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No. 5, AKS Nagar, Near Gandhi Park, Coimbatore - 641 001

GS Paper I – History & Culture

Bold, energetic voice of modern India

Asha Bhosle's voice – down-to-earth, lively, full of emotion – marked the rise of a more confident, worldly, self-aware portrayal of women in cinema; legendary artist will be remembered for fearless spirit, versatility, playful charm with a timbre that easily switched from restraint to raw sensuality

Anuj Kumar

An artist of extraordinary range and emotional colour, Asha Bhosle breathed her last on Sunday. She is survived by her son, Anand, and a fan base spread over three generations.

Forever young, Asha's voice helped define a major cultural shift in post-Independence India, the rise of a more confident, worldly, and self-aware portrayal of women in Indian cinema. While her sister Lata Mangeshkar often represented an idealised, and almost unreal, femininity, Asha's singing was more down-to-earth, lively, full of emotion, and open about expressing desire.

She could shift in a single phrase from classical restraint to raw sensuality, or from playful irony to devastating melancholy.

From O.P. Nayyar's gently inviting *Aaiye Meherbaan* (*Howrah Bridge*, 1958), to R.D. Burman's psychedelic, counter-culture anthem *Dum Maro Dum* (*Hare Ram Hare Krishna*, 1971), and A.R. Rahman's lively *Rangela Re* (*Rangela*, 1995), Asha's rebellious *joie de vivre* remained irrepresible for generations.

In parallel, the Padma Vibhushan awardee collaborated with Ustad Ali Akbar Khan and lent her intellectually agile voice to Ravi's *Tora Man Darpan Kehlaye* (*Kaajal*, 1965), Burman's *Piya Bawri* (*Khoobsurat*), and Khayyam's *Dil Cheez Kya Hai* (*Umrao Jaan*, 1981) – the pinnacle of her classical and dramatic range.

Born Asha Mangeshkar into the illustrious musical family of Dinanath Mangeshkar in Sangli, she started singing at age 10 with a Marathi number.

After a decade of struggle, she became the voice of children in *Nanhe*

studied the actor, the character, the era, and the director's vision, then delivered a voice that felt owned by that performer. She made Zeenat Aman sound unapologetically sensual, Rekha poetic, and Urmila Matondkar and Kajol effervescent.

Distinct, versatile artist

She grew up in the shadow of her elder sister Lata yet forged an utterly distinct artistic identity. A teenage marriage to Ganpatrao Bhosle that ended in separation, the need to support herself and her children through singing, and the industry's initial tendency to typecast the younger Mangeshkar sister, Asha's early life was a struggle.

But she never lost faith in the name that her legendary father gave her. She had to do something that her illustrious *dididi* would not try. Though she hailed from a classical tradition, she had an interest in Western music since childhood.

She liked the fusion of Spanish, American, and Indian tunes and composers like Nayyar and Pancham (R.D. Burman), who played an important role in helping her find her niche, and realised that she could bring the elements of Hindustani music into western compositions with ease.

She emerged on the scene when Lata, Shmashad Begum, and Geeta Dutt were the top three.

Her ambition and will to experiment, combined with circumstances, proved that she bridged the gap in no time. *Howrah Bridge* also had Geeta Dutt's *Mera Naam Chin Chin Choo*, but *Aiye Meharbaan* lasted longer in the collective memory of the young at heart. Her breath control in *Raat Akeli Hai* (*Jewel Thief*, 1967) won her the nod of the demanding S.D. Burman.

Earlier, the composer's

Glorious journey

Born on September 8, 1933 in Sangli, Asha Bhosle was trained in classical music by her father, Dinanath Mangeshkar



She grew up in a deeply musical family with her siblings Lata Mangeshkar and Usha (singers), and Meena and Hridaynath (composers)

- Asha Bhosle married Ganpatrao Bhosle in 1949 when she was just 16. She later married composer R.D. Burman
- She recorded her first song at just 10 after her father's death. It was the Marathi song *Chala Chala Nav Bata* for *Majha Bai* in 1943
- The breakthrough came in the 1950s, especially through collaborations with O.P. Nayyar
- Her collaboration with R.D. Burman redefined Hindi film music in the 1960s and 1970s

