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Trends in Clean Cooking Fuel Adoption in Karnataka: A Secondary Data Analysis of NFHS and PMUY Reports

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Abstract:

This study examines recent trends in the adoption of clean cooking fuels in Karnataka using secondary data from the National Family Health Survey (NFHS-4 and NFHS-5) and reports of the Pradhan Mantri Ujwala Yojana (PMUY). It analyses changes in household dependence on liquefied petroleum gas (LPG) and traditional biomass fuels between 2015 and 2021. Evidence from the NFHS reveals a substantial increase in LPG adoption during this period, particularly among rural households and economically disadvantaged groups, coinciding with the expansion of PMUY connections across the state. Furthermore, PMUY data indicate a steady growth in beneficiary coverage from 2016 to 2024, underscoring the scheme's critical role in facilitating first-time access to clean cooking energy. The findings underscore the need for targeted policy interventions to reduce rural–urban disparities and ensure the sustained adoption of clean cooking solutions in Karnataka.

Keywords: *Clean cooking fuels; LPG adoption; NFHS; PMUY; Rural-Urban disparity.*

Introduction

This research article analyses the recent trends in the adoption of clean cooking fuel in Karnataka by analysing secondary data from the National Family Health Survey (NFHS-4 and NFHS-5) and Pradhan Mantri Ujjwala Yojana (PMUY) reports. Clean cooking energy is an important aspect of Public Health, environmental protection and socioeconomic development in India. However, a large number of rural households still depend on traditional biomass fuels such as firewood, cow dung cake and agricultural residues for cooking. The continued use of these fuels exposes women and children to indoor air pollution and leads to several health problems. It also contributes to deforestation and environmental

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degradation. Because of these concerns, access to clean cooking fuel has received increasing attention in public policy discussions in recent years. To address this issue, the Government of India has introduced various programs aimed at promoting cleaner household energy. Among them, the Pradhan Mantri Ujjwala Yojana has played a significant role by providing subsidized LPG Connections to women from economically weaker sections. The scheme was implemented mainly to reduce dependence on traditional fuels and to improve living standards in rural areas of India.

In Karnataka, the adoption of clean cooking fuels has improved over the last decade. This improvement is highly associated with the expansion of LPG Distribution networks, better connectivity in rural areas the Government support through programs such as PMUY. Despite this progress, the shift from biomass to LPG has not been uniform across the state. In several districts, households continue to depend partly or fully on traditional fuels due to factors such as low income, high refill cost and availability issues. Data from the National Family Health Survey (NFHS) provide useful information on household fuel use and cooking practices.

The NHF4 and NFHS-5 surveys allow a comparison of changes in clean cooking fuel adoption over time and across different social groups. In addition to the PMUY administrative data offers insights into the increase of LPG connections and the reach of the scheme in Karnataka.

Against this background, the present study looks at recent trends in clean cooking fuel Adoption in Karnataka using secondary data from NFS-4, NFHS-5 and PMUY reports. It examines changes in the use of LPG and traditional biomass fuels with a focus on different districts and socioeconomic groups across the state. The study also considers the role of Pradhan Mantri Ujjwala Yojana in improving access to clean cooking energy. The findings are intended to support ongoing discussions on energy transition, rural development and public health to promote practical inputs for strengthening the clean cooking initiative in Karnataka.

Review of literature

Access to clean cooking is widely recognized as a critical determinant of household health, environmental sustainability and women's welfare in developing economies. In India, continued dependence on traditional Biomass fuels such as firewood, cow dung cake, and agricultural residues has historically contributed to indoor air pollution, adverse health outcomes and time poverty among women, particularly in rural areas. (IIPS, 2017)

National Family Health Survey (NFHS-4), 2015-2016, reported that the majority of Karnataka households still depend on firewood for cooking, especially in rural areas. LPG access has improved, but remains limited among economically weaker groups. The survey

highlighted clear district-wise clean cooking fuel adoption. Women's exposure to household smoke was found to be very high. The report established the baseline for food evaluation for later improvements.

National Family Health Survey (NFHS-5) 2019-2021 showed a significant rise in LPG adoption across Karnataka compared to NFHS-4. Rural households recorded notable improvement, including the early impact of PMUY connections. However, many households continue to use mixed fuel, despite on LPG. District data reveal that northern Karnataka still lags behind the southern and urban regions. The report demonstrated progress and also pointed to affordability barriers.

PMUY State-Level Monitoring Report-Karnataka (2020-2022). State monitoring data showed an improvement in active LPG usage after the PMUY rollout. Refill rates are deferred widely across the district, especially in tribal and agricultural areas. Also, the last-mile delivery issues continued in remote areas. The report emphasized targeted support for vulnerable groups.

Research Gap

Although several national-level studies have examined clean fear adoption and the impact of PMUY in India, relatively little attention has been given to Karnataka. Using detailed comparisons from NSH-4 and NFHS-5, limited research has focused especially on Karnataka. Existing studies largely emphasize LPG access, with less attention given to sustained usage and rural-urban differences. As a result, state-level evidence on long-term clean cooking fuel adoption and associated challenges in Karnataka remains insufficient.

Objectives

1. To examine trends in clean cooking fuel usage in Karnataka, using data from NSH-4 and NFHS-5
2. To analyses rural-urban differences in the adoption of LPG in Karnataka.
3. To assess the role of the Pradhan Mantri Ujjwala Yojana in improving access and usage to LPG.
4. To identify Challenges affecting the sustained use of clean cooking fuels.

