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# THE EDUCATIONAL EDGE: DOES WIVES' SUPERIOR EDUCATION COMPARED TO THEIR SPOUSES DRIVE CLEANER COOKING PRACTICES?

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***Abstract:*** **Despite progress, a significant portion of India's population, especially in rural regions, lacks access to clean cooking fuels. Traditional cooking practices, which utilize crop residues, cow dung, fuelwood, and coal, contribute to severe health and environmental issues, including respiratory and cardiovascular diseases, cancer, deforestation, and climate change. These fuels also exacerbate gender inequality, as women spend significant time on fuel collection and cooking, limiting their participation in wage-earning activities.**

**Household air pollution from these fuels resulted in approximately 0.81 million premature deaths in India in 2019, with a disproportionate impact on women in developing countries. The National Sample Survey Office (NSSO) reports that in 1998, women spent 50 hours weekly on household chores, with 15-20 per cent dedicated to childcare, hindering their economic productivity. The persistence of fuel stacking, where households use multiple fuel types, remains a significant challenge. Despite economic improvements, the transition to cleaner fuels has been slow, indicating that income alone does not fully explain fuel choices.**

**This paper examines the relationship between the spousal education difference and the use of clean cooking fuels in households, employing the multinomial logistic regression method based on the Indian Human Development Survey (IHDS-II) data. The analysis shows that around 20% of women have higher education than their husbands, and these households are more inclined to adopt clean cooking fuels. This study highlights the association between women's education and cleaner cooking practices. It emphasizes the necessity of integrated approaches to combat energy poverty and to achieve the Sustainable Development Goal of ensuring clean energy to all.**

***Index Terms*** **– Clean cooking fuels, Traditional cooking practices, Household air pollution, Spousal Education difference, Energy poverty**

## INTRODUCTION

Energy access is one of the crucial sustainable development goals. Around 2.3 billion people globally still rely on traditional cooking fuels and 675 million people lack access to electricity (IEA, IRENA, UNSD, World Bank, WHO 2023). Lack of access to cleaner cooking and lighting fuels leads to socio-economic, environmental and health issues. Globally, women are majorly responsible for cooking activities, resulting in a disproportionate burden of household air pollution, which is a major contributor to health issues like heart disease, stroke, cancer, lung diseases and pneumonia on them. Annually, 3.2 million individuals die prematurely from traditional cooking practices (World Health Organization, 2023). At the ongoing progress rate, there will be 1.9 billion people relying on conventional cooking fuels in 2030 and 660 million people will be living without electricity (IEA, IRENA, UNSD, World Bank, WHO 2023). In developing countries, women and children spend a considerable amount of time collecting fuel wood. This time-consuming task is one of the major reasons women in these countries are unable to complete their education. As a result, their bargaining power in the labor market is reduced, depriving them of job opportunities. This direct involvement of women in cooking as well as collecting fuels makes it logical that they have greater preference for cleaner fuels. Participation of females in household decision-making increases the household's probability of using LPG in cooking (Armand Totouom, 2024). Empowered women are likelier to adopt cleaner fuels through channels

like financial autonomy, work and education (Pronay Ghosh et al, 2024). The daughters-in-law in families in which mothers-in-law have completed at least secondary education have better chances of being engaged in paid work compared to those with illiterate mothers-in-law (Leena Bhattacharya, 2023). Thus, education is closely associated with women's empowerment and with the transition to modern cooking and lighting fuels.

Patriarchal norms and societal pressures force many women to marry at a young age, resulting in their drop out of school at an early stage of education. Historically, men tend to have higher education than women, but recently, many countries globally have witnessed a gender reversal in education. The lower variance in scholastic performance of females and increasing returns over time to female education are the major reasons behind this reversal (Laurent Bossavie & Ohto Kanninen, 2018). The Gender Parity Index in higher education in India has increased from 0.97 in 2017-18 to 1.01 in 2019-20. With improvements in the educational attainments of women, India has witnessed a decreasing trend in hypergamy (women who marry men with higher educational attainment) and an increasing trend in hypogamy (women who marry men with lower educational attainment) (Zhiyong Lin, Sonalde Desai & Feinian Chen, 2020). These trends suggest that the academic status of women has not only improved in absolute terms but has also seen relative advancements. This change in educational dynamics necessitates the case for an investigation into the impact of the relative educational advancement on the nature of cooking fuel used in a household.