CHARTBUSTERS

- Abhi Na Jao Chhod Kar** (*Hum Dono*, 1961): A tender duet with Mohammed Rafi, this song captures romantic hesitation with delicacy. Its conversational rhythms made it one of Hindi cinema's most beloved love songs
- Aaja Aaja Main Hoon Pyar Tera** (*Teesri Manzil*, 1966): A burst of rock-and-roll energy, this R.D. Burman composition pushed playback singing into Western territory. Bhosle reportedly rehearsed extensively to match its breathless tempo
- Piya Tu Ab To Aaja** (*Caravan*, 1971): Sultry, playful, and iconic for its "Monica, O My Darling" refrain, this track redefined the cabaret song and cemented Bhosle's image as Hindi cinema's most daring voice
- Dum Maro Dum** (*Hare Rama Hare Krishna*, 1971): A counterculture anthem that captured the hippie zeitgeist in India. Its rebellious tone gave Bhosle a new generational audience
- Chura Liya Hai Tumne Jo Dil Ka** (*Yaadon Ki Baaraat*, 1973): This timeless classic remains one of Bollywood's most enduring love songs
- Yeh Mera Dil** (*Don*, 1978): An energetic song that paired Bhosle's voice with Helen's screen presence
- In Aankhon Ki Masti** (*Umrao Jaan*, 1981): A masterpiece in *ghazal gayaki*, it earned Bhosle a National Award and showcased her command over classical nuance
- Mera Kuch Samaan** (*Ijaazat*, 1987): Minimalist and haunting, this Gulzar composition broke conventional song structure
- Rangela Re** (*Rangela*, 1995): A reminder of Bhosle's longevity, well into her 60s, she adapted seamlessly to A.R. Rahman's modern soundscape with a youthful flair
- Radha Kaise Na Jale** (*Lagaan*, 2001): This semi-classical piece brought Bhosle's voice to a new millennium audience, bridging generations effortlessly
- She collaborated with Boy George and Adnan Sami
- In 2011, Bhosle's name was registered in the Guinness World Records for recording the most number of studio recordings in the history of music. She recorded nearly 12,000 songs in 20 languages



Her Hindi film debut came with the song *Sawan Aaya In Chunarिया* (1948)

ACHIEVEMENTS

- 2000: Dadasaheb Phalke Award
- 2008: Padma Vibhushan
- Asha Bhosle was nominated for the Grammy Awards in 1977 for her collaboration with Ustad Ali Akbar Khan for the album *Legacy*. In 2005, another album, *You've Stolen My Heart* by Kronos Quartet, comprising of arrangements of composer R.D. Burman and Asha, was nominated for the Grammy



From my side, it has always been a relationship of admiration and awe. She was truly iconic; there has never been another singer as versatile as her

USHA UTHUP

She has made many of my songs so popular with her unique voice and style. I had a very special relationship with both Lataji and Ashaji

HEMA MALINI

Today, words feel too small for the loss we feel. One moment, the heart falls silent, and the next, it drifts through the countless melodies she gifted all of us

SACHIN TENDULKAR



pressive tool, and in cabaret awards, *Umrao* tragedies – the separation reigning divas well into the



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GS Paper II – Polity

Delimitation, and not women's reservation, is the issue

The Prime Minister is making appeals to Opposition parties to support Bills that the government wants to bulldoze in a special session of Parliament when the election campaign in Tamil Nadu and West Bengal will be at its peak. There can be only one reason for the extraordinary hurry, which is to derive political advantage and place the Opposition on the defensive.

The Prime Minister is, as usual, being economical with the truth.

The Parliament passed the Nari Shakti Vandan Adhiniyam, 2023 unanimously in September 2023 during a special session. The Adhiniyam introduced Article 334-A in the Constitution which mandated one-third reservation for women in the Lok Sabha and Vidhan Sabhas, scheduled to come into effect after the completion of the next Census and the Census-based delimitation process. The Opposition had not asked for this condition. In fact, the Leader of the Opposition in the Rajya Sabha, Shri Mallikarjun Kharge, had forcefully demanded that the reservation provision be implemented from the 2024 Lok Sabha elections itself. For reasons best known to itself, the government did not agree.

Now, we are given to understand that Article 334-A will be amended to make women's reservation applicable from 2029 itself. Why did it take the Prime Minister 30 months to make his U-turn? And why can he not wait a few weeks to convene the special session? Opposition leaders have written to the government not once but thrice requesting that an all-party meeting be convened after the last phase of elections is over in West Bengal on April 29, to discuss what the new proposals of the government are. But that perfectly reasonable request has been turned down. Instead, the Prime Minister has resorted to writing op-eds, making appeals to political parties, and organising *sammelans*. It is an underhand tactic that reflects the Prime Minister's one-upmanship and his 'my way or the highway' approach to decision-making.

Lessons from the past

Contrast this with the manner in which the 73rd



Sonia Gandhi

Chairperson of the Congress Parliamentary Party

Any delimitation involving an increase in the strength of the Lok Sabha must be politically – and not just arithmetically – equitable

and 74th Constitution Amendment Bills were finally passed by Parliament in April 1993 and June 1993, respectively. The Bills took almost five years of discussion and debate, following which reservation for women in elections to panchayats and *nagarpalikas* became law. This was a singular achievement of the late Prime Minister Rajiv Gandhi. Today, there are about 15 lakh elected women representatives in rural and urban local bodies, constituting over 40% of the total. The Nari Shakti Vandan Adhiniyam, 2023 stands on the shoulders of this achievement.

