

Research article

Does the Choice of Cooking Fuel Impact Happiness and Life Satisfaction?

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ABSTRACT

The subjective experiences and perceptions of people when switching to cleaner cooking fuels are typically ignored in favor of objective indicators like respiratory health or time spent gathering firewood. Given that a sizable section of the populace still cooks using traditional biomass fuels while the country moves toward cleaner fuels like LPG and electricity, this research gap is particularly important in Indonesia. This study examines the association between the use of cleaner cooking fuels and two dimensions of subjective well-being: happiness and life satisfaction, using data from the most recent wave of the Indonesia Family Life Survey (IFLS). Propensity Score Matching (PSM) and Ordinary Least Squares (OLS) are used in this analysis to mitigate selection bias and precisely evaluate treatment effects. The empirical results reveal that the use of clean cooking fuel positively impacts an individual's subjective well-being, enhancing both happiness and life satisfaction. Individuals in rural areas get a more pronounced effect. The findings will offer important perspectives for decision-makers and interested parties focused on enhancing access to clean cooking energy and elevating subjective well-being in Indonesia, particularly in rural regions.

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1. INTRODUCTION

Promoting economic expansion and improving societal well-being require clean energy. To this day, however, solid fuels like coal and wood are still widely used in many developing nations. With major ramifications for health, gender equality, the economy, the environment, and climate change, the problem of access to clean fuels and cooking technology has lasted for three decades. According to the International Energy Agency (2020), over 2.5 billion people lack access to clean cooking energy. Prior studies have shown that prolonged use of solid fuels for cooking might substantially elevate the likelihood of experiencing negative health effects, including respiratory disorders, cardiovascular diseases, lung diseases, ischemic heart disease, and overall poor health status (Yu et al., 2018; Deepthi, et al., 2019; Qiu et al., 2019; Ali et al., 2021; and Qiu et al., 2023).

Cooking fuel use causes indoor air pollution, which is a serious problem, especially in developing nations where traditional cooking methods are common. Traditional cooking fuels like coal, kerosene, and solid biomass are frequently used. Due to incomplete combustion, inadequate ventilation, and the cooking area's proximity to the living room, frequent use of this cooking fuel results in higher levels of indoor air pollution. Insufficient combustion leads to elevated levels of harmful pollutants, including PM2.5, PM10, CO, SO2, black carbon (BC), polycyclic aromatic hydrocarbons (PAHs), and, in certain instances, amounts above the limits set by the Environmental

Protection Agency (Gorjinezhad et al., 2017). The detrimental effects of indoor air pollution can alter the perception of a home from a secure and pleasant environment to one that poses significant hazards to people's well-being.

Enabling the shift to clean cooking fuels has several advantages, including enhancing personal health and well-being, mitigating household air pollution, curbing greenhouse gas emissions, and averting environmental destruction. Clean fuels also enhance indoor air quality by lowering the presence of hazardous pollutants that contribute to indoor air pollution. The clean energy transitions result in remarkable reductions in the contributions to ambient PM_{2.5}, avoiding premature deaths associated with PM_{2.5} exposure (Shen et al., 2019). Clean cooking is associated with several benefits, including improved health, cooking convenience, more leisure time, decreased costs, and reduced carbon emissions. The use of clean cooking energy sources has shown the potential to improve individual health by reducing the incidence of diseases such as hypertension, respiratory problems, and asthma (Li et al., 2022; Liu, 2022). Meanwhile Liu et al. (2020) found a significant and positive correlation between clean fuel consumption and an individual's ability to carry out daily tasks, particularly among female participants. Previous studies have also suggested that implementing clean cooking practices significantly reduces the prevalence of mental health problems as measured by reduced depressive symptoms (Li et al., 2021; Shao et al., 2021; Li et al., 2022; and Liu et al., 2022).