Women who are more educated than their spouses experience increased decision-making power and physical freedom, but may have reduced emotional independence (Thiagu Ranganathan & Avina Mendonca, 2023). Education can enhance a woman's decision-making power within the household. This increased agency may allow her to advocate for and implement changes, such as switching to clean cooking fuels. Some studies have shown the impact of absolute education level of women on cooking fuels. Still, no such research has focused on the effects of education of women compared to their spouses on cooking fuels. In line with this, the present paper focuses on the relationship between spousal education comparison and cooking fuels.

## LITERATURE REVIEW

There is well-established literature exploring the factors affecting household energy transition to cleaner fuels. Initial literature focused on the 'Energy-Ladder' hypothesis, according to which income is the crucial factor determining the household energy transition to cleaner fuels like LPG from inefficient fuels like firewood, coal and agricultural residue as a linear movement (Leach, 1975, 1992). Many studies have confirmed the crucial role of economic status, mainly income in a household's decision to shift to modern fuels (Farsi, Filippini & Pachauri, 2007; Gautam Gupta & Gunnar Kohlin, 2006). An average 10 percent increase in income corresponds to an additional 4.7 percentage points in the number of LPG users and a reduction of 2.6 percentage points in wood users and 2.1 percentage points in kerosene users (Farsi, Filippini & Pachauri, 2007). However, subsequent studies discarded the 'Energy-Ladder' hypothesis, and replaced it with the 'Energy-Stacking' hypothesis. Instead of switching completely from an inefficient fuel to a modern fuel with an increase in income, households will only partly switch to different fuels and continue using multiple fuels (Heltberg, 2004; Hanna & Oliva, 2015).

Many studies have shown the importance of socio-demographic factors in explaining household fuel-use patterns. The choice of household cooking fuel is influenced by factors like how old the household head is, the number of persons in the household and the gender of the head. Educational attainment of household head and adults in a household improves the probability of switching to efficient fuels. Education increases the opportunity cost of collecting fuel and income. Education also creates awareness about the benefits of using efficient cooking fuels (Farsi, Filippini & Pachauri 2007; Gupta & Kohlin, 2006). Households also have preferences for certain fuels. Traditions and cultural beliefs also decide the type of cooking fuel. Households map some food to specific fuel type and have taste preferences influencing household cooking fuel decision (Akpalu, Dasmani & Aglobitse, 2011). Switching to cleaner fuels involves psychological hurdles too. Households prefer the taste of food when cooked with solid fuels (Joon et al, 2009). Cooking fuels also follow law of demand. Households are sensitive to own-price of fuel and tend to reduce the quantity demanded of fuel with an increase in its price and vice versa (Cheng & Urpelainen, 2014). A 10 per cent decrease in LPG price will increase the average LPG users by 7 per cent and reduce the users of wood and kerosene by 3.1 and 3.9 per cent respectively (Farsi, Filippini & Pachauri, 2007). Infrastructural and technological barriers to smooth energy transition persists despite policy efforts. Access to electricity alone cannot ensure household energy transition to modern fuels as electricity is majorly used for lighting and holds a minor share in cooking (Bhattacharyya, 2014). Asset possession shows mixed results. Ownership of assets like refrigerator, exclusive kitchen, pressure cookers and television are the main factors affecting household clean cooking fuels (Jabir Ali & Waseem Khan, 2022). Landholding size and livestock numbers exhibit complex influences on the use of traditional fuels, manifesting both positive and negative effects. Demurger & Fournier (2011) found that an

increase in farmland size correlates negatively with firewood consumption, while households with more livestock also tend to consume less firewood. This contrasts with the findings of Kaul & Liu (1992), who observed a close relationship between biomass consumption and the size of farmland, asserting that larger landholdings and higher livestock numbers lead to increased firewood usage. The former study suggests the presence of the 'income effect' in household fuel consumption, implying that higher income from larger landholdings and more livestock results in reduced reliance on firewood. Conversely, the latter study challenges this notion, indicating that increased resources may lead to greater consumption of firewood. Social norms too play a major role in deciding the nature of cooking fuel in a household. Urban Indian households with the first child as male have two percentage points more chances of using clean cooking fuels than households with a female first child (Avinash Kishore & Dean Spears, 2014).