The last decadal Census was due in 2021. The Modi government kept postponing it. One consequence of this has been that over 10 crore people have been deprived of their legal entitlements under the National Food Security Act, 2013 that provides the basis for the Pradhan Mantri Garib Kalyan Anna Yojana. Census operations have begun only after an inexplicable delay of five years. It is being proudly claimed that it is a digital Census. Senior officials have themselves publicly declared that because of its digital nature, most of the population enumeration numbers will be available in 2027 itself. The government's excuses for its tearing hurry to call this session and conduct delimitation are evidently hollow.

Almost exactly a year ago, the Prime Minister announced that the 2027 Census would also be a caste census. This was after filing affidavits in the Supreme Court and answering questions in Parliament rejecting the idea of conducting a caste census. This was also after the Prime Minister accused Congress leaders calling for a caste census as suffering from what he called "an urban naxal mindset". Be that as it may, Census 2027 is supposed to enumerate the population by caste in order to give greater meaning to social justice and empowerment. Bihar and Telangana have carried out comprehensive caste surveys in their respective States, with the whole process not taking more than six months.

It is clear, therefore, that the propaganda that a caste census will delay the publication of the Census 2027 is just not true. In fact, the Prime Minister's real intention now is to further delay and derail the caste census.

The special session is scheduled to begin on April 16. Yet till now, there has been no official proposal shared with MPs on what exactly the government wants the session to consider. It appears that some formula for delimitation is being suggested. Any delimitation must be preceded by a Census exercise as in the past. And it goes without saying that any delimitation involving an increase in the strength of the Lok Sabha must be politically – and not just arithmetically – equitable. States that have been pioneers in family planning, and smaller States, must not be placed at an absolute or relative disadvantage.

A proportionate increase may, in fact, result in the loss of relative influence because the difference in absolute numbers get magnified.

Need for careful consideration

The Nari Shakti Vandan Adhiniyam, 2023 provides for reservation within reservation. This means that the one-third of seats reserved for Scheduled Castes and Scheduled Tribes respectively will also be reserved for women.

During the debate in September 2023, the Leader of the Opposition in the Rajya Sabha had demanded that a similar reservation be also provided for women belonging to the Other Backward Classes (OBCs). Reservation for OBCs has been already provided for in higher education and government employment.

The monsoon session of Parliament will begin in mid-July. The heavens will not fall if the government were to call an all-party meeting after April 29, to discuss its proposals with the Opposition, allowing time for a public debate, and then have the Constitution Amendment Bills considered in the monsoon session. There is simply no justification, except narrative management during troubled times, for this tearing hurry to bulldoze extremely far-reaching changes to our polity. The process is deeply flawed and anti-democratic. Reservation for women is not the issue here. That has already been settled. The real issue is delimitation which, based on the information unofficially available, is extremely dangerous and an assault on the Constitution itself.



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GS Paper II – Polity

Between 14 years and the gallows

The Sattankulam trial judge accepted the Sriharan bar in his sentencing order and was forced to the rope; even ordinary life imprisonment, the judge wrote, would let the convicts come out in fourteen years through determined effort

LETTER AND SPIRIT

V. Venkatesan

In April 6, the Madurai trial court in *Central Bureau of Investigation (CBI) v Sriharan* sentenced nine suspended policemen to death. They had killed P. Jayaraj and his son J. Bennix in police custody in June 2020. Judge G. Muthukumar's reasoning is being celebrated as judicial intolerance of uniformed brutality. It is also worth reading as a confession. The case fell within the rarest of rare, he wrote, in terms that left no room for life imprisonment

The doctrine he was applying comes from *Bachan Singh v State of Punjab* (1980). There a Constitution Bench held that the death sentence may be imposed only in the rarest of rare cases when the "alternative option of life imprisonment is unquestionably foreclosed". The Sattankulam judge believed it was foreclosed. The trial court had only two options. It could send the convicts away for life. Or it could send them to the gallows. What it could not do was occupy the middle ground constitutional courts have fashioned since 2008. That ground is a life sentence quantified in years, twenty or thirty or forty, served without remission. The intermediate sentence has become a fixture of Indian capital jurisprudence. It remains off-limits to the trial courts themselves.

The doctrinal source is the 3:2 majority of the Constitution Bench in *Union of India v V. Sriharan @ Murugan* in December 2015. The majority built on *Swamy Shraddhananda v State of Karnataka* (2008). It held that only the High Courts and the Supreme Court could commute death to a fixed-term life sentence beyond statutory remission. Sessions courts, the bench ruled, could not invent a special category of sentencing. The principle has since been reaffirmed in *Kiran v State of Karnataka*



GETTY IMAGES/ISTOCKPHOTO

(2025) and applied in *Sukhdev Yadav v State (NCT of Delhi)* (2025).