Considerable efforts have been made both domestically and internationally to encourage the use of clean cooking fuels in developing nations. As stated by the World Health Organization (WHO), the main goal of the Sustainable Development Goals (SDG) number 7 is to ensure that clean, affordable, reliable, sustainable, and modern energy is widely available. Several countries have adopted clean cooking energy transition programs by converting to Liquid Petroleum Gas (LPG) at the national level, including Indonesia. It is crucial to fully comprehend the influencing factors and consequences related to cooking fuel choices when planning and carrying out projects in order to expedite the transition to clean cooking fuels. The selection of cooking fuel is impacted by socioeconomic factors that are indicative of household and individual attributes, including gender, educational attainment, income, availability of ventilation, household size, and the geographical location of the rural or urban (Dongzagla & Adams, 2022; Qiu et al., 2023). The pace of energy transition in rural regions is slower compared to urban areas, as evidenced by studies conducted by Malakar (2018) and Hakam et al. (2022). Consequently, policymakers are actively promoting the use of clean fuels for household cooking to combat environmental problems like deforestation and land degradation, as well as public health issues. The clean energy transition initiative in Indonesia was launched in 2007 and started to provide results between 2009 and 2012. This program successfully transformed people's behavior by replacing the use of firewood and kerosene with LPG, a cleaner cooking fuel (Thoday et al., 2018; Hakam et al., 2022).

Additionally, to having an impact on an individual's physical health, the choice of fuel for cooking can also have an impact on subjective well-being. In recent years, the link between energy consumption patterns and overall well-being has become the focal point of interdisciplinary research. Among these various aspects of intersection, the impact of adopting clean cooking energy on subjective well-being has garnered significant attention. Subjective well-being encompasses an individual's cognitive and affective evaluation of their life, reflecting positive aspects of psychological health such as life satisfaction, happiness, and fulfillment (Diener, 2000). Psychological health literature generally assesses an individual's subjective well-being by relying on self-reports of happiness and life satisfaction (Ma & Zheng, 2021). Cooking with clean fuels can also directly contribute to increased happiness, comfort, and satisfaction. Gathering firewood or tending to a dirty stove can be time-consuming tasks, typically carried out by women. The use of clean cooking fuels can result in time savings, allowing individuals to engage in education, income-generating activities, or leisure (Mall & Rani, 2020; Maji et al., 2021; Ma et al., 2022). These studies suggest that a comprehensive shift to clean fuels can contribute to higher levels of happiness and life satisfaction. Hence, it is essential to evaluate the impact of the selection of cooking fuel on the subjective well-being of individuals, in addition to examining their physical health.

The correlation between the utilization of clean cooking energy and subjective well-being is

established by the augmentation of an individual's leisure time, as clean cooking fuel reduces cooking time, eliminates the need to gather firewood, and offers convenience (Mall & Rani, 2020; Li et al., 2022; Ma et al., 2022; Scott et al., 2023). Increased leisure time positively correlates with increased opportunities for engaging in social activities, leading to enhanced happiness and improved psychological well-being (Liu et al., 2022; Chen et al., 2023). Ma et al. (2022) conducted a study utilizing national data from the 2016 China Labor Force Dynamics Survey. They aimed to investigate the factors influencing household cooking fuel choices and individual subjective well-being. They focused on two variables: happiness, which measures the individual's experience, and life satisfaction, which evaluates their overall well-being. The study found that shifting to a clean cooking fuel might greatly enhance the subjective well-being of persons living in rural areas of China. The conceptual framework and hypothesis of the relationship between cooking fuel choice and subjective well-being are illustrated in Figure 1.