Women empowerment is closely linked to the access to clean cooking fuels. Moreover, women with higher intra-household bargaining power have better say in deciding the nature of cooking fuel. There is a strand of literature which suggests that households led by women are more inclined to use cleaner cooking fuels compared to those headed by men (Rahut et al 2016; Mensah & Adu, 2015). Female headed households have 8 percentage points higher probability of choosing LPG than male headed households (Gould & Urpelainen, 2019). Another group of studies reveal that status of women in a household decides the nature of cooking fuel. Access to formal employment and ability to make household expenditure decisions are the significant factors deciding access to clean fuels in India (Pallavi Choudhuri & Sonalde Desai, 2020). Increased awareness of women regarding health benefits of using clean fuels decide household's choice of modern cooking fuels (Afridi, Debnath & Somanathan, 2021). This paper is structured as follows: Section 2 provides a comprehensive literature review, outlining the relevant theories and previous studies on the topic. Section 3 discusses the data sources and the methodology employed in the analysis. Section 4 presents the descriptive statistics to give an overview of the key variables. The results of the analysis are detailed in Section 5, followed by a discussion of the findings in Section 6. Finally, Section 7 concludes the paper, summarizing the key insights and implications

## DATA SOURCES AND METHODOLOGY

This paper utilizes data from the India Human Development Survey-II, carried out in 2011-12. IHDS-II is a comprehensive, nationally representative survey conducted by the National Council of Applied Economic Research in partnership with the University of Maryland. It covered 42,152 households across 1,503 villages and 971 urban neighborhoods in India. The study focuses on ever-married women aged 15-49. Both household and individual data from these women were used to extract the necessary variables for the research. The survey included questions on fertility, health, marriage, and gender relations within households. We have used our major independent variable spousal education differential and others from this data. Information on major cooking fuel used in a household is used from household data. Data guidelines provided by IHDS are used to merge the two datasets. Appropriate weights have been used to calculate different variables. STATA software has been used for analysis in this study. We proceed first by performing descriptive analysis of different variables and then use multinomial logistic regression method for enquiring the impact of spousal education difference on the type of household cooking fuel.

For our analysis we have restricted our sample to ever-married women in the age group 15-49 for whom data on education is available for both husband and wife. Moreover, we have categorized household cooking fuel in three dimensions i.e. only dirty, only clean and mix. IHDS ask how a particular fuel is majorly used in a household. There are households for whom none of the fuel is reported to be used mainly for cooking. These households are dropped from our analysis. After considering all these restrictions our sample size reduces to 27,543 observations.

## DESCRIPTIVE ANALYSIS

In this section, we will discuss the spousal education comparison in India. Further, we will examine the social, economic, demographic, and marriage-related characteristics of women. Spousal education comparison is defined in terms of the difference between the completed education of a woman and the completed education of her husband. Table 1 shows the average spousal education comparison across different age groups in India. The average spousal education comparison ranges from -1.15 to -2.57 in rural India across different cohorts and from -0.32 to -2.24 in urban India. At the all-India level, this range is from -0.99 to -2.42. On average, women are less educated than their husbands across all age groups, but this gap narrows as we move from higher to lower age groups.