The Sattankulam trial judge accepted the bar in his own sentencing order. He cited the December 2025 *Kiran* ruling which held that Sessions Courts cannot bridge "the hiatus between 14 years and death". In paragraph 323 of his order, Judge Muthukumar recorded that the Sessions Court has no power to impose imprisonment for life until death. The defence for the fourth accused had pleaded the same limitation, citing the same authority.

Limitations on Trial Courts

The justification offered in *Sriharan* is surprisingly thin. The majority called the special category an inherent power of constitutional courts, unavailable to trial courts. Yet trial courts already wield the most consequential sentencing power the Code of Criminal Procedure (CrPC) recognises. If they can extinguish life under *Bachan Singh*, why may they not impose the lesser sentence of life without remission?

The Supreme Court has acknowledged

the trap. In *Kiran*, the Bench described Shraddhananda's concern: ordinary life imprisonment amounts to fourteen years with remission, leaving a gap that grave crimes outstrip. The special category was devised to bridge the hiatus. *Sriharan* then withheld the bridge from the trial courts most likely to need it.

The consequence in Sattankulam is plain. Even ordinary life imprisonment, the judge wrote, would let the convicts come out in fourteen years through determined effort. Section 433A of the CrPC fixed that minimum. He found the interval derisory for the brutality before him. *Sriharan* denied him the calibrated alternative. He could not direct, say, thirty years of actual incarceration without remission, a sentence second only to death. He could only choose between a sentence he considered inadequate and the rope. He chose the rope.

The defenders of *Sriharan* must be heard. Uniformity, they argue, requires the special category to remain with constitutional courts, lest sessions judges impose idiosyncratic non-remittable terms. They invoke appellate scrutiny in

death references as the only safeguard. Trial courts also impose death sentences, subject to confirmation under Section 366 of the Code. Uniformity is achieved through appellate correction, not through pre-emptive denial of jurisdiction.

A sharper critique is empirical. The Square Circle Clinic at NALSAR released its Annual Statistics Report on the death penalty in February. Its findings cut against any easy reading of the Sattankulam result. In *Manoj v State of Madhya Pradesh* (2022), the Supreme Court directed trial courts to gather information about the prisoner's background, mental health and prison conduct before imposing a death sentence. These guidelines are routinely ignored. *Vasanta Sampat Dupare* (2025) elevated compliance with *Manoj* to a fair trial right under Article 21, without changing trial court practice.

At the same time, the special category *Shraddhananda* devised has become the rule rather than the exception at the appellate level. All five Supreme Court commutations in 2025 went to whole-life without remission.

The Sattankulam verdict will travel to the Madras High Court on confirmation. The Madurai Bench has followed this case since taking *suo motu* cognisance in June 2020. It will have the option *Sriharan* denied the trial judge. It may convert the sentences into fixed-term life imprisonment without remission. That outcome would expose the contradiction. A special category trial courts cannot use is becoming the default above them.

According to the Square Circle Clinic's report, most trial courts impose death sentences without the mitigation hearings *Manoj* demands. The Sattankulam judge did hold them, and the architecture failed him anyway. Extending the special category of fixed-term sentencing to him would appear to remedy one rung of a broken ladder. Yet reconsideration of the post-*Bachan Singh* edifice would still be overdue.

(The author is a journalist and legal researcher.)

THE GIST

The death sentences for the Sattankulam custodial killings highlight a conflict between the "rarest of rare" doctrine and legal restrictions, with the trial judge choosing the death penalty over an inadequate life sentence because judicial precedents barred them from imposing a fixed-term, non-remittable sentence.

Critics argue this outcome highlights a "broken ladder" in Indian jurisprudence, where the Supreme Court's *Sriharan* decision forces trial courts into binary sentencing (death or '14-year jail') by withholding the "middle ground" of long-term imprisonment, a tool now default at the appellate level.



GS Paper III – Economic Development

Tapping fisheries in reservoirs

Budget 2026-27 highlights undertaking of initiatives for integrated development of fisheries in 500 reservoirs and Amrit Sarovars (ponds developed under Mission Amrit Sarovar) to enhance income of fish farmers. This will also involve strengthening market access to fish farmer-producer organisations and cooperatives.

India is the second largest fish producer in the world. Now, it is also the second largest globally in aquaculture production. The country has witnessed a 106% increase in the national fish production since 2013-14 that stands at a record 197.75 lakh tonnes in 2024-25. Interestingly, 75% of our fish production comes from inland fisheries that include freshwater, brackish, and saline water resources. Reservoirs, spread over an area of more than 31.50 lakh hectares, are a major source of freshwater fisheries and aquaculture. Fish production from these water bodies is approximately 18 lakh tonnes.

Located primarily in eastern, central and the peninsular regions, these reservoirs contribute to the livelihood of millions of fish farmers. This is especially true for economically backward and water-scarce regions where they play a crucial role in providing direct/indirect employment and food security.

While Madhya Pradesh has the maximum area under reservoirs (about six lakh hectares), Tamil Nadu has the highest number of reservoirs at over 8,000.

