 4.65% fat, 0.54% minerals, 3.4% proteins, and 86% water's-casein makes up 27% of cow milk proteins, casein 9%, a-casein 36%, and peptides 27% [49]. About 3% of milk comprises casein, which is present in milk in a colloidal state, and other pigments like xanthophylls, carotene, and riboflavin. In addition to being a great provider of calcium and phosphorus, milk also has essential fatty acids. Milk also contains phospholipids such as cephalin, lecithin, sphingomyelin, and vitamins A, B2, B3, and K [50,51]. Drinking cow milk has several positive health effects. For infants, cow milk is utilised in place of breast milk. It is necessary for the development of teeth and bones and the control of heart functions[52]. Milk's low-cholesterol fat is essential for physical and mental growth and supports healthy immunological, digestive, and cognitive systems. A crucial source of energy is lactose. Vitamin A in milk improves vision, but vitamin K controls blood clotting. Milk is a gold mine of health benefits.

Milk can be consumed to alleviate anaemia in infants. Cow milk encourages healthy gut flora while limiting the formation of pathogenic gut germs [53]. Xanthine oxidase, lactoperoxidase, and lysozyme are milk enzymes that fight germs, while b-casomorphins, exorphin, and serorphin are peptides that treat diarrhoea. Patients with diabetes, hyperlipidemia, and gall bladder problems are advised to drink milk regularly[54]. Milk's linoleum acid isomer is proven to have anti-cancer properties. It was discovered to limit the growth of cancer. Breast, colon, and skin cancer are all resistant to milk's anti-cancer properties[55]. The Government of India announced the "Rashtriya Gokul Mission" in 2014 to expand the number of indigenous cow breeds and obtain more A2-type milk in light of all these positive impacts of A2-type milk[56].

The process for making Panchagavya ghrita and its variations

Traditional techniques for making Panchagavya ghrita have been referenced in two of the most well-known Ayurvedic textbooks, Acharya Charaka and Vagbhata acharya (PGG). The manufacture of PGG with equal amounts of each of the five Panchagavya components has been advised in this ancient literature[57]. The Government of India recently produced and released material that described a pre-preparation of cow dung juice. Before using cow dung and cow urine to manufacture PGG, the Ayurvedic Formulary of India (AFI) advised pre-treatment and filtration. Additionally, all of the panchagavya materials need to be wholly combined in equal amounts and cooked at a low flame until the formulation fulfilled all AFI-required requirements.[58]

PGG variants

PGG formulation variations are also mentioned in Ayurvedic literature, demonstrating that PGG might be administered alone or in conjunction with other herbs. The terms Swalpa-panchagavya ghrita, PGG, and Mahapanchagavya ghrita are examples of such combinations and single-use. Such herb combination in the PGG may improve the formulation's therapeutic profile.

The benefits of Panchagavya for health

Effect of Analgesia

Using the rat tail immersion test and diclofenac sodium (50 mg/kg, oral) as a reference standard, cow urine (2 ml, oral) and its distillate (2 ml, oral) were examined for analgesic efficacy in rats of both sexes (150–200 g). The tail immersion test measured the amount of time required for a reflex action at 0, 30, 60, and 90 minutes after the analgesic effect of the medication had been apparent. Cow urine and distillate were shown to have an analgesic activity comparable to that of the group receiving diclofenac sodium. The analgesic effect was attributed to volatile fatty acids and steroidal components, validated in further investigations using more sophisticated analytical methods. The

study provided scientific support for using cow urine for pain alleviation, which Veda[59] recommends.

Hepatoprotective Effect

PGG showed hepatoprotective ability against carbon tetrachloride-induced hepatotoxicity in male albino rats of the Sprague Dawley strain at a dose of 150–300 mg/kg. By using silymarin as a reference standard, serum marker enzymes such as serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), alkaline phosphatase (ALP), and acid phosphatase (ACP) were evaluated to measure the liver function. With equal effectiveness to silymarin, PGG formulation strongly inhibited the CCl4-induced SGOT, SGPT, ALP, and ACP [60] increase. Thymidylate synthesises and phospholipids increase thymidine kinase levels in the liver, and they peak at 72 hours, showing liver regeneration [61,62].

Anti-Haemorroid Activity

The anal mucosa is symptomatically enlarged and displaced distally in haemorrhoids. Patients of both sexes with grade I and II haemorrhoids were treated with 250 mg of gaumutra-ghana (cow urine extract) and water twice daily for 30 days. Cow urine consumption had beneficial benefits on the big intestine. A clinical study validated cow urine as an oral supplement to relieve discomfort, facilitate faces, stop itching, and stop bleeding[63,64].

Wound Healing Activity

Cow ghee has shown potential for treating wounds. High levels of saturated and unsaturated fatty acids are thought to have aided wound healing [65]. In a study, the effectiveness of cow ghee combined with an extract from Eagle marvellous leaves was examined for its capacity to heal wounds and its effects on various parameters, including the reduction of the wound's surface area, wound closure, wound contraction, and tissue regeneration where damage had occurred. Within eight days, the combination showed quick wound healing[66,67]. Cow ghee was also evaluated with Aloe vera for wound healing potential by topical application of 0.5 g of formulated gel. Wound contraction ceased between 21 and 24 days, increasing epithelisation, providing tensile strength, and promoting collagen formation. The therapeutic intensity of wound healing was comparable with 0.5 g Framycetin sulphate cream (1% w/w)[68]. Cow urine was examined for wound healing activity using the Westar albino rat's excision wound model of both sexes. Nitrofurazone was used as a reference standard. The experiment revealed the significant wound-healing ability of cow urine. External application of cow urine for 14 days on the damaged area exhibited 50% wound healing compared to 50.3% healing of nitrofurazone, showing cow urine was more effective than nitrofurazone[69].