**Table 1 Relative Spousal Education**

| | Average spousal education comparison | | |
|---|---|---|---|
| **Age group** | **Rural India** | **Urban India** | **All India** |
| 15-20 | −1.15 | −0.32 | −0.99 |
| 21-25 | −1.40 | −0.50 | −1.18 |
| 26-30 | −1.98 | −0.84 | −1.64 |
| 31-35 | −2.55 | −1.07 | −2.09 |
| 36-40 | −2.35 | −1.44 | −2.06 |
| 41-45 | −2.57 | −2.02 | −2.39 |
| 46-50 | −2.53 | −2.24 | −2.42 |
| **All** | **−2.12** | **−1.29** | **−1.87** |
| **N** | 18,300 | 9,243 | 27,543 |

*Source: Author's calculations.*

Table 2 presents the attributes of eligible women (aged 15-49 years) in our sample. The typical or mean age of women is 34.04 years. Women with lower or equal educational attainments compared to their partners are, on average, 2.64 years older than those with higher educational attainments than their partners. The average years of completed education are 5.09 years more for women with higher education levels than their partners (9.52) than those with lower or equal education levels (4.42). Conversely, the average years of completed spousal education is 1.4 years higher for women with lower or equal education levels (7.55) than those with higher education levels (6.15). The former group has, on average, 0.65 more children than the latter group (2.59 vs. 1.94).

Regarding urban residence, 42.59% of women with higher education levels than their partners are urban residents, compared to 31.21% of those with lower or equal education levels. Caste composition reveals that a significant proportion of women with lower or equal education levels (22.36% and 8.55%) belong to Scheduled Castes and Scheduled Tribes compared to those with higher education levels (18.67% and 5.32%). Women with lower or equal education levels are younger at marriage (17.63 years) compared to those with higher education levels (19.38 years). A higher proportion of women with higher education levels are engaged in salaried jobs or business (13.39%) compared to those with lower or equal education levels (8.59%).

Women with lower or the same education attainments are more likely to belong to households with the farm sector as the primary source of income (35.89%) compared to those with higher education levels (30.39%). The average household income is higher for women with higher education levels, although not statistically significant. Women with higher education attainments have a larger proportion with most say in work decisions (36.40%) and wedding decisions (12.29%) compared to those with lower or equal education levels (33.45% and 11.36%, respectively).

Approximately 7% of women in the sample have the most say in purchasing expensive items, with no significant difference between the two groups. Women with higher education levels have a higher proportion with a name on a bank account (57.48%) and owning home or rental papers (15.39%) compared to those with lower or equal education levels (51.85% and 13.26%). Most women in the sample (92%) need permission before leaving their homes for health centres, with no significant contrast observed between the two groups. Women with higher education attainments are more inclined to adopt only clean cooking fuels (37.90%) compared to those with lower or equal education levels (28.84%). They are also more likely to stack fuels (27.50%) than those with lower or equal education levels (23.66%). Regarding relying exclusively on dirty fuels for cooking, only 34.59% of women with higher education use these fuels compared to 47.49% of those with lower or equal education levels.