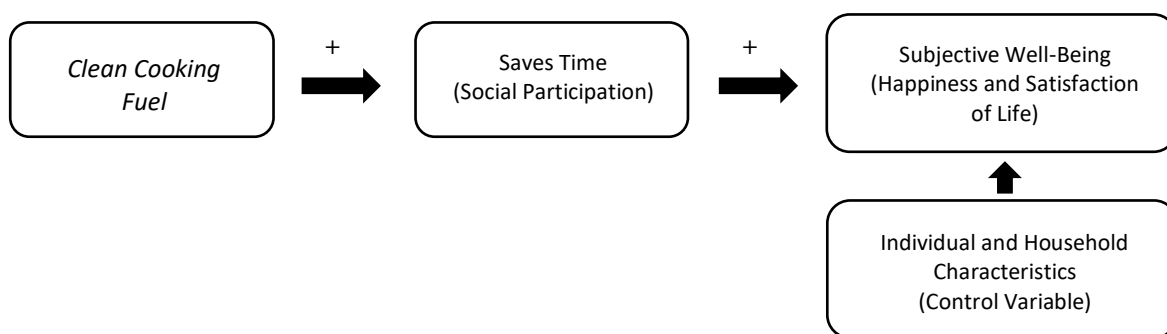


Figure 1. Conceptual Framework

Although current studies examine the health and environmental effects of cooking fuel options in developing countries such as Indonesia, there remains a notable deficiency in comprehending the wider consequences for subjective well-being. Many investigations emphasize quantifiable factors such as respiratory health or the duration spent gathering firewood, ignoring the personal experiences and viewpoints of those moving towards cleaner cooking fuels. The significance of this research gap is especially pronounced in Indonesia, where a substantial segment of the population continues to depend on traditional biomass for cooking, while the transition to cleaner fuels such as LPG and electricity remains a work in progress. This study explores into the subjective experiences of individuals, investigating the impact of various cooking fuel choices on their perceptions of happiness and life satisfaction. This study aims to fill the existing research gap, enhancing our understanding of the complicated implications of cooking fuel choices. It will provide valuable insights for developing effective interventions and policies that promote sustainable and equitable energy transitions in Indonesia and similar developing countries.

This study makes three contributions. First, to the best of the authors' knowledge, this is the first study to investigate the impact of clean cooking fuel choices on happiness and life satisfaction in the Indonesian context. Prior studies have mostly concentrated on examining the effects of indoor air pollution on physical health (Imelda, 2020; A'yun & Umaroh, 2022). Furthermore, the investigation acknowledges the unique characteristics of Indonesia's socio-cultural and economic landscape, highlighting how cooking practices are deeply intertwined with tradition, gender roles, and community interactions. This detailed comprehension will provide important insights into the factors influencing fuel selections and their effects on well-being. In addition, the utilization of the Propensity Score Matching (PSM) approach allows for the estimation of the treatment effect while considering selectivity bias (Gitaharie et al., 2022; Luo et al., 2023), hence enhancing the understanding of the causal link between the choice of cooking fuel and an individual's subjective well-being. This study provides evidence-based recommendations to policy makers and stakeholders dedicated to increasing access to clean cooking and improving the overall subjective well-being of individuals in Indonesia. The rest of this article is structured as follows: the methodology and data are described in the second section, followed by the findings and discussion in the third section, and finally in the fourth section we present the conclusions.

2. RESEARCH METHODS

2.1. Data

The empirical analysts in this work utilized data from the most recent wave of the Indonesian Family Life Survey (IFLS), which was gathered in 2014. This dataset offers comprehensive information about the selection of cooking fuels and subjective well-being (happiness and life satisfaction). IFLS is a nationally conducted survey by Rand Corporation that is thorough, representative, and open to the public. Two considerations arise from the use of IFLS data in 2014. Firstly, only the last wave of IFLS includes data on individual subjective well-being measures, such as happiness and life satisfaction, whereas these measures were not included in earlier waves. Secondly, the year 2014 effectively captures the evolving adoption of clean cooking fuels in Indonesian households, influenced by the government's LPG conversion program initiated in 2007 and its rapid development from 2009 to 2011. Following the removal of samples with incomplete information (data cleansing), a sample size of 27,632 persons was obtained. Table 1 lists the operational definitions, variable measurements, and descriptive statistics that were employed in this investigation.