A key factor in the rise of the country's fish production is the increase in fish productivity in reservoirs to 100 kg per hectare compared to 50 kg in 2006. This has been made possible by application of cage culture technology with sufficient stocking of quality seed backed by requisite budgetary support under flagship programmes such as Blue Revolution (BR) and the Pradhan Mantri Matsya Sampada Yojana (PMMSY). While the Indian major



Abhilaksh Likhi

Union Secretary,
Department of
Fisheries,
Government of India

carps (Catla, Rohu, Mrigal) form the core species for stocking, need-based stocking of additional species (Tilapia, Pangasius, etc.), in consultation with beneficiaries, is provided under the above programmes.

These reservoir cages, floating or stationary, are typically made of synthetic netting or mesh with a structure for support. The mesh allows for natural water flow, ensuring oxygen and nutrient exchange with the surrounding environment. These cages are anchored to the bottom or suspended from buoys to maintain their position and depth. This facilitates easier feeding, monitoring, and disease management. Further, to promote species diversification, in addition to rectangular cages, circular cages are increasingly being deployed.

Bimal Chandra Oran is a fish farmer from Saraikela district in Jharkhand who has taken up aquaculture for his livelihood in the Chandil reservoir ecosystem. As a member of the Chandil Bandh Visthapit Matsyajibhi Swalambhi Sahkar Samiti (CBVMSS), he set up two cages and was provided subsidised seed and feed inputs. This was followed by a series of capacity-building trainings to upgrade his skills. Over the years, he has cultured Tilapia and Pangasius species through the reservoir cage technology. Backed by marketing support through cooperative society, he has been able to produce three tonnes of fish, thereby achieving an annual turnover of more than ₹3 lakh.

An Indian Council of Agricultural Research (ICAR)-Central Institute of Inland Fisheries (CIFRI) study envisions that aquaculture productivity can go up to 300 kg from the current 100 kg per hectare in such reservoirs. To achieve this potential, experts suggest adopting a value chain approach through the integrated development of these reservoirs. This includes converged setting up

of hatcheries, feed mills, storage sheds, ice plants, berthing platforms, auction centres, and marketing retail outlets, and ensuring availability of boats and refrigerated trucks.

To ground the above value chain approach, a cluster-based strategy is being implemented by the National Fisheries Development Board (NFDB) to enhance the competitiveness of the reservoir ecosystem through end-to-end solutions. In line with this strategy, recently a reservoir cluster has been announced for the Halalai and Indra Sagar dams in Madhya Pradesh. The effort will be, first and foremost, to identify sectoral gaps in fisheries production, productivity, and processing capacities within this reservoir ecosystem. Critical, for instance, herein will be the assessment of multiplicity of agencies owning fishing rights, which sometimes poses challenges in data gathering. And without doubt, it will also entail enhancing economies of scale for local fish farmers by their aggregation through cooperatives and fish farmer-producer organisations. Such reservoir clusters will be replicated in other States and Union Territories as well.

In addition, Mission Amrit Sarovar is being implemented with the core vision of conserving surface and underground water in district ponds. A key innovation herein is mapping of user groups for pond management through community participation. Each Amrit Sarovar is designed to have a pondage area of minimum one acre with a holding capacity of 10,000 cubic metres. The Amrit Sarovar at Dine Dite Rijo in Upper Subansiri district of Arunachal Pradesh is a success story of a retention basin that has been successfully used for stocking and aquaculture of ornamental fishes. Tapping fisheries in reservoirs and Amrit Sarovars aligns with the Viksit Bharat@2047 vision to empower fishermen families to thrive and contribute to the nation's Blue Revolution.

The rise in the country's fish production has been made possible by the application of cage culture technology

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GS Paper III – Environment

Tourism and trade

Consensus is vital in leveraging the strategic importance of Nicobar

The Union government's ₹92,000 crore mega-infrastructure project for the holistic development of the Great Nicobar Island (GNI) by building it up as a port and tourism-led economy has gathered speed in the last six months, even as concerns remain about its impact on the Island's ecology and the rights of local populations, the Nicobarese and the Shompen – two indigenous tribal groups. The Andaman and Nicobar Islands administration has notified a draft master plan for the project. Apart from the International Container Transshipment Port (ICTP), the airport, and power plants, the draft master plan envisions developing the GNI as a "seaside destination in a pristine, unspoilt, protected environment", outlining plans for business, adventure, biodiversity tourism, family entertainment, amusement parks, etc., along with adequate social infrastructure for healthcare, education, and livelihood. The draft is planned for a projected population of over 3.36 lakh by 2055, by which time the expected tourist inflow will be a million a year. Over 70% of the direct employment the government hopes to create will be in tourism and allied sectors. The current population of the GNI is a little less than 10,000. This transformation of the GNI, aided by the ICTP, is crucial to leverage the "strategic importance" of the Island's location at the western entrance to the Malacca Strait. The draft plan has said the port will help India achieve its "aims to capture a significant share in global sea trade".