**Table 2 Descriptive Statistics**

| Variable | All sample | Equal/less educated than spouse (1) | More educated than spouse (2) | Difference (1−2) | t-statistic |
|---|---|---|---|---|---|
| Age | 34.04 | 34.59 | 31.94 | 2.64 | 21.58*** |
| Education (completed years) | 5.47 | 4.42 | 9.52 | −5.09 | 75.88*** |
| Spousal education | 7.26 | 7.55 | 6.15 | 1.40 | 19.83*** |
| Number of children (alive) | 2.46 | 2.59 | 1.94 | 0.65 | 29.68*** |
| Urban residence | 33.55% | 31.21% | 42.59% | −11.37% | 16.24*** |
| ***Caste*** | | | | | |
| SC | 21.60% | 22.36% | 18.67% | 3.68% | 6.01*** |
| ST | 7.88% | 8.55% | 5.32% | 3.23% | 8.06*** |
| OBC (from all religions) | 40.71% | 40.37% | 42.02% | −1.65% | 2.25*** |
| Age at marriage (in years) | 17.99 | 17.63 | 19.38 | −1.74 | 32.33*** |
| Employment (salaried job or business, ≥240 hrs) | 9.58% | 8.59% | 13.39% | −4.79% | 10.95*** |
| Household income | 140,395.6 | 139,277.7 | 144,702.3 | −5,425.6 | 1.54 |
| Farm major income source | 34.76% | 35.89% | 30.39% | 5.49% | 7.75*** |
| Most say in work decision | 34.06% | 33.45% | 36.40% | −2.94% | 4.17*** |
| Most say in wedding expense | 11.56% | 11.36% | 12.29% | −0.93% | 1.95* |
| Most say in expensive items | 7.05% | 6.95% | 7.45% | −0.49% | 1.30 |
| Name on bank account | 53.06% | 51.85% | 57.48% | −5.62% | 6.41*** |
| Owns home or rental papers | 13.70% | 13.26% | 15.39% | −2.12% | 4.07*** |
| Ask permission to go to health centre | 92.03% | 92.08% | 91.80% | 0.28% | 0.70 |
| Only clean cooking fuel | 30.70% | 28.84% | 37.90% | −9.06% | 13.22*** |
| Only dirty cooking fuel | 44.83% | 47.49% | 34.59% | 12.90% | 17.51*** |
| Stack fuels | 24.45% | 23.66% | 27.50% | −3.84% | 6.01*** |

*Source: Author's calculations. Columns (1) and (2) report group means; Difference = (1)−(2). The final column reports the absolute t-statistic for the difference in means. *** p<0.01, ** p<0.05, * p<0.10.*

## RESULTS

This section analyses the results from a multinomial logistic regression model. Our analysis employs the logistic model, marginal effects at the mean, and log-odds. The dependent variable in this study is the type of cooking fuel used, categorized as 0 for only dirty fuels, 1 for only clean fuels, and 2 for mixed fuels. The major independent variable is 'relative education,' which captures the relative educational attainment between a woman and her partner. It is a binary categorical variable with two groups: women with education higher than their partners and women with education less than or equal to their partners. Other independent variables include urban residence, primary income source, employment in salaried jobs or business, household income, age, family size, caste, livestock ownership, and farm ownership.

**Table 3 Results**

| Variable | Outcome (vs. only dirty) | Logit coefficient | Marginal effect | Odds ratio |
|---|---|---|---|---|
| **Relative education** *base: women with ≤ spouse's education* | Clean | 0.29*** [0.04] | 0.0138*** [0.005] | 1.34*** [0.06] |
| | Mixed | 0.37*** [0.04] | 0.0444*** [0.006] | 1.45*** [0.06] |
| **Residence area** *base: rural* | Clean | 2.05*** [0.04] | 0.2887*** [0.007] | 7.78*** [0.36] |
| | Mixed | 0.77*** [0.04] | −0.037*** [0.007] | 2.17*** [0.10] |
| **Main income source: farm** *base: nonfarm sector* | Clean | −0.08*** [0.04] | −0.000754 [0.006] | 0.91** [0.04] |
| | Mixed | −0.15*** [0.03] | −0.02*** [0.006] | 0.85*** [0.03] |
| **Women in salaried job/business** *base: not employed* | Clean | 0.39*** [0.06] | 0.04*** [0.007] | 1.48*** [0.09] |
| | Mixed | 0.17*** [0.06] | 0.001 [0.008] | 1.19*** [0.07] |