Table 1. Operational Definitions of Variables and Descriptive Statistics

Variables	Operational Definition	Obs	Mean	Std. Dev.	Min	Max
Happiness	Self-rated happiness: 0 = not happy; 1 = happy	27,632	0.918	0.274	0	1
Satisfaction	Self-rated life satisfaction 0 = not satisfy; 1 = satisfy	27,632	0.861	0.346	0	1
Clean_cook	cooking fuel consumption: 0 = dirty cooking (kerosene, firewood, charcoal, coal); 1 = clean cooking (electricity and gas)	27,632	0.740	0.438	0	1
Gender	gender: 0 = male; 1 = female	27,632	0.534	0.499	0	1
Age	Ranges between 15 - 101 years	27,632	37.308	14.578	15	101
<i>Educ</i>	<i>Education</i>					
Uneducated	Did not pass elementary school	27,632	0.036	0.187	0	1
Primary	Graduated from elementary school	27,632	0.297	0.457	0	1
Secondary	Graduate from high school	27,632	0.534	0.499	0	1
Tertiary	Graduated from college	27,632	0.133	0.340	0	1
<i>Marital</i>	<i>Marital status</i>					
Unmarried	Unmarried	27,632	0.185	0.388	0	1
Married	Marry	27,632	0.744	0.437	0	1
Divorced	Divorce on/dead	27,632	0.071	0.258	0	1
Work	Working status: 0 = not working; 1 = work	27,632	0.688	0.463	0	1
Smoking	Smoking habit: 0 = no smoking; 1 = smoking	27,632	0.358	0.479	0	1
Health	Health status: 0 = unwell; 1 = healthy	27,632	2.968	0.658	1	4
Social	Social participation: 0 = no; 1 = yes	27,632	0.746	0.435	0	1
Hhsize	Number of family members in a household	27,632	6.465	3.300	1	40
Lninc	Log per capita income	27,632	15.349	1.145	7.218	19.807
Ventilation	Ventilation in the house; 0 = none; 1 = exists	27,632	0.864	0.342	0	1
Kitchen	Kitchen separates from the main house: 0 = no; 1 = separate	27,632	0.156	0.363	0	1
Electricity	Electricity access: 0 = none; 1 = exists	27,632	0.992	0.087	0	1
Tv	Television ownership: 0 = do not have; 1 = has	27,632	0.925	0.263	0	1
Refrigerator	Refrigerator ownership: 0 = do not have; 1 = has	27,632	0.652	0.476	0	1
Urban	Area of residence: 0 = rural; 1 = urban	27,632	0.589	0.492	0	1

Source: IFLS 2014, authors calculation

In estimating the impact of cooking fuel choice on individual subjective well-being, a several control variables are needed in the form of a set of covariates related to individual and household characteristics that affect individual choices in using cooking fuel and factors that affect subjective well-being. The control variables used in this study were individual characteristics such as gender,

age, education level, marital status, employment status, smoking habits, and per capita income. In addition, control variables are also used in the form of household characteristics such as the presence of ventilation in the house, separate kitchens, electricity access, ownership of televisions, refrigerators, and residential areas in the urban or rural areas.

2.3. Model Specification

The main purpose of this study is to calculate the impact of cooking fuel choice on the subjective well-being of individuals as measured by happiness and life satisfaction. The baseline estimation technique is Ordinary Least Square (OLS) regression.

$$Happiness_i = \beta_0 + \beta_1 Clean_cook_i + \beta_3 X_i + \varepsilon_i \quad (1)$$

$$Satisfaction_i = \gamma_0 + \gamma_1 Clean_cook_i + \gamma_3 X_i + \varepsilon_i \quad (2)$$

where, the variable $Happiness_i$ is the happiness level of individual i ; $Clean_cook_i$ is the choice of cooking fuel (clean and dirty) used by individuals i ; X_i is a vector of the control variables used in this study in the form of individual and household characteristics including gender, education, marital status, work status, physical health, smoking habits, social participation, per capita income, household size, ventilation, separate kitchen, electricity access, TV ownership, refrigerator, and residential area in rural or urban areas.

Households' choice of cooking fuel is not chosen at random, but rather as a result of self-selection (Li et al., 2022; Liu et al., 2022), implying the risk of selection bias. If this selection bias is not addressed, it might result in inaccurate estimations of the influence of culinary decisions on individuals' subjective well-being as assessed by happiness and life satisfaction. As a result, this study will be devoid of bias since the selection technique employs the Propensity Score Matching (PSM) method. This strategy is widely used to eliminate selection bias (Liu et al., 2020; Liu et al., 2022, Luo et al., 2023). The fundamental concept of Propensity Score Matching (PSM) is to carefully choose a certain subset of individuals from the control group who closely resemble the individuals in the treatment group, based on their propensity scores. The propensity score, denoted as $p(X_i)$, represents the chance of a sample being in the treatment group given the observed variables X_i . The initial step involves estimating $p(X_i)$ using a logit model and subsequently predicting the probability of selection using the formula shown in Equation (3) as follows. This step is also used to determine the factors that influence cooking fuel choice.