Research Design

The study employs a descriptive-analytical research design based entirely on secondary data. The purpose of the study is to analyse recent trends in the adoption of clean cooking fuel in Karnataka across two NFHS surveys and assess the contribution of Pradhan Mantri Ujjwala Yojana in expanding LPG access. The design enables systematic comparison of temporal changes and identification of social-spatial disparities.

Results and Discussion

The trend in the use of clean cooking fuel : The NFHS data clearly show that the use of clean cooking fuels in Karnataka has increased over time. The findings from the NFHS-4 State facts sheet (2015-16) indicate that 54.7% of households report using clean cooking fuels in their households. In contrast, the data from NFHS-5 (2019 -21) show a much higher level of adoption, with

79.7% of households using clean cooking fuels. This represents an increase of nearly 25 per cent between the two survey rounds, suggesting a substantial shift in household cooking practices within a relatively short period. This rise reflects an improving access to LPG and other modern fuels across the state, improved distribution systems, and policies support appear to have played an important role in enabling this transition.

Overall, the results point to significant progress in clean cooking fuel adoptions in Karnataka. At the same time, the extent of change highlights the importance of continued policy support to ensure that access to clean fuel is maintained and translated into regular use across all regions of the state.

Table 1: Trends in household use of clean cooking fuels in Karnataka, NFHS-4 and NFS-5

Survey Round	Survey Year	Household Using Clean Cooking Fuel (%)
NFHS-4	2015-16	54.7
NFHS-5	2019-21	79.7
Change	-	+25%

The table indicates are substantial rise in the proportion of households using clean cooking fuels in Karnataka between NFS-4 and NFHS-5. The increase of approximately 25 percentage points reflects a strong upward trend in clean cooking fuel adoption during the study period.

Rural-Urban disparity in clean cooking fuel Adoption in Karnataka;

The NFHS data reveal a clear difference between rural and urban households in the use of clean cooking fuels in Karnataka. In both NFHS-4 and NFHS-5, a higher proportion of urban households reported using clean cooking fuels compared to rural households. Although rural areas have experienced are noticeable rise in clean fuel usage over time, their level of adoption continues to remain lower than that observed in urban areas. The results also suggest that many rural households follow a mixed pattern of fuel use, where LPG is used alongside traditional biomass fuels such as firewood. This indicates that the transition to clean cooking energy in rural areas is often partial rather than complete. In contrast, urban households depend more consistently on clean cooking fuels as their primary source of energy. Overall, while the gap between rural and urban areas have narrowed between NFHS-4 and NFHS-5, differences in clean cooking fuel adoption persist.

Table 2: Urban Urban-rural distribution of households using clean cooking fuels in Karnataka (%)

Residence	NFHS-4(2015-2016)	NFHS-5(2019-2021)	Absolute Change (%)
Urban	87.4	95.2	+7.8
Rural	44.3	74.1	+29.8
Total	54.7	79.7	+25.0

The table shows a substantial increase in clean cooking fuel usage in both Urban and rural Karnataka between NFHS-4 and NFHS-5. Although rural areas recorded a larger absolute improvement, urban households contribute to exhibiting higher levels of clean cooking fuel adoption.

Role of Pradhan Mantri Ujjwala Yojana(PMUY) in the adoption of clean cooking fuel;

The results indicate that the implementation of Pradhan Mantri Ujjwala Yojana (PMUY) has played an important role in expanding access to clean cooking fuel (LPG) across Karnataka. Since the implementation of the scheme in 2016, that has been a constant rise in LPG connections among economically weaker households. By early 2020, Karnataka had around 2,836,102 PMUY beneficiaries, indicating widespread coverage of LPG connections throughout the state. The district-level data shows that PMUY led to the release of a large number of new LPG connections across Karnataka, especially in rural and economically weaker districts. For many poor households, this was their first access to a clean cooking fuel. The spread of connections across districts indicates broad geographical coverage, with the higher beneficiary numbers seen in districts that have a larger rural population. This expansion in LPG access occurred alongside a noticeable rise in clean cooking fuel usage during the study period, suggesting that

PMUY played an important role in enabling households to move away from traditional cooking fuels. But the study also indicates that many households continue to use firewood or other traditional fuels along with LPG; therefore, the transition to clean cooking fuels among PMUY beneficiaries appears to be partial, with affordability and refill-related issues limiting the LPG use for everyday cooking.

Findings of the study

1. Clean cooking fuel usage in Karnataka increased significantly from 54.7% in NPH-4 to 79.7% in NFS-5, indicating strong growth in adoption.
2. Urban households showed higher adoption of clean cooking fuels than rural households, though rural areas experienced noticeable improvement over time.
3. PMUY significantly expanded the LPG access in Karnataka, covering over 2.8 million beneficiary households, but sustained usage remains uneven.
4. Substantial district-level variation exists in clean fuel adoption, with several districts remaining below the state coverage.

Conclusion

The study analyzed changes in clean cooking fuel adoption in Karnataka using secondary data from NFHS and PMUY sources. The findings clearly indicate that household use of clean cooking fuels has

increased over the study period, showing progress in moving away from traditional biomass-based cooking practices. A major contributor to this change has been the expansion of LPG access after the introduction of Pradhan Mantri Ujjwal Yojana, which provides first-time access to clean cooking energy for a large number of economically weaker households across the state.

However, the transition has not occurred evenly across Karnataka. Differences between Urban and rural areas, as well as variations across districts, continue to persist. The results suggest that having access to LPG does not always lead to regular or exclusive use, as many households still depend partly on traditional fuel. While Karnataka has made meaningful progress in expanding clean cooking fuel coverage, ensuring consistent usage and achieving a complete shift to clean fuels remain important challenges. Addressing issues related to Affordability, accessibility, and sustained use will be crucial for achieving long-term Clean energy goals in Ka

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