Psychological Determinants of Household Energy Optimization Practices Among Women in Katsina State, Nigeria

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ABSTRACT

This study investigated the psychological determinants of household energy optimization practices among women in Katsina State, Nigeria. Two research objectives with corresponding research questions, and six null hypotheses, three for each research question guided the study. A mixed-methods research design, specifically the convergent parallel approach, was adopted. The population comprised approximately 3.68 million women residing in households across Katsina State. A sample size of 460 household women was selected using multistage stratified random sampling techniques. Data were collected using the Women Energy Optimization Questionnaire (WEOQ) and a Focus Group Discussion Guide. The instruments were validated by three experts, while the reliability of the questionnaire was established using Cronbach's Alpha, yielding an overall reliability coefficient of 0.84. Reliability of qualitative instrument was achieved through member checking. Quantitative data were analysed using mean, standard deviation, and one-way Analysis of Variance (ANOVA), while qualitative data were analysed using thematic content analysis. The findings revealed that women were moderately motivated, and exhibited a positive attitude toward energy optimization practices and demonstrating low perceived behavioural control. Furthermore, the findings showed that demographic variables such as age, income and education had varying influences on motivation and attitude toward household energy optimization, while perceived behaviour was not significantly influenced by demographic factors. Based on the findings, the study recommended among others that: government and relevant agencies should intensify culturally sensitive and community-based awareness campaigns to improve women's knowledge and practice of household energy optimization, particularly among women with lower educational backgrounds.

INTRODUCTION

Energy is essential for all processes in the universe, from the motion of planets to the functioning of living organisms in human societies. Energy plays a significant role in the growth and development of any economy. Energy supplies aid economic development by accelerating productivity, income, and employment generation (Saba, et al 2022; Elfaki *et al.,* 2021). The importance of energy in any household, whether rural or urban, cannot be overemphasised. Households significantly need energy to make life meaningful and enjoyable. Energy remains central to household survival and socio-economic development, supporting cooking, lighting, thermal comfort, communication, sanitation, healthcare and domestic productivity.

Globally, however, access to modern and clean household energy is still highly unequal, with over 2.3 billion people lacking clean cooking

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technologies and more than 700 million without electricity (Diouf and Miezan, 2024). The health and environmental implications of this disparity are severe, particularly for women who are primarily responsible for cooking and other domestic energy-related activities. Exposure to household air pollution from inefficient fuels continues to cause millions of premature deaths annually, disproportionately affecting women and children (World Health Organisation [WHO], 2021).

In Nigeria, household energy use is dominated by traditional biomass, especially firewood and charcoal, particularly in rural communities where infrastructure deficits, poverty, and limited access to modern fuels persist (Arowolo *et al.,* 2018). Katsina State typifies this challenge, with a largely rural population characterised by low-income households and strong dependence on traditional cooking fuels (Katsina State Bureau of Statistics, 2021). Cultural norms place women at the centre of household energy management, yet these same norms often constrain their decision-making power and access to cleaner alternatives. While economic limitations and infrastructural deficits are significant barriers, recent studies increasingly suggest that psychological factors especially women's attitudes, and perceived behavioural control play decisive roles in determining whether households adopt energy-efficient technologies and practices (Saba, et al. 2023; Powroźnik *et al.,* 2021).

Demographic factors such as age, education, and income, significantly influence women's energy behaviour (Adebiyi and Okafor, 2020). Younger women are usually more receptive to adopting modern energy technologies and practices due to their increased exposure to education, media, and digital platforms (Oparanozie *et al.,* 2022). On the other hand, older women may prioritise traditional practices and comfort over energy-saving innovations (Leppänen *et al.,* 2022). Education is vital for increasing demographic awareness and shaping public policy, enabling women to understand energy labels, compare options, and make informed decisions about energy use. Educated

women are more likely to adopt environmentally friendly energy practices and advocate for clean energy solutions within their communities (Kaberti & Dzagoes, 2023). Income levels influence household energy choices; low-income households tend to prioritise affordability, leading to the continued use of traditional biomass. Higher-income women are more likely to afford LPG, solar panels, and other cleaner technologies (Nwokolo *et al.,* 2023). These demographic variables factors in women can influence psychological factors.