$$p(X_i) = \Pr(T_i = 1|X_i) = F(\hat{\theta}X_i) \quad (3)$$

Furthermore, the Average Treatment Effect (ATE) can be calculated by the *nearest neighbor* matching method shown in Equation (4) as follows. In addition, the impact of cooking fuel choice on happiness and life satisfaction may differ by group. Therefore, the next analysis is a heterogeneity analysis using rural and urban sub-samples.

$$ATE = E(Y_i^1 - Y_i^0 | p(X_i), T_i = 1) = \frac{1}{n} \sum_{i=1}^n |_{T_i=1} [Y_i^1(X_i) - \frac{1}{k} \sum_{i=1, j \in A_i^k} Y_j^0] \quad (4)$$

3. RESULTS AND DISCUSSION

3.1. Result

In comparing IFLS data from wave 4 in 2007, households using dirty cooking fuel accounted for 79%, significantly higher than those using clean cooking fuel, which comprised only 21%. Figure 2 shows that households use kerosene or kerosene (43%) the most as cooking fuel, followed by firewood (36%). Meanwhile, Figure 2 shows that in 2014 there was a significant increase in the proportion of households using clean fuel, which was 79%, and dirty fuel users decreased to 26%. The most used type of cooking fuel in 2014 was LPG (73%). This is in line with the kerosene to LPG conversion program carried out by the Government of Indonesia effectively from 2009 to 2011.

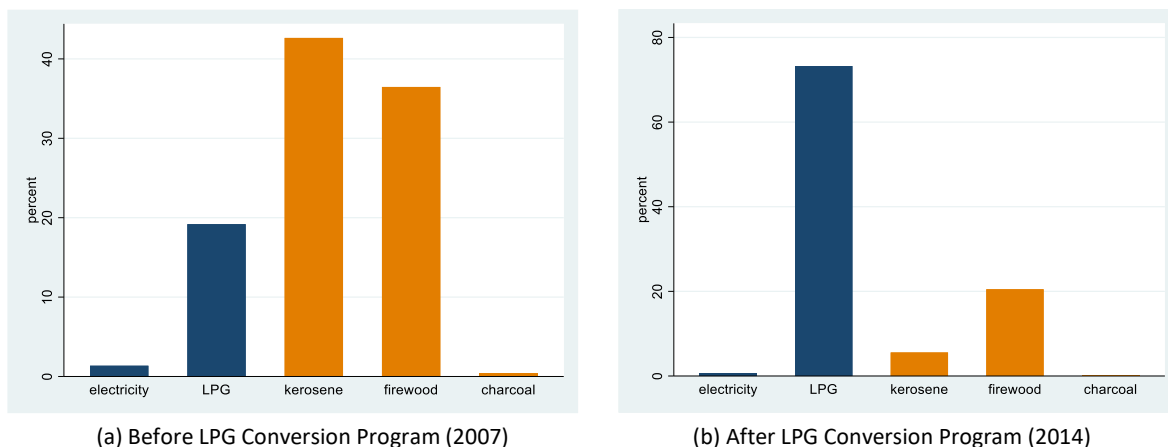


Figure 2. Proportion of Cooking Fuel Users (a) Before LPG, and (b) After LPG Conversion Program

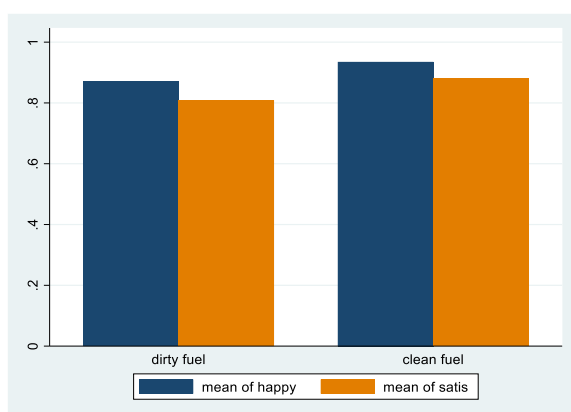


Figure 3. The Picture of Happiness and Life Satisfaction Based on Cooking Fuel Users