Effect on Eyes

Computer Vision Syndrome (CVS) symptoms, which include eye dryness, burning, itching, and redness, are widespread issues. For the treatment, lubricating eye drops are utilised; however, frequent use can harm the eyes because they contain preservatives. Cow ghee has a lubricating quality that makes it safe to use in the treatment of CVS. Vitamin A, found in cow ghee, keeps the outer membrane of the eyeball wet and guards against dryness and blindness[70].

Antimicrobial Activity

When tested against pathogens such as *Bacillus subtilis, Salmonella typhi, Klebsiella pneumonia*, and *Pseudomonas aeruginosa*, cow pee and cow urine distillate showed antimicrobial action[71]. Maximum activity was seen against *Pseudomonas aeruginosa* and *Salmonella typhi* with cow urine distillate[72]. Additionally, the distillate and cow urine showed free radical scavenging abilities. Comparatively speaking, fresh cow urine performed better than distillate. Fresh cow urine had antimicrobial activity comparable to ofloxacin, which was regarded as the gold standard [73].

Anti-Epileptic Effect

PGG's ability to prevent epileptic seizures was tested in rats using the maximum electroshock model of convulsion induction. Rats' increased motor activity as a result of PGG's anti-convulsant effects. Additionally, the formulation successfully prevented phenobarbitone-induced sleepiness. As an adjunctive therapy for the management of epilepsy, the PGG is advised [74].

Nootropic Effect

PGG75 showed significant memory-enhancing and memory-retention action.

Anti-Cancer Effect

By expressing cox-2 and peroxisome proliferators activated receptors-g (PPAR-g) in the mammary glands, a study comparing cow ghee with soyabean oil in a rat model of 7,12-dimethylbenz(a)-anthracene (DMBA)-induced mammary carcinogenesis indicated the anti-cancer potential of cow ghee. Comparing the group getting cow ghee to the group receiving soyabean oil, the group receiving cow ghee had lower tumour occurrences (26.6%), low tumour weight (1.67 g), and volume (1925 mm^3) [74]. Additionally, cow urine has shown promise as an anti-cancer drug [76,77].

Role of Panchagavya in Agriculture

The use of Panchagavya in agricultural fields showed several benefits.

Effect on Soil

By raising organic matter, macronutrient levels, and nutrient uptake by plants, as well as by encouraging the growth and reproduction of microorganisms and preserving good soil health, Panchagavya increases soil fertility. The porosity of the soil is increased, the aggregate stability is balanced, the pH is controlled, and the nutrient profile is controlled, all of which advance the soil's physical attributes. In his research, Beulah found that using panchagavya in agricultural fields significantly affects plant development and crop productivity by fostering helpful soil bacteria surrounding the roots[78].

Effect on different parts of plants and crops

When panchagavya is sprayed on plants, larger leaves and a denser canopy are always produced. Panchagavya also improves photosynthetic material, which maximises the production of metabolites and photosynthates [79]. Along with thick, high branching and roots that grow in deeper soil layers, it also produces lateral shoots from the trunk that deliver the most fruits to maturity. With a high intake of nutrients and water, it also helps plants and crops stay fresh for longer [80].

Panchagavya-Based Nanotechnology

The basic building blocks of nanotechnology are called nanoparticles, which are composed of macromolecular substances that have a drug's active ingredient or physiologically active molecule dissolved, entrapped, encapsulated, adsorbed, or connected. Due to their ability to transport pharmaceuticals to the suitable location at the right time in the proper dosage, nanotechnologies have a wide range of applications and have emerged as one of the functional areas of drug delivery research[81]. Arumugam *et al.,* used copper sulphate solution (25 mM) and Panchagavya filtrate as the substrate in creating Panchagavya-mediated copper nanoparticles. Several methods were used to characterise copper nanoparticles, including the scanning electron

microscope, high-resolution transmission electron microscope, dynamic light scattering, ultraviolet spectrophotometer, and Fourier transmission infrared spectroscopy. They have also been assessed for their potential cytotoxicity and antioxidant effects [82]. The produced nanoparticles were studied and showed concentration-dependent antimicrobial action against bacterial species resistant to antibiotics, including *Aeromonas* species, *Acinetobacter* species, and *Citrobacter* species.

CONCLUSION

Panchagavya is a promising treatment for many human afflictions and has proven its capacity to benefit humanity. Although scientific efforts are required to evaluate biological activities, set standards, and validate safety, the impacts of panchagavya must not be restricted to only ancient literature. For any product, thorough testing is necessary to verify its composition, chemical behaviour, pharmacological activity, safety, toxicity profile, and mechanism of action. To draw attention to India's rich traditional culture and literature, it is equally necessary to educate the public and promote panchagavya products.

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