But while the administration has sought public suggestions and objections for 30 days, it remains unclear till when this window will remain open, given that the draft does not mention when it was notified. This draft plan follows another draft plan to relocate local Nicobarese communities to make way for the project. The two plans seemingly contradict each other with regard to where existing populations may be relocated, which has renewed fears among these groups. These communities have been opposing the project's clearance since 2022, alleging that their forest rights had not been settled. While the National Green Tribunal has set aside concerns about the project's impact on the GNI's biodiversity by citing its "strategic importance", a challenge to the project's clearances remains in the Calcutta High Court. Some have also questioned the project's commercial and naval merits. Considering that the project aims to irreversibly alter the demography, and ecology of the GNI, the most prudent path for the government is to take the time needed to build a more holistic consensus over it.

CM
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GS Paper III – Science & Technology

Are biomass stoves a cleaner, cheaper alternative to LPG?

Can modern cookstoves turn the return of firewood into a sustainable alternative during the LPG crisis?

Ankit Mathur

The story so far:

Owing to the LPG crisis, many areas—especially rural regions—have reported going back to firewood that are generally seen as increasing drudgery for women, while also causing pollution and health hazards.

Are today's firewood-based stoves less polluting and benign to human use?

Modern biomass stoves, often called improved cookstoves (ICS), represent a major step up from traditional cooking methods. Unlike old-fashioned mud stoves, they can cut fuel use by up to two-thirds while dramatically reducing smoke.

Traditional "chulhas" waste most of their heat through poor airflow and have an efficiency of barely 10%. By contrast, modern stoves reach thermal efficiency levels of 38% to 45%. Technologies such

as secondary aeration help to catch soot and harmful gases before they turn into smoke.

How can mass firewood-based cooking be made sustainable?

Cooking with firewood can be sustainable, provided the wood is harvested and used responsibly. Firewood is a renewable resource as long as the rate of extraction does not exceed the rate of regrowth. Since improved cookstoves burn fuel more efficiently, they can reduce the amount of wood needed for a meal.

Modern cookstoves can also run on alternative biomass fuels, including pellets and briquettes made from sawdust or agricultural waste. This widens the fuel base and takes some pressure off raw firewood.

Financing is key to achieving deployment at scale. Emissions savings enabled by improved cookstoves can be tracked and turned into carbon credits,

creating a funding stream that makes stoves more affordable for lower-income families.

What about the cost of equipment and fuel expenses?

Upfront costs vary significantly. Household models start below ₹2,000, while commercial systems can exceed ₹20,000, depending on the manufacturer and purchase channel (whether direct, through e-commerce, or via distributors). For low- and middle-income households, managing upfront costs can be made easier through financing partnerships involving microfinance, CSR programs, and carbon finance.

The principal operating cost is fuel, and modern cookstoves' high thermal efficiency can significantly reduce fuel requirements. Today's stoves have cut firewood consumption by more than 50%.

Firewood is highly cost-effective compared with LPG, especially during the

ongoing supply crunch when commercial LPG rates in major cities have exceeded ₹100/kg. From the wide range of prices available for different firewood types, it is possible to assume a rough average cost of around ₹10/kg (if firewood is being bought instead of being simply scavenged). Considering that 4 kilos of firewood deliver the same cooking energy output as 1 kg of commercial LPG (in an improved cookstove), firewood could potentially offer cost savings of well over 60%.

What supply chain would be needed for mass adoption? Will this be a massive investment?

Adopting biomass cookstoves on a large scale absolutely does not require a massive investment in fuel supply chains. Since the primary fuels—like firewood, crop waste, and dung cakes—are already widely available in rural and semi-urban areas, there is less need for expensive, centralised infrastructure.

Scaling up is therefore more about strengthening distribution networks. Success depends on improving logistics, last-mile delivery, and local partnerships. Just as importantly, building user awareness and providing reliable after-sales support are essential to making sure these stoves remain a permanent part of daily life.

(The author is co-founder and CEO, Greenway Grameen)

THE GIST

Improved Cookstoves (ICS) offer a sustainable solution by increasing thermal efficiency, reducing smoke, and cutting firewood usage by over 50%.

Mass adoption of efficient biomass stoves does not require massive infrastructure investment, as local, renewable fuels (wood, agricultural waste) are readily available.

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GS Paper III – Science & Technology

Support women's quota law amendments: PM to parties

Kharge questions the timing and points to the lack of consultations as Modi says it is imperative that the 2029 Lok Sabha and Assembly elections are conducted with women's reservation in place


The Hindu Bureau
NEW DELHI

Ahead of the extended sitting of the Budget Session to clear amendments to the women's reservation Act, 2023, Prime Minister Narendra Modi on Sunday wrote to the heads of all political parties seeking their cooperation, calling it a moment to demonstrate responsibility towards women.