| | | | | |
|---|---|---|---|---|
| **Log income** | Clean | 1.08*** [0.02] | 0.09*** [0.002] | 2.94*** [0.06] |
| | Mixed | 0.77*** [0.02] | 0.05*** [0.002] | 2.17*** [0.04] |
| **Age (in years)** | Clean | 0.01*** [0.002] | 0.001*** [0.0002] | 1.01*** [0.002] |
| | Mixed | 0.01*** [0.002] | 0.001*** [0.0003] | 1.01*** [0.002] |
| **Family size** | Clean | −0.13*** [0.008] | −0.016*** [0.001] | 0.87*** [0.007] |
| | Mixed | −0.04*** [0.006] | 0.002*** [0.001] | 0.95*** [0.006] |
| ***Caste (base: Forward caste)*** | | | | |
| **OBC** | Clean | −0.65*** [0.04] | −0.07*** [0.005] | 0.51*** [0.02] |
| | Mixed | −0.33*** [0.04] | −0.008 [0.006] | 0.71*** [0.02] |
| **SC** | Clean | −1.34*** [0.05] | −0.13*** [0.006] | 0.26*** [0.01] |
| | Mixed | −0.71*** [0.04] | −0.03*** [0.007] | 0.48*** [0.02] |
| **ST** | Clean | −1.67*** [0.08] | −0.15*** [0.01] | 0.18*** [0.01] |
| | Mixed | −1.26*** [0.07] | −0.09*** [0.01] | 0.28*** [0.02] |
| **Others** | Clean | −0.42*** [0.16] | −0.016 [0.02] | 0.65*** [0.10] |
| | Mixed | −0.65*** [0.17] | −0.07*** [0.01] | 0.51*** [0.08] |
| **Owns livestock** | Clean | −1.16*** [0.04] | −0.16*** [0.006] | 0.31*** [0.01] |
| | Mixed | −0.16*** [0.04] | 0.06*** [0.007] | 0.85*** [0.03] |
| **Owns farm** | Clean | 0.11*** [0.05] | 0.009 [0.006] | 1.12** [0.05] |
| | Mixed | 0.08** [0.04] | 0.006 [0.006] | 1.08** [0.04] |

*Source: Author's calculations from a multinomial logit model (base outcome: only dirty fuel). Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.10.*

Table 3 presents the findings from the logistic regression model, including marginal effects and log-odds. The coefficients from the logistic model indicate how a unit increase in each independent variable is associated with the likelihood of using one type of fuel over another, relative to the reference category.

For the relative education gap, the positive coefficients suggest that an increase in this gap (moving from situations where women have less or equal education compared to their spouses to where they have more education) is associated with a higher likelihood of using only clean or mixed cooking fuels as opposed to exclusively dirty fuels. Specifically, with all other factors held constant, a unit increase in the relative education gap is associated with a household being 1.34 times more probable to use clean fuels and 1.45 times more probable to use mixed fuels, relative to dirty fuels. Marginal effects reveal that this increase in the education gap is associated with a lower probability of using dirty fuels by 0.0583, while it is associated with higher probabilities of using clean fuels by 0.0138 and mixed fuels by 0.0445.

Households in urban areas are more inclined to use only clean or mixed fuels rather than dirty fuels. Urban households have 7.78 times the chances of adopting clean fuels and 2.17 times the likelihood of adopting mixed fuels compared to dirty fuels. Marginal effects indicate that urban residence is associated with a lower probability of relying solely on dirty fuels by 0.2517, higher chances of adopting clean fuels by 0.2887, and slightly lower chances of adopting mixed fuels by 0.0371.

Households dependent on farm income are less inclined to adopt clean or mixed fuels compared to dirty fuels. Specifically, such households are 8.2 per cent less inclined to adopt clean fuels and 14.4 per cent less inclined to use mixed fuels relative to those relying on non-farm income sources. Marginal effects show an increase in the probability of using dirty fuels by 0.0216 and a slight decrease in the chances of adopting mixed

fuels by 0.0208 for households with farm income. However, the effect on the use of clean fuels is not significant.

Employment in salaried positions or business correlates with a higher likelihood of adopting clean or mixed fuels over dirty fuels. Women in salaried or business roles are 48 per cent more likely to use clean fuels and 19 per cent more inclined to adopt mixed fuels compared to those who do not hold such employment. Marginal effects reveal that salaried or business employment is associated with a lower probability of using dirty fuels by 0.0446 and a higher likelihood of using clean fuels by 0.0435, with no significant impact on mixed fuel use.

Increased household income is associated with a higher likelihood of adopting clean or mixed fuels as opposed to dirty fuels. Specifically, a unit increase in income is associated with a household being 2.94 times more inclined to use clean fuels and 2.17 times more probable to use mixed fuels compared to dirty fuels. Marginal effects show a reduction in the probability of using dirty fuels by 0.15, while the likelihood of using clean fuels increases by 0.09 and mixed fuels by 0.05.