An overview of cooking fuel users and subjective well-being in Indonesia in 2014 is shown in Figure 3. Users of clean cooking fuel have a higher average of happiness and life satisfaction compared to users of dirty cooking fuel. Descriptive statistics and operational definitions of variables used in this research are shown in Table 1. Subsequently, we proceed to examine the factors that influence the selection of cooking fuels for domestic use. Table 2 reports the determining factors that have a significant influence on the determination of cooking fuel use; the asterisk (*) indicates its significance. The age, education level, marital status, work status, health status, household size, income, ventilation, kitchen location, electricity access, TV ownership, refrigerator ownership, and residential area all have a significant impact on household choices regarding clean cooking fuel. On the other hand, gender, social participation, and smoking habits were found to have no impact on the selection of cooking fuel.

The last section in this sub-section is about calculating the impact of using clean cooking fuel on individual happiness and life satisfaction. Table 3 shows the results of the Ordinary Least Squares (OLS) regression. Column (1) shows that without the control variable, individual users of clean cooking fuel have a 6.5% higher level of happiness compared to individual users of dirty cooking fuel. After adding the control variable, the coefficient decreased to 2% in column (2), indicating that the control variable captured the negative bias of the relationship between the choice of cooking fuel and individual happiness. Almost all significant control variables affected individual happiness, except gender and primary education.

Furthermore, regarding the life satisfaction outcome variable, column (3) presents the regression results without the control variable, while column (4) includes it. Individuals using clean cooking fuel exhibit a 7.1% higher level of life satisfaction compared to those using dirty cooking fuel, according to column (3). However, in column (4), the coefficient decreases to 2.7%, indicating that the control variable mitigates the negative bias in the relationship between cooking fuel choice and individual life satisfaction.

Table 2. Determinants of Household Cooking Fuel Choice

Variables	Coefficient	Z-test	Prob.
Gender	-0.020	-0.400	0.688
Age	-0.009***	-6.500	0.000
Primary	0.449***	5.620	0.000
Secondary	0.799***	9.490	0.000
Tertiary	1.012***	10.260	0.000
Married	0.460***	9.160	0.000
Divorced	0.591***	7.140	0.000
Work	-0.233***	-6.270	0.000
Social	0.044	1.170	0.243
Health	0.050**	2.090	0.036
Smoking	0.014	0.280	0.778
Hhsize	-0.010**	-2.040	0.041
Lninc	0.354***	23.620	0.000
Ventilation	0.130***	2.880	0.004
Kitchen	-0.411***	-10.000	0.000
Electricity	0.434**	2.550	0.011
Refrigerator	0.859***	26.070	0.000
TV	0.853***	15.580	0.000
Urban	1.220***	37.530	0.000
Constant	-7.321***	-23.550	0.000
Obs	27632		
R ²	0.2020		

Notes: ***, **, and * are significant at 1%, 5%, 10%.

Almost all significant control variables affected individual life satisfaction, except for age, basic education, household size, and the location of separate kitchens. The findings indicate that opting for clean cooking fuel positively impacts individual well-being by enhancing happiness and life satisfaction. This is consistent with the research hypothesis and previous research conducted in China (Ma et al., 2022).

Table 3. Results of Ordinary Least Square (OLS) Regression Without and With Control Variables

Variables	Model (1) Happiness	Model (2) Happiness	Model (3) Satisfaction	Model (4) Satisfaction
Clean_cook	0.065*** (0.004)	0.020*** (0.005)	0.071*** (0.005)	0.027*** (0.006)
Gender	-	0.003 (0.005)	-	0.012* (0.006)
Age	-	-0.001*** (0.000)	-	-0.000 (0.000)
Primary educ	-	0.014 (0.013)	-	0.001 (0.014)
Secondary educ	-	0.054*** (0.013)	-	0.036** (0.014)
Tertiary educ	-	0.067*** (0.014)	-	0.057*** (0.015)
Married	-	0.033*** (0.005)	-	-0.011* (0.006)
Divorced	-	-0.056*** (0.012)	-	-0.050*** (0.012)
Work	-	0.007* (0.004)	-	-0.002 (0.005)
Smoking	-	-0.024*** (0.005)	-	-0.051*** (0.006)
Health	-	0.053*** (0.003)	-	0.054*** (0.003)