In response, Congress president Mallikarjun Kharge reiterated the demand for an all-party meeting for pre-legislative deliberations and questioned the timing of introducing the amendment Bill amid Assembly elections.

The government seeks to introduce amendments delinking the implementation of women's reservation in legislative bodies from delimitation based on the ongoing enumeration. Instead, it proposes to carry out delimitation based on the 2011 Census, without using population as the metric to determine a State's representation in the Lok Sabha.

"Any society progresses only when women have the opportunity to pro-



This is a moment above any one party or individual. It is a moment to demonstrate responsibility towards women and our future generations

NARENDRA MODI
Prime Minister



The calling of the sitting during elections reinforces our belief that govt. is hurrying the implementation of Bill to gain political mileage rather than truly empower women

MALLIKARJUN KHARGE
Congress president

gress, make decision and, more importantly to lead. For India to realise its vision of becoming a developed nation, it is essential that women play a greater and active role in this journey," Mr. Modi said in his letter dated April 11. Recalling the unanimous passage of the *Nari Shakti Vandan Adhiniyam* in September 2023, he described it as a "memorable moment" in India's parliamentary journey and said it reflected unity across party lines.

Referring to deliberations at the time of the law's passage, the Prime Minister said there had been broad consensus that its provisions should come

into effect at the earliest. He said it was imperative that the 2029 Lok Sabha and Assembly elections were conducted with women's reservation in place. He urged leaders to come together in "one voice" to pass the amendments. "This is a moment above any one party or individual. It is a moment to demonstrate responsibility towards women and our future generations," he wrote.

Mr. Kharge reminded the Prime Minister that the women's reservation law had been passed unanimously 30 months ago and that the Congress had demanded its immediate im-

plementation at the time. He said that while the Prime Minister's letter referred to a consensus on early implementation, the government had failed to act on it then.

Mr. Kharge said the Opposition had not been taken into confidence ahead of the special sitting and criticised the government for not sharing details of the delimitation exercise linked to the law's implementation. Without clarity on delimitation and related aspects, he said, it would be impossible to hold a meaningful discussion.

Rejecting Mr. Modi's claim of consultations with political parties, the Congress chief said Opposition parties had been urging the government to convene an all-party meeting after the completion of the current round of elections on April 29 to discuss the constitutional amendments being contemplated. He also questioned the timing. "The calling of a special sitting during the ongoing state elections only reinforces our belief that your government is hurrying the implementation of the Bill to gain political mileage rather than truly empower women," he said.



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GS Paper III – Science & Technology

Study unravels why men experience more skin infections than women

Hormones may do more than regulate mood, behaviour, and reproduction – and new findings suggest they may also determine how vulnerable we are to skin infections and how we fight them; male sex hormones, which include testosterone, help bacteria communicate and cause skin infections by activating a bacterial signalling system

Kavi Bharathi R.

Men experience more skin infections than women – doctors have known this for a while. They have proposed both behavioural and physiological reasons for this difference but the exact mechanism has been unclear.

Recently, scientists at UT Southwestern Medical Centre in Texas in the U.S. reported that the male sex hormones, androgens, which include testosterone, help bacteria communicate and cause skin infections by activating a bacterial signalling system called quorum sensing.

Their findings, published in *Nature Microbiology*, show that reducing testosterone levels in mouse models increased the animals' resistance to infections. When the researchers applied testosterone topically to female mice, the infection became more severe.

Skin's hormones

Sex hormones are generally thought to be produced by the testes or ovaries. However, Tamia Harris-Tryon, Associate Professor of dermatology and immunology at UT Southwestern, and her team had previously shown using an advanced technique called liquid chromatography tandem mass spectrometry that the skin also generates and secretes extremely small concentrations of these hormones.

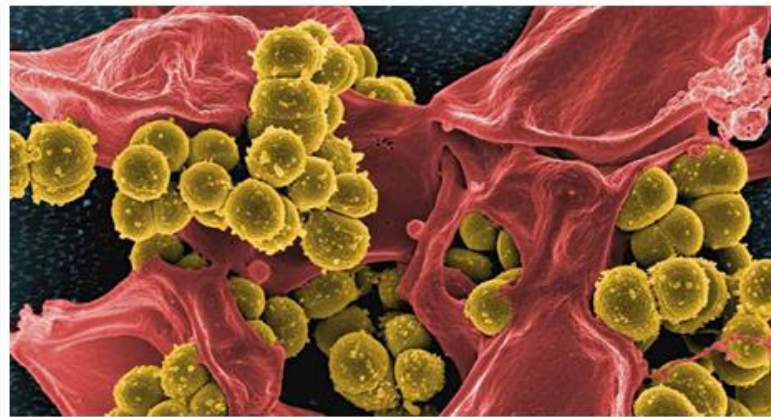
"We continue to be fascinated by how the skin makes sex hormones and how this changes in skin diseases," Dr. Harris-Tryon said.

