

**GENDER AND ENERGY POVERTY; EXPLORING THE
INTERRELATIONSHIP BETWEEN UNCLEAN COOKING
FUEL AND WOMEN’S HEALTH**



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A thesis submitted in partial fulfillment of the requirements for the degree of
Master of Philosophy

In Governance & Public Policy

To

Faculty of Social Sciences

National University of Modern Languages, (NUML)

Islamabad, Pakistan.

(2025)

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Declaration

I Ayesha Iftikhar Ahmed daughter of Iftikhar Ahmed Registration # 05M.PHIL/GPP/S22 Discipline Governance & Public Policy Candidate of Master of Philosophy at the National University of Modern Languages do hereby declare that the thesis Gender and Energy Poverty; exploring the interrelationship between unclean cooking fuel and women's health submitted by me in partial fulfillment of my M. Phil degree, is my original work, and has not been submitted or published earlier. I also solemnly declare that it shall not, in the future, be submitted by me for obtaining any other degree from this or any other university or institution. I also understand that if evidence of plagiarism is found in my thesis/dissertation at any stage, even after the award of a degree, the work may be canceled, and the degree revoked.

Acknowledgement

First of all, I am thankful to Allah, the Almighty who blessed me with courage and strength to complete my thesis. I also would like to thank my parents who extended their full moral and financial support to me throughout my study and whose prayers have surrounded me throughout my life.

I express my most sincere appreciation to my supervisor Dr. Athar Rashid who equipped me with the exceptional skills that helped me not only to complete my M—Phil degree but also to excel in my professional career as well. Despite a raging pandemic and a demanding schedule, he remained responsive and accommodating. I also would like to thank Dr. Shahid Habib and Dr. Zain Rafique for their support and guidance at various stages and I would also like to thank all of the interviewees for sparing time out of their busy schedules to help us with this study, clarify our queries, their valuable comments and answered all of the questions. This research wouldn't have been possible without their cooperation and support.

The time I spent at NUML Islamabad was a unique experience of my life as I have never attended such a magnificent university campus in my academic career. I learned many things by interacting with my fellows, seniors and veteran teachers who possessed vast practical experiences of various aspects of life particularly in the field of Governance and Public Policy. While, traveling on campus locomotives, having interaction with NUML Students, belonging to various fields and different backgrounds was also an amazing experience.

Abstract

This study investigates the correlation between unclean cooking fuel and women's health. As one of the pressing facts of energy poverty, the use of unclean cooking fuels disproportionately affects women, causing manifold health issues due to prolonged exposure. The study employs a qualitative survey questionnaire method. The results depict a pervasive dependency on unclean fuels due to gender roles and socio-economic factors. This dependency results in significant health problems for women, such as respiratory diseases and eye problems. With these findings, the paper argues for gender-responsive strategies for energy poverty alleviation, advocating for cleaner and more accessible cooking fuel options in rural Pakistan. The study highlights the importance of incorporating gender considerations in addressing energy poverty for a more sustainable and equitable society. The usage of biomass fuel is quite common in low and middle-income countries. Burning of biomass fuels immediately ruins the air and puts people at risk for numerous ailments; this also affects the residents of Bhalwal hamlet. The purpose of the study is to demonstrate the impact of biomass fuel on the women's health of the people of Bhalwal village and the residents' satisfaction with the transition from traditional stoves to better ones (good electric stoves). Fuel consumption is a heavy burden and a major problem in the third World countries due to indoor pollution and poverty, especially in Pakistan. This study investigates the relationship between the usage of biomass fuel and energy poverty in cooking fuel choices in remote areas of Bhalwal, district Sargodha Pakistan. This article also shows how women utilize biomass fuel for heating and cooking since they are low on energy, which hurts their health and alters the climate. The participants' willingness to convert to modern stoves was indicated by the results, which also indicated that traditional stoves have detrimental consequences on the environment and human health. Furthermore, the study demonstrates a favorable correlation between healthcare expenses and the usage of biomass fuel for cooking and heating purposes. Because of poor wealth most women in the remote areas are using biomass fuel for cooking and heating purposes. The research findings also showed that diseases such as asthma, skin irritation, ocular irritation and other ailments were frequent in women and children. In total, the findings presented support the association between health care expenditure and biomass fuel utilization. Women may rush to design and use new energy-saving solutions to protect their health in light of the diseases associated with bad cooking oil. Consequently, the problem in connection with the issues of the negative effect of biomass fuels on the health of the inhabitants, the indication of safety

measures, and the introduction of appropriate policies, can remove the problems associated with biomass fuels.

Keywords: Biomass fuel, Clean cooking fuel, Women's health hazards, Energy poverty, Gender inequality, Pakistan.

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Abbreviation

Acronym	Full Form
ADB	Asian Development Bank
AQI	Air Quality Index
CCA	Clean Cooking Alliance
CO	Carbon Monoxide
COPD	Chronic Obstructive Pulmonary Disease
DALYs	Disability-Adjusted Life Years
EU	European Union
GDP	Gross Domestic Product
GDG	Global Development Goals (<i>Assumed; please verify</i>)
IAP	Indoor Air Pollution
LPG	Liquefied Petroleum Gas
NGO	Non-Governmental Organization
NOx	Nitrogen Oxide
OPHI	Oxford Poverty and Human Development Initiative (<i>Assumed</i>)
PM2.5	Particulate Matter 2.5 Microns
PSLM	Pakistan Social and Living Standards Measurement (<i>Assumed</i>)
SEA	South-East Asia
SEA4ALL	Sustainable Energy for All (<i>Assumed</i>)
SSA	Sub-Saharan Africa
TOY	Time of Year (<i>Assumed</i>)
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WHO	World Health Organization
WP	Western pacific

CHAPTER No. 1

Introduction

1.1 Background of the study

This type of fuel has been in use from as early as the development of fire and has a long history that has affected the health of man. Throughout history, various diseases associated with smoke exposure in fossil fuel production have affected humanity due to polluted air. Indoor air pollution affected our ancestors for millennia and prevented them from realizing good respiratory, ocular, and cardiovascular health. Fire as controlled by humans has been in existence for about 1.5 million years and has served as a source of heat, protection, and tool for hunting and preparation of food. But this advancement cost air contamination as the outcome. Studies of ancient hunter-gatherers residing in caves show high levels of air pollution resulting from indoor cooking fires used for meat preparation, dating back around 400,000 years. Notably, preserved lung tissues from Egyptian mummies also reveal high pollution levels (Ritchie & Roser, 2021). Cooking with polluting fuels acts as a hidden threat to health (World Economic Forum, 2021).

International organizations are taking this issue seriously, particularly the World Health Organization (WHO), which holds particular apprehension regarding the health impacts on women and children. Efforts are underway to address this problem, with WHO conducting surveys to uncover relevant data. According to their comprehensive report, 33 % of the global population—approximately 2.5 billion people—individual continue depends on outdated stoves or open fires using gasoline, biomass (including timber, livestock waste, and crop residues), and coal, which severely contaminates indoor air. This exposure significantly increases the likelihood of developing non-communicable diseases such as breathing organs cancer, chronic restrictive pertaining to lungs disease, ischemic heart disease, and stroke. Another WHO report from 2019 estimates that 3.3 million people globally die prematurely each year due to illnesses linked to occupational air pollution caused by the incomplete combustion of solid fuels and kerosene used in cooking.

The causes behind the 3.2 million deaths include several significant health issues. Ischemic heart disease is responsible for 32% of these fatalities, with indoor air pollution playing a role in 12% of those cases, resulting in over one million deaths each year that could potentially be prevented. Stroke contributes to 23% of the total deaths, where the use of solid fuels and

kerosene accounts for approximately 12% of daily exposure to harmful household air pollutants.

Lower respiratory infections (LRIs) are linked to 23% of deaths, with indoor air pollution nearly doubling the risk for children. In fact, it is associated with 40% of lungs infection-related deaths in those under the age of five. Adults facing acute lower respiratory infections are also at significant risk from indoor pollutants, which contribute to 22% of all pneumonia deaths in adults.

Chronic obstructive pulmonary disease (