Variables	Model (1) Happiness	Model (2) Happiness	Model (3) Satisfaction	Model (4) Satisfaction
Social	-	0.015*** (0.004)	-	0.024*** (0.005)
Hhsize	-	-0.001** (0.001)	-	-0.001 (0.001)
Lninc	-	0.015*** (0.002)	-	0.014*** (0.002)
Ventilation	-	0.015*** (0.005)	-	0.026*** (0.007)
Kitchen	-	-0.017*** (0.005)	-	-0.005 (0.006)
Electricity	-	0.028 (0.027)	-	0.057* (0.031)
TV	-	0.060*** (0.009)	-	0.063*** (0.010)
Refrigerator	-	0.027*** (0.004)	-	0.026*** (0.005)
Urban	-	-0.016*** (0.004)	-	-0.006 (0.004)
Constant	0.870*** (0.004)	0.407*** (0.040)	0.809*** (0.005)	0.313*** (0.047)
Obs	27632	27632	27632	27632
R ²	0.0110	0.080	0.0080	0.0460

Note: Standard errors in parentheses; *, ** and *** represent significance at 1%, 5% and 10% levels respectively

Table 4 displays the average treatment effect (ATE) of cooking fuel choice on happiness and life satisfaction. The ATE calculation employs Propensity Score Matching (PSM) to mitigate bias stemming from individuals' self-selection in choosing cooking fuel. In Column (1), it is shown that individuals using clean cooking fuel have a happiness rate 2.1% higher than those using dirty cooking fuel. Compared to the results of the OLS regression in Table 3, Column (2), the coefficient obtained exceeds 0.1%. In Column (2), it is evident that individuals using clean cooking fuel have a 2.4% higher level of life satisfaction compared to those using dirty cooking fuel. When compared to the results of the OLS regression in Table 3, Column (4), the coefficient obtained is less than 0.3%. Nevertheless, the direction and significance remain aligned, so it can be concluded that the choice of clean cooking fuel has a positive impact on the subjective well-being of individuals as measured by increased happiness and life satisfaction.

Table 4. Average Treatment Effect of Cooking Choices on Individual Subjective Well-Being

Average Treatment Effect (ATE)	Model (1) Happiness	Model (2) Satisfaction
Clean fuel versus dirty fuel	0.021*** (0.005)	0.024*** (0.007)
Observations	27632	27632

Note: Standard errors in parentheses; *, ** and *** represent significance at 1%, 5% and 10% levels respectively

Table 5. Analysis of Treatment Effect of Sub-Samples Based on Urban and Rural Areas

Average Treatment Effect (ATE)	Urban		Rural	
	Happiness	Satisfaction	Happiness	Satisfaction
Clean fuel versus dirty fuel	0.023*** (0.004)	0.017 (0.130)	0.014** (0.044)	0.031*** (0.000)
Observations	16279	16279	11353	11353

Note: Standard errors in parentheses; *, ** and *** represent significance at 1%, 5% and 10% levels respectively

The next analysis is to divide the sample into sub-samples based on urban and rural areas. The results of the ATE estimation of the sub-sample are shown in Table 5. The results show that the

impact of the choice of cooking on subjective well-being is greater felt by individuals living in rural areas. This can be explained by the coefficient of life satisfaction for urban samples; there is no significance, meaning that the choice of cooking does not affect the life satisfaction of individuals living in urban areas. Meanwhile, the impact on happiness is greater in urban areas than in rural areas.

3.2. Discussion

This study presents strong evidence regarding the beneficial effects of adopting clean cooking fuel on subjective well-being in Indonesia. Our findings indicate that individuals utilizing cleaner fuels experience significantly greater levels of happiness and life satisfaction in comparison to those who rely on dirty fuels for cooking. This is consistent with the research hypothesis and previous research conducted in China (Ma et al., 2022). A variety of aspects may account for the beneficial link between clean cooking fuels and subjective well-being. Initially, enhanced health: cleaner fuels diminish exposure to detrimental indoor air pollution, resulting in improved respiratory health and overall well-being. This finding is consistent with earlier research that emphasizes the various disadvantages associated with solid fuel usage, such as negative physical health impacts, depression and anxiety syndrome, time constraints, and cognitive ability (Qiu et al., 2019; Kurata et al., 2020; Ali et al., 2021; Deng et al., 2022; Maji et al., 2021).

Secondly, the shift from traditional biomass to alternative energy sources allows for more time dedicated to productive activities. This transition reduces the hours spent on collecting firewood, enabling individuals, especially women, to participate in income-generating tasks, pursue education, or enjoy leisure activities, thereby improving their sense of independence and overall well-being. This aligns with earlier studies carried out by Maji et al. (2021) in India. Their findings indicate that the utilization of LPG leads to a decrease in cooking time (approximately 37 minutes) and a reduction in the time spent gathering fuels (around 24 minutes) in rural households, collectively saving up to an hour of women's labor demands each day. Third, increased leisure time positively correlates with increased opportunities for engaging in social activities, leading to enhanced happiness and improved psychological well-being. Earlier studies carried out by Biermann (2016) and Curchill et al. (2020) in advanced economies like Germany and Australia have shown consistent results regarding the relationship between fuel poverty and life satisfaction. These studies have revealed that the utilization of clean fuel is positively correlated with increased life satisfaction. In comparison with earlier studies, our estimates offer clearer insights by directly examining how cooking fuel choices impact subjective well-being (happiness and life satisfaction) in Indonesia context.

The adoption of LPG conversion as a means of transitioning to clean energy has been successfully carried out in several developing countries, including India, Pakistan, Bangladesh, Ghana, and Indonesia. The LPG conversion program in Indonesia has effectively altered the behavior of those who formerly relied on firewood, kerosene, and charcoal by encouraging them to use cleaner fuels. Several factors impact the decision to utilize clean cooking fuel in Indonesia. This study discovered a negative association between age and the likelihood of utilizing clean cooking fuel, indicating that as age increases, the probability of using clean cooking fuel decreases. Concurrently, there is a positive correlation between education, per capita income, asset ownership, and the decision to use clean cooking fuel. This conclusion aligns with prior studies investigating the factors influencing the selection of clean cooking fuel in Ghana, as demonstrated by Twumasi et al. (2021).

4. CONCLUSIONS

This study examines the impact of cooking fuel selection on individuals' subjective well-being in Indonesia. The empirical analysis indicates that the utilization of clean cooking fuel has a beneficial effect on an individual's subjective well-being, enhancing both happiness and life satisfaction. Clean cooking fuel extends beyond mere energy concerns, it is an essential element of psychological well-being. The investigation underscores the extensive societal advantages associated with the shift towards cleaner energy sources. Furthermore, rural communities face significant challenges, this highlights the necessity for focused strategies and policies that emphasize access to clean cooking fuels in rural regions. The strong and advantageous relationship between the energy transition and

individuals' subjective well-being in rural areas implies that governments should make more efforts to expedite the transition and promote the use of clean cooking fuels. Government action is crucial to ensure easy accessibility of clean cooking fuels in rural areas of Indonesia, considering the restricted availability of such fuels in these regions. An investigation of the factors that impact the selection of cooking fuel might assist in formulating effective policy solutions. Subjective well-being ought to be a crucial measure in the assessment of energy policies. Evaluating how energy decisions influence happiness and life satisfaction can offer a comprehensive insight into their efficacy.

The findings of this study can offer valuable insights for policy recommendations to the government. Initially, it is essential to establish targeted subsidies and financial incentives to enhance the accessibility and affordability of clean cooking fuels, especially for low-income households located in rural areas. Additionally, prioritize the enhancement of infrastructure, including dependable electricity grids and LPG distribution systems, to facilitate the broad implementation of clean cooking technologies. Third, initiate extensive awareness campaigns to inform communities about the health, environmental, and well-being advantages of clean cooking fuels, while also tackling potential barriers to adoption such as cultural norms or misconceptions.

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