The skin is a hormonally responsive organ. Its sebaceous glands can produce hormones, making testosterone readily available to microbes living on the skin's surface. This is relevant to bacteria like *Staphylococcus aureus*. They don't begin an infection right away. Instead, they wait and multiply, and activate their disease-causing machinery only once the colony is dense enough to have a fighting chance. Bioinformatic analysis further revealed that the bacteria also respond to the host's hormones.

"Together, these observations led the team to explore a potential connection between host hormonal changes and microbial dynamics on the skin," Maria Sindhura John, the study's first author and a postdoctoral researcher at UT Southwestern, said.

To test whether testosterone from the skin drives infection, the researchers engineered mice that were unable to produce testosterone in the skin. These animals had markedly less severe infections and less skin barrier damage compared to normal mice. When testosterone was applied to hormone-deficient female mice, the infection became more severe.

The effect was specific to androgens. Female sex hormones, oestradiol and progesterone, didn't affect the bacteria's quorum sensing – where bacteria release



A coloured scanning electron micrograph of methicillin-resistant *Staphylococcus aureus* (MRSA) bacteria, shown in gold, interacting with a human neutrophil, in red. [NIAH](#)

chemical signals into their environment and as the bacterial population grows, the concentration of these signals rises.

"This elegant study shows that host-derived androgen hormones modulate the quorum sensing system to make the bacteria more virulent," Ferric C. Fang, a clinician scientist at the University of Washington School of Medicine, who wasn't involved in the study, said. "Thus, the bacteria not only talk to each other, but the host also talks to the bacteria. This may help to explain why men are more susceptible to staphylococcal skin infections than women and could lead to new approaches for the treatment or prevention of these infections."

Beyond antibiotics

S. aureus is the leading cause of skin infections worldwide. It commonly colonises the skin and nose but when it enters the bloodstream, it can cause septicæmia, a life-threatening condition that could lead to organ failure.

These infections have been increasingly harder to treat, thanks to the rise of multi-drug-resistant *S. aureus*, a strain that resists methicillin and other related antibiotics. Doctors have associated it with prolonged hospital stays and higher mortality.

Conventional antibiotics try to kill bacteria or inhibit their growth, which creates strong evolutionary pressures that encourage bacteria to develop resistance to antibiotics. However, the new study targeted quorum sensing, which disrupts the bacteria's ability to coordinate harmful behaviours without necessarily threatening their survival.

"This also reduces selective pressure for resistance and may preserve beneficial



The bacteria not only talk to each other, but the host also talks to the bacteria. This may help to explain why men are more susceptible to staphylococcal skin infections than women

FERRIC C. FANG
Clinician scientist at the University of Washington School of Medicine

microbes, making it a potentially more sustainable strategy in combating antimicrobial resistance," Dr. Sindhura John said.

The researchers identified a mirror-image form of testosterone called enantiomer-testosterone (*ent-T*). While testosterone activated quorum sensing, *ent-T* blocked the bacterial communication pathway and reduced toxicity in human skin cells, red blood cells, and neutrophils in laboratory experiments. Computational modelling revealed how *ent-T* interacted with the bacterial targets, pointing to a possible strategy to tackle antibiotic resistance.

"This was an unexpected but exciting discovery," Dr. Sindhura John said.

'Imagine someone is angry'

While studying how bacteria respond to natural testosterone and exploring structurally similar molecules to understand the specificity of the response, they found bacteria could distinguish between subtle molecular differences. This opened a new avenue to design compounds that can deliberately switch off harmful bacterial behaviour.

"Imagine if someone is angry – you

don't remove or kill the person," Dr. Sindhura John said. "Rather, you calm them down so they behave normally again. We are doing something similar with bacteria."

Similarly, *S. aureus* is usually a normal skin resident but it becomes harmful when its environment changes. Instead of killing it, the researchers want to suppress its virulence and restore it to a harmless state. "This way, we reduce antibiotic resistance and maintain skin balance," Dr. Sindhura John added.

The interaction between humans and the resident bacteria is complex and poorly understood. "This study provides an interesting new angle, with the potential for exploitation to reveal new ways to combat important human infections," Simon J. Foster, the West Riding Chair in microbiology at the University of Sheffield, said.

Early phase trials

The researchers aim to test these findings in human skin models and move to early-phase trials to assess safety and efficacy. They are also keen to understand how these mechanisms operate within the complexity of the human microbiome.

"If successful, this approach could represent a paradigm shift in how we treat infections – moving away from broadly killing bacteria toward more precise modulation of their behaviour," Dr. Sindhura John said.

This approach could lead to therapies that are more effective, less disruptive to the body's natural microbiome, and less likely to drive antibiotic resistance.

(Kavi Bharathi R. is a science writer based at the Indian Institute of Science, Bengaluru. bbharathi.colors@gmail.com)

THE GIST

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