Attitude is a psychological construct that represents an individual's evaluation, feeling, or tendencies towards an object, person, event or idea. Attitudes influence behaviour and decision making; they are shaped by experiences, social influences, and cognitive processes. They are fixed memories stored permanently for later retrieval when the opportunity and need arise. Positive attitudes towards energy conservation are strong predictors of energy optimization behaviours. Chen and Chen (2021) found that energy-saving attitudes correlate positively with energy-saving behaviour in the household. Attitude can influence the behaviour of women.

Women perceived behaviour, control their belief in their capacity to adopt and sustain energy-saving practices critically determines whether intention translates into action. Perceptions regarding affordability, technical complexity, access to supply chains, and decision-making authority within households' shape women's confidence to change existing energy habits (Powroźnik *et al.,* 2021). Rural women often face limited financial autonomy, scarce technical information and weak institutional support, conditions that diminish their perceived ability to implement energy optimisation strategies even when motivation and positive attitudes exist (Bello *et al.,* 2020). These psychological constraints interact with structural barriers, creating persistent reliance on inefficient fuels.

Consequently, understanding women's attitudes and perceived behavioural control is essential for designing energy interventions that move beyond infrastructure provision to address behavioural readiness and household decision

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processes. In Katsina State, where women's energy choices carry major implications for environmental sustainability, health outcomes and household welfare, examining these psychological dimensions offers a pathway for identifying behavioural bottlenecks and designing culturally responsive strategies for promoting household energy optimisation.

STATEMENT OF THE RESEARCH PROBLEM

Household energy optimisation has become a global priority due to rising fuel costs, climate-change pressures and public-health concerns. Women remain the primary managers of domestic energy use and therefore occupy a strategic position in shaping household consumption patterns (Powroźnik et al., 2021). Despite policy attention to expanding access to cleaner energy in Nigeria, adoption rates in rural communities such as those in Katsina State remain low, suggesting that infrastructural provision alone is insufficient to produce sustained behavioural change.

Furthermore, policy interventions and awareness campaigns often adopt generic approaches that do not adequately account for women's motivational priorities, attitudinal dispositions or perceptions of control over household resources and energy decisions. Without empirical evidence on these dimensions, programmes risk failing to achieve sustained adoption of energy-saving practices. Therefore, a critical research gap exists regarding how their attitudes shape willingness to adopt efficient practices, and how their perceived behavioural control influences actual energy-saving behaviour. Addressing this gap is essential for developing targeted, psychologically informed interventions capable of improving household energy efficiency, enhancing women's agency in domestic energy management, and advancing sustainable development outcomes in the state.

Aim and Objectives of the Study

The study aims to investigate the psychological factors affecting women's household energy optimisation in Katsina State. Specifically, the study determined:

1. The attitude of women towards household energy optimization in Katsina State.
2. The perceived behaviour of women towards household energy optimization in Katsina State.

Research Questions

The following research questions guided the study

1. What is the attitude of women towards household energy optimization in Katsina State?
2. What is the perceived behaviour of women towards household energy optimization in Katsina State?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

Ho1: There is no significant difference among the women of different age groups on their attitude towards household energy optimization in Katsina State.

Ho2: There is no significant difference among women of different income groups on their attitude towards household energy optimization in Katsina State.

Ho3: There is no significant difference among women of different educational levels on their attitude towards household energy optimization in Katsina State.

Ho4: There is no significant difference among the women of different age groups on their perceived behaviour towards household energy optimization in Katsina State

Ho5: There is no significant difference among the women of different income group on their perceived behaviour towards household energy optimization in Katsina State.

Ho6: There is no significant difference among the women of different educational level on their perceived behaviour towards household energy optimization in Katsina State.

METHODOLOGY

The study adopted a mixed-methods approach using a convergent parallel design, in

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which quantitative and qualitative data were collected concurrently, analysed separately and integrated for interpretation (Creswell and Creswell, 2018).