An increase in the age of women in the household also correlates with a higher likelihood of using clean or mixed fuels rather than dirty fuels. Each additional year in age is associated with a 1.01 times greater likelihood of using either clean or mixed fuels compared to dirty fuels. Marginal effects show a decrease in the probability of using dirty fuels by 0.0024 and an increase in the probabilities of using clean and mixed fuels by 0.001 each.

A larger household size is associated with a lower likelihood of choosing clean or mixed fuels. Each additional household member is associated with a lower likelihood of adopting clean fuels by 0.016 and mixed fuels by 0.0024, while being associated with a higher likelihood of using dirty fuels by 0.0136.

Caste is associated with differences in fuel choice, with varying impacts depending on the caste category. Moving from Forward Caste to Other Backward Caste is associated with a lower likelihood of using clean fuels by 49% and mixed fuels by 29 per cent. Transitioning from Forward Caste to Scheduled Caste or Scheduled Tribe is associated with further significant reductions in these probabilities, with Scheduled Tribes showing the highest decrease. Marginal effects reveal that belonging to Scheduled Castes or Tribes is associated with higher chances of using dirty fuels and lower chances of using clean or mixed fuels.

Ownership of livestock is linked to a decreased likelihood of using clean or mixed fuels. Households with livestock are 69 per cent less inclined to use efficient cooking fuels and 15 per cent less inclined to use mixed fuels compared to dirty fuels. Livestock ownership is associated with a higher likelihood of using dirty fuels by 9 per cent and lower chances of using clean fuels by 16 per cent, while being associated with a slightly higher likelihood of using mixed fuels by 6 per cent.

Conversely, owning a farm is associated with a higher likelihood of using clean or mixed fuels compared to dirty fuels, with a 12 per cent higher likelihood for clean fuels and an 8 per cent higher likelihood for mixed fuels. However, the effect on cooking fuel choice is not statistically significant.

## DISCUSSION

The findings of this study highlight a strong association of women's education with the adoption of clean cooking fuels. Women with higher education levels than their husbands are significantly more likely to use clean cooking fuels compared to those with equal or lesser years of education. This suggests that educated women are more aware of the health benefits and environmental impacts associated with clean cooking fuels. Moreover, their enhanced educational status may empower them to make informed decisions and advocate for healthier household practices.

Additionally, our study reveals that these more educated women have a higher share of those working in regular paid jobs. This economic independence may further strengthen their involvement in household decisions, including the choice of cooking fuels. The financial stability that comes with regular employment may provide them with the means to invest in cleaner and potentially more expensive cooking technologies, thus reinforcing the link between women's education, employment, and the adoption of clean cooking fuels.

The positive correlation between women's education and the use of clean cooking fuels also highlights the importance of addressing gender disparities in education. Education not only equips women with knowledge but also enhances their agency and decision-making power within households. As primary caregivers and managers of household resources, educated women are often well placed to steer their families towards more sustainable and health-conscious choices.

## CONCLUSION

This study finds that higher education levels in women, especially when they surpass their husbands' education levels, are significantly associated with the adoption of clean cooking fuels. Additionally, educated women are more likely to be employed in regular paid jobs, which may further support their ability to make informed and financially feasible choices for their households. These findings point to the potential value of

investing in women's education as a strategic measure to promote public health and environmental sustainability. Policymakers should prioritize educational initiatives that target women, particularly in regions where traditional cooking practices prevail.

In addition to expanding access to education, policies should focus on gender equality in educational attainment and the empowerment of women within households. Programs that integrate health and environmental education into the curriculum can further enhance awareness and drive behavioral change. By fostering an environment where educated women can exercise their influence, we can achieve broader adoption of clean cooking technologies, leading to improved health outcomes and reduced environmental degradation. The study reaffirms that educating women is not just a goal in itself but a catalyst for broader socio-economic and environmental benefits.

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