Adoption of Rice Husk Briquettes as an Alternative to Woodfuel: Evidence from Commercial Cooking Sectors in Northeastern Bangladesh

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1. Introduction

Access to clean, affordable, and reliable energy is crucial for poverty alleviation and achieving SDG Goal 7 in developing countries. Traditional biomass is the primary energy source in these countries due to economic and infrastructural limitations hinder access to alternatives like kerosene, gas, LPG, and electricity. In this context, available agricultural residue briquettes are a promising renewable alternative. Bangladesh, an agriculture-based economy, produces around 38 million tons of rice annually, yielding 11 million tons of rice husk (residue ratio 0.28). Since the 1980s, Bangladesh has produced rice husk briquettes (RHBs) from waste rice husk, benefiting resource-poor farmers and generating employment. Despite using 46% of agricultural residues for cooking, this industry is not yet widespread. This study explores the transition to RHBs as an alternative to woodfuel within a 30-km radius of two forest protected areas: Khadimnagar National Park (KNP subregion) and Lawachara National Park (LNP subregion) in northeastern Bangladesh.

2. Analytical methods

We sampled commercial consumers (restaurants, tea stalls, and food manufacturers) in 209 markets out of 535 within 30 km of the KNP and LNP borders. The survey included multiple consumers using RHBs and/or in combination with LPG, and woodfuel. Energy consumption quantities were recorded in local units like 'maund' (37.32 kg) and converted to metric tonnes (t). Statistical analyses were performed using R, and box-and-whisker plots were generated. The calorific value of rice husk was 14 MJ/kg (range 13-16 MJ/kg) per IRRI. One kilogram of RHBs was assumed to generate heat equivalent to 1.63 kg of woodfuel (Ahiduzzaman and Islam 2016; Ahiduzzaman 2006). The potential quantity of woodfuel replaced by RHBs was calculated using this equation: $WF_{replaced} = Q_{RHBs} \times Pf$, where WF-woodfuel, Q_{RHBs}-quantity of RHBs, and Pf = 1.63 performance factor of RHBs over woodfuel.

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3. Results of the analysis

A total of 862 RHBs consumers were surveyed across 209 markets: 742 shops from 162 markets in the KNP subregion and 120 shops from 47 markets in the LNP subregion. From these shops, 564 consumers in the KNP subregion (76%) and 60 consumers in the LNP subregion (50%) used only RHBs for cooking. Additionally, 94 and 70 consumers, respectively in the KNP subregion used RHBs in combination with LPG and woodfuel (Figure 1a). The average consumption of RHBs was higher in the KNP subregion (19.5 t/yr) compared to the LNP subregion (15.4 t/yr). Semi-urban consumers used more RHBs (19.6 t/yr) than rural (17.3 t/yr) and urban (11.4 t/yr) consumers. In the KNP subregion, shops that used RHBs in combination with LPG and woodfuel consumed higher amounts of RHBs. Conversely, in the LNP subregion, shops that used only RHBs or combined them with LPG had higher RHBs consumption (Figure 1b). Using additional one or two fuels in combination with RHBs significantly affected annual RHBs consumption in the KNP subregion ($p < 0.001$), but not in the LNP subregion ($p > 0.427$). Additionally, two-way ANOVA showed that neither subregions ($p > 0.283$) nor fuel types ($p > 0.471$) influenced annual RHBs consumption. On average, each shop spent 1,743 US$/yr on RHBs, which is higher than the 1,210 US$/yr spent on woodfuel. Analysis revealed that using RHBs could save a total of 26,645 t/yr of woodfuel in two subregions or 31 t/yr of woodfuel per shop.

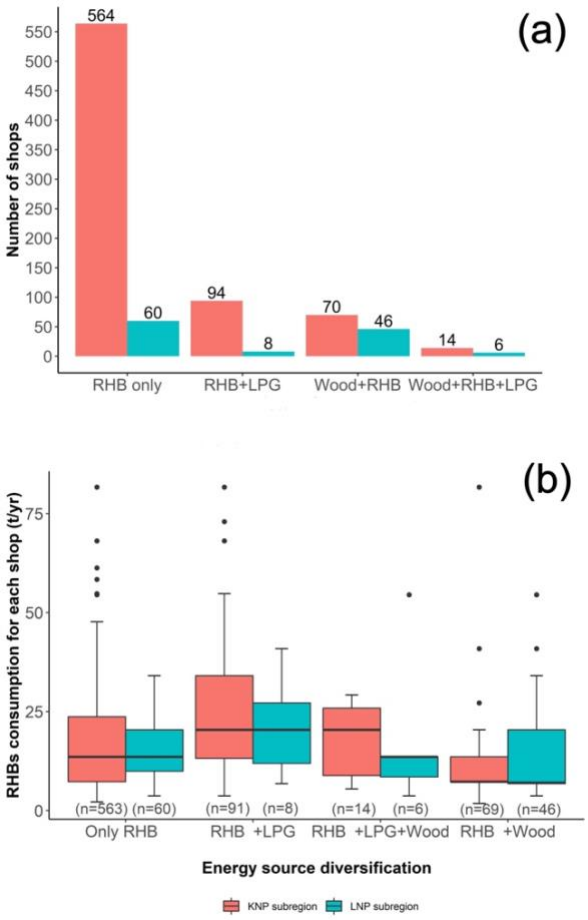

Figure 1: Adoption of rice husk briquettes with other alternatives to woodfuel for commercial cooking

4. Conclusion

RHBs are helping to fill gaps between energy demands and woodfuel supply, especially in semi-urban communities. Promotion of RHBs is hence important, even though it did not show the reduction of woodfuel on a per-shop basis. So, there is a significant need for research to improve fuel properties and stove designs, making briquettes more environmentally and user-friendly.