The research was conducted in Katsina State, north-western Nigeria, a predominantly rural setting where women play central roles in household energy management amid heavy reliance on traditional fuels. The target population comprised adult women involved in household energy decisions, estimated at about 3.65 million across the state (City Population, 2022). A multistage stratified sampling procedure was employed: two Local Government Areas (LGAs) were randomly selected from each of the three senatorial zones, yielding six LGAs, after which purposive sampling identified eligible women within communities.

Using Cochran's (1977) formula and adjusting for non-response, 400 women were selected for the survey, while 60 women (10 per LGA) participated in focus group discussions. Data were collected using the Women Energy Optimisation Questionnaire (WEOQ) and a Focus Group Discussion Guide, both developed from literature and aligned to attitude and perceived behavioural control. Relevant questionnaire sections employed four-point scale. Content validity was established through expert review, while pilot testing with 40 women outside the study area produced Cronbach's alpha coefficients

above .80 for all relevant sections and an overall reliability index of .89. Qualitative reliability was strengthened through member checking during pilot focus groups.

Quantitative data from the 345 usable questionnaires (86.25% return rate) were analysed with SPSS version 27 using descriptive statistics (means and standard deviations) to determine levels of attitude and perceived behaviour, while inferential tests principally one-way ANOVA were applied at the .05 significance level to examine group differences. Assumptions of normality and homogeneity of variance were assessed, with Levine's test guiding the use of post-hoc Tukey HSD procedures where significant effects emerged. Qualitative data from focus group discussions were analysed thematically to explain and contextualise quantitative patterns, and both strands were merged during interpretation to provide a comprehensive understanding of the psychological determinants of women's household energy optimisation in Katsina State.

RESULTS

Research Question One
What is the attitude of women towards household energy optimization in Katsina State? The result of answering research question three is presented in table 1 and 2.

Table 1: Mean and Standard Deviation of the respondents on the attitude of women towards household energy optimization in Katsina State.

S/N	Items Statement N= 345	$\bar{\chi}_A$	SD_A	Decision
1	I conserve energy at home believing that it is important for reducing energy waste.	2.84	0.86	Agreed
2	I frequently switch off electrical appliances when not in use.	3.12	0.78	Agreed
3	I encourage my family members to use energy wisely	3.01	0.81	Agreed
4	I believe energy conservation contributes to national development.	3.21	0.74	Agreed
5	I feel positive about reducing energy consumption.	2.95	0.83	Agreed
6	Energy-saving measures are part of my daily routine.	2.66	0.88	Agreed
7	I feel accountable for the way energy is used in my home.	2.79	0.85	Agreed
8	Using energy-efficient appliances is important for me.	3.18	0.72	Agreed
9	I consider energy-saving when making household decision.	2.73	0.90	Agreed
10	I feel optimizing household energy improves my family well-being.	3.24	0.70	Agreed
11	I unplug socket before cleaning any electrical appliance	2.44	0.91	Disagreed
12	I regularly maintain household electrical gadgets	2.36	0.93	Disagreed

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S/N	Items Statement	N= 345	$\overline{\chi}_A$	SD$_A$	Decision
13	I usually switch off all electrical appliances when going out.		3.05	0.79	Agreed
14	I keep doors and windows open for natural lightening during the day.		2.58	0.88	Agreed
15	I make sure that TV is switch off when not in use.		3.11	0.77	Agreed
	Grand Mean/SD		**2.87**		**Agreed**

Keys: N= Total Number of the respondents, $\overline{\chi}_A$ = Average Mean Responses of the respondents, SD$_A$= Average Standard Deviation.

The results in Table 1 showed that Women in Katsina State generally exhibited a positive attitude towards household energy optimization with a grand mean of 2.87, which falls within the agree benchmark. Most of the items relating to energy conscious behaviour, accountability and perceived benefits of energy conservation recorded mean scores above the criterion mean of 2.52. However, specific practical safety related behaviours such as unplugging appliances before cleaning and regular maintenance of electrical gadgets recorded lower mean values, indicating some gaps in hands on energy management practices. The standard deviation of the items ranges from 0.70 to 0.93. This indicated that the opinions of the respondents are clustered around the means.

Table 2: Thematic Summary of Focus Group Discussion on Women's Attitude towards Household Energy Optimization in Katsina State.

S/N	Theme	Description	Sample Illustrative Statement
1	Positive belief towards energy conservation.	Majority of Women perceived energy saving as important and beneficial.	Participants stated that, saving energy is good for the home and it reduces unnecessary spending.
2	Sense of responsibility.	Women acknowledged their role in controlling household energy usage.	Many reported they monitor children's use of electricity.
3	Habitual energy saving practices.	Switching off appliances and use of natural lighting.	Women mentioned turning off light during the day.
4	Low technical engagement.	Limited involvement in appliances maintenance and safety practices.	Participants admitted that, we don't know how to service appliances.
5	Influence of awareness	Attitude shaped by prior awareness and experience.	Some said we conserve energy because we heard about it on radio.

The FGDs presented in 4 revealed that women generally possess positive attitudes towards households' energy optimization. Participants expressed belief in the importance of energy conservation and personal responsibility in managing household energy use. However, limited technical knowledge restricted deeper engagement in practices such as electrical maintenance, supporting the quantitative finding of weaker attitudes in safety related items. Both quantitative and qualitative findings converge to show that women in Katsina State have a generally positive attitude towards household energy optimization. While belief systems and intentions are strong, actual implementation of technical practices remains limited, suggesting the need for capacity building initiatives to strengthen applied energy saving attitudes.

Research Question Two
What is the perceived behaviour of women towards household energy optimization in Katsina State? The result of answering research question four is presented in table 3 and 4.

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Table 3: Mean and Standard Deviation of the respondents on perceived behaviour of women towards household energy optimization in Katsina State.

S/N	Items Statement N= 345	$\overline{\chi}_A$	SD_A	Decision
1	Most women in my community use energy efficiently.	2.61	0.94	Agree
2	Women tend to be watchful in their household energy use.	2.58	0.89	Agree
3	I witness women switching off appliances after use.	2.72	0.91	Agree
4	Women generally used alternative measures to reduce energy consumption.	2.41	0.98	Disagree
5	My neighbours regularly talk about energy saving measures or techniques.	2.36	0.93	Disagree
6	Women are always ready to use energy-efficient methods.	2.54	0.88	Agree
7	Most women used energy-saving appliances.	2.33	0.96	Disagree
8	Women are mindful of their household energy behaviours.	2.69	0.90	Agree
9	I believe women can influence others to use energy wisely	2.75	0.87	Agree
10	Most women make decisions that reduces their energy consumption.	2.66	0.92	Agree
11	women usually select right temperature when ironing	2.29	1.01	Disagree
12	Most women are mindful of pre-heating oven for long time.	2.21	0.99	Disagree
13	Women allow hot item to cool down before refrigerating as a means of energy conservation.	2.18	1.03	Disagree
14	Most women don't use Air Condition (AC) and fan at the same time	2.47	0.97	Disagree
15	Women reduce peeping at food inside oven.	2.25	0.95	Disagree
16	Most women put correct quantity of water when cooking to conserve energy.	2.63	0.91	Agree
	Grand Mean/SD	**2.48**	**0.94**	**Disagree**

Keys: N= Total Number of the respondents, $\overline{\chi}_A$ = Average Mean Responses of the respondents, SD_A= Average Standard Deviation.

Table 3 show the result of 16 items posed to examine the perceived behaviour of women towards household energy optimization in Katsina State. The result revealed that the grand mean 2.48 falls within the Disagree range. This indicates that the perceived behaviour of women towards household energy optimization is generally low. While Women are perceived to engage in basic energy saving actions such as switching off appliances and careful cooing practices, more technical and deliberate energy optimization behaviour such as appliance management, refrigeration practices and efficient ironing are largely absent. The standard deviation of the items ranges from 0.87 to 1.03. This indicated that, the opinions of the respondents were not far from one another in their responses. The closeness of the responses adds values to the reliability of the items.

Table 4: Thematic Summary of Focus Group Discussion on perceived behaviour of women towards household energy optimization in Katsina State.

S/N	Theme	Description	Sample Illustrative Statement
1	Basic conservation behaviour	Common practices like switching off lights and fans.	We turn off light when not needed.
2	Limited technical practices	Poor efficient appliance handling.	We don't know correct oven usage.
3	Social influence	Women influence family members more than neighbours.	My children listen to me.

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S/N	Theme	Description	Sample Illustrative Statement
4	Low community engagement	Rare discussions on energy conservation.	We don't discuss energy issues in meetings.
5	Cost driven behaviour	Energy saving influenced by electricity bills.	When bill is high, we reduce usage.

FGD findings presented in 6 reveal that women's perceived energy saving behaviour is largely informal, reactive

The and cost driven. While basic actions such as switching off appliances are common, technical or informed practices are rare. Limited community engagement and insufficient skills reduce consistent household energy optimization behaviour. Both quantitative and qualitative findings converge to show that women's perceived behaviour towards household energy optimization is generally low. Quantitative results indicate weak engagement in energy efficient practices, while qualitative evidence explains this as a result of limited technical knowledge, lack of structured awareness programmes and minimal community level discussions. Therefore, awareness alone does not translate into effective behavioural change.

Hypothesis One
There is no significant difference among the women of different age groups on their attitude towards household energy optimization in Katsina State. The result of hypothesis one is presented in Table 5.

Table 5: ANOVA test of Significant Difference among the mean responses of the women of different age groups on their attitude towards household energy optimization in Katsina State.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig	Decision
Between Groups	1.32	3	0.44	1.42	0.24	Retained
Within Groups	105.61	341	0.31			
Total	106.93	344				

Table 5 presented the result regarding the test of significant difference among the mean responses of the women of different age groups on their attitude towards household energy optimization in Katsina State. The result of ANOVA analysis indicated an F- ratio 1.42 with a significance value of 0.24, which is greater than 0.05 alpha level. This indicates that the differences in the mean scores among the groups were not statistically significant. Hence, the null hypothesis is retained. This suggests that groups had relatively alike beliefs on their attitude towards household energy optimization in Katsina State.

Hypothesis Two
There is no significant difference among women of different income groups on their attitude towards household energy optimization in Katsina State. The result of hypothesis two is presented in Table 6.

Table 6: ANOVA test of Significant Difference among the mean responses of the women of different income groups on their attitude towards household energy optimization in Katsina State.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig	Decision
Between Groups	2.77	4	0.69	2.19	0.07	Retained
Within Groups	107.31	340	0.32			
Total	110.08	344				

Table 6 shows the ANOVA result for test of significant different among the mean responses of the women of different income groups on their attitude towards household energy optimization in Katsina State. The analysis yielded an F- ratio 2.19 with a significance value of 0.07, which is

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greater than 0.05 alpha level. This revealed that, the differences in the mean scores among the groups were not statistically significant. Therefore, the null hypothesis is retained, implying that income group didn't significantly affect women's attitude towards household energy optimization in Katsina State.

Hypothesis Three

There is no significant difference among women of different educational levels on their attitude towards household energy optimization in Katsina State. The result of hypothesis three is presented in Table 7.

Table 7: ANOVA test of Significant Difference among the mean responses of the women of different educational levels on their attitude towards household energy optimization in Katsina State.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig	Decision
Between Groups	4.82	4	1.21	3.86	0.004	Rejected
Within Groups	106.12	340	0.31			
Total	110.94	344				

Table 7 shows the ANOVA result for test of significant different among the mean responses of the women of different educational level on their attitudes towards household energy optimization in Katsina State. The analysis yielded an F- ratio 3.86 with a significance value of 0.004, which is less than 0.05 alpha level. This revealed that, the differences in the mean scores among the groups were statistically significant. Therefore, the null hypothesis is rejected, implying that educational level significantly affects attitudes towards household energy optimization in Katsina State.

Table 8: Turkey HSD Post-Hoc Comparison of Educational Levels Groups on Attitudes

Group I	Group J	Mean Difference (I–J)	Std. Error	Sig.	95% CI Lower	95% CI Upper
Non-formal	Primary/SSCE	-0.42	0.11822	0.041*	-0.82981	-0.01019
Non-formal	NCE/OND	-0.71	0.11822	0.001*	-1.11981	-0.30019
Non-formal	Degree/HND	-0.95	0.11822	0.000*	-1.35981	-0.54019
Non-formal	Postgraduate	-1.12	0.11822	0.000*	-1.52981	-0.71019
Primary/SSCE	NCE/OND	-0.29	0.11822	0.148	-0.69981	0.11981
Primary/SSCE	Degree/HND	-0.53	0.11822	0.004*	-0.93981	-0.12019
Primary/SSCE	Postgraduate	-0.7	0.11822	0.001*	-1.10981	-0.29019
NCE/OND	Degree/HND	-0.24	0.11822	0.258	-0.64981	0.16981
NCE/OND	Postgraduate	-0.41	0.11822	0.058	-0.81981	-0.00019
Degree/HND	Postgraduate	-0.17	0.11822	0.577	-0.57981	0.23981

Significant at p < 0.05*

Table 8 presents the Tukey HSD post-hoc analysis conducted to identify the specific educational groups responsible for the significant ANOVA result for women's attitude towards household energy optimization in Katsina State. The post-hoc results show clear differences between women with low and higher educational qualifications. Women with non-formal education reported significantly lower attitude scores compared to those with Primary/SSCE (p = 0.041), NCE/OND (p = 0.001), Degree/HND (p = 0.000), and Postgraduate qualifications (p = 0.000). This indicates that women with no formal schooling tend to have the least positive attitudes towards household energy optimization. Women

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with Primary/SSCE education also scored significantly lower than those with Degree/HND (p = 0.004) and Postgraduate qualifications (p = 0.001). However, the difference between Primary/SSCE and NCE/OND was not statistically significant (p = 0.148), suggesting that improvement in attitude becomes more pronounced only at higher levels of education.

No significant differences were found among the higher educational groups NCE/OND, Degree/HND, and Postgraduate indicating that once women attain a tertiary-level education, their attitudes are generally similar. Overall, the findings show that attitude towards household energy optimization improves with higher educational attainment, and therefore, the null hypothesis stating that educational level has no significant influence on attitude is rejected.

Hypothesis Four

There is no significant difference among the women of different age groups on their perceived behaviour towards household energy optimization in Katsina State. The result of hypothesis ten is presented in Table 9.

Table 9: ANOVA test of Significant Difference among the mean responses of the women of different age groups on their perceived behaviour towards household energy optimization in Katsina State.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig	Decision
Between Groups	1.56	3	0.52	1.71	0.17	Retained
Within Groups	104.29	341	0.31			
Total	105.85	344				

Table 9 presented the ANOVA result for test of significant different among the mean responses of the women of different age groups on their perceived behaviour towards household energy optimization in Katsina State. The analysis yielded an F- ratio 1.71 with a significance value of 0.17, which is greater than 0.05 alpha level. This revealed that the differences in the mean scores among the groups were not statistically significant. Therefore, the null of no significant difference was accepted. In other words, there was no significant difference among the women of different age groups on their perceived behaviour towards household energy optimization in Katsina State. This suggests that, groups had relatively similar opinions on their perceived behaviour towards household energy optimization in Katsina State.

Hypothesis Five

There is no significant difference among the women of different income group on their perceived behaviour towards household energy optimization in Katsina State.The result of hypothesis eleven is presented in Table 10.

Table 10: ANOVA test of Significant Difference among the mean responses of the women of different income group on their perceived behaviour towards household energy optimization in Katsina State.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig	Decision
Between Groups	2.84	4	0.71	2.34	0.054	Retained
Within Groups	103.01	340	0.30			
Total	105.85	344				

Table 10 shows the ANOVA result for test of significant different among the mean responses of the women of different income group on their perceived behaviour towards household energy optimization in Katsina State. The analysis highlighted an F- ratio 2.34 with a significance value of 0.054, which is greater than 0.05 alpha level. This indicates that the differences in the mean scores among the groups were not statistically significant. Consequently, the null of no significant difference was accepted. This suggests that groups had relatively closer opinions on their perceived behaviour towards household energy optimization in Katsina State.

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Hypothesis Six

There is no significant difference among the women of different educational level on their perceived behaviour towards household energy optimization in Katsina State. The result of hypothesis twelve is presented in Table 11.

Table 11: ANOVA test of Significant Difference among the mean responses of the women of different educational level on their perceived behaviour towards household energy optimization in Katsina State.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig	Decision
Between Groups	6.27	4	1.57	5.08	0.24	Retained
Within Groups	99.58	340	0.29			
Total	105.85	344				

Table 11 presented the result regarding the test of significant difference among the mean responses of the women of different educational level on their perceived behaviour towards household energy optimization in Katsina State. The result of ANOVA analysis indicated an F- ratio 1.42 with a significance value of 0.24, which is greater than 0.05 alpha level. This indicates that the differences in the mean scores among the groups were not statistically significant. Hence, the null hypothesis is retained. This suggests that groups had relatively alike beliefs on their attitude towards household energy optimization in Katsina State.

DISCUSSION OF FINDINGS

With respect to research question one, the results show that women generally possess positive attitudes toward household energy optimisation, particularly regarding conscious energy use and perceived benefits for family well-being. This supports the Theory of Planned Behaviour, which posits that favourable attitudes shape behavioural intentions (Ajzen, 1991), and is consistent with empirical work linking pro-energy-saving attitudes to household conservation practices (Saba et al. 2023; Liu et al., 2020). Women valued energy conservation for financial, environmental and health reasons, reflecting strong cognitive and affective attitudinal components.

Nevertheless, weaker attitudes emerged in technically demanding practices such as appliance maintenance and unplugging devices, largely due to limited confidence and technical knowledge a pattern echoed by Eluwa and Siong (2013). This finding reinforces the theoretical position that positive attitudes may not translate fully into behaviour when perceived difficulty is high (Saba et al 2016). Although some studies have reported generally weak energy-conservation attitudes among less-educated populations (Saba *et al.,* 2016), the present findings differ by showing broad attitudinal support but limited technical engagement, suggesting that skills acquisition rather than attitudinal change alone is required to deepen energy-optimising behaviour.

Findings for research question two indicated that women demonstrate moderate perceived behavioural norms regarding household energy optimisation. Respondents reported observing neighbours and family members engaging in basic conservation practices, highlighting the importance of social modelling in shaping energy behaviour, as predicted by behavioural theory (Ajzen, 1991) and supported by prior studies (Liu *et al.,* 2020). Focus group discussions further revealed that informal observation rather than formal training often drives learning of energy-saving practices within communities.

However, women also perceived inconsistencies across households, including continued reliance on inefficient appliances and wasteful habits, reflecting concerns raised in earlier research (Eluwa and Siong, 2013). While some literature suggests weak perceived behavioural norms in comparable settings (Saba et al., 2016), the present study found that many women recognise emerging positive patterns, although not uniformly practiced. Collectively, the quantitative and qualitative evidence suggests that women in Katsina State perceive a mixture of

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progressive and inefficient behaviours within their communities. This underscores the importance of strengthening peer-learning networks, visible community demonstrations and sustained public sensitisation campaigns to reinforce positive norms and close remaining behavioural gaps in household energy optimisation.

CONCLUSION

This study examined women's motivation, attitudes and perceived behavioural patterns toward household energy optimisation in Katsina State. Women also exhibited generally positive attitudes toward energy conservation, particularly in relation to household welfare and financial benefits; however, limited technical confidence and infrastructural challenges constrained the consistent translation of these favourable dispositions into practice. Similarly, women reported moderate perceived behavioural tendencies, shaped by family and community influences, though inconsistent role-modelling within neighbourhoods weakened the strength of these social norms. Educational exposure significantly enhanced women's attitudes and perceived behavioural orientations, while income disparities influenced motivational readiness. Persistent structural barriers such as inadequate access to reliable information, the high cost of energy-efficient appliances and unstable electricity supply continued to hinder sustained household energy-optimising behaviour.

RECOMMENDATIONS

Based on these conclusions, the following recommendations are advanced:
1. Targeted attitudinal change and awareness programmes should be implemented by government agencies, non-governmental organisations and community leaders using local languages and community platforms, with emphasis on practical demonstrations that strengthen women's favourable attitudes toward household energy optimisation.
2. Community-based skills training and peer-learning initiatives should be promoted through women's associations and local networks to provide hands-on technical guidance and reinforce positive social norms, thereby enabling women perceived behavioural expectations into consistent household energy-optimising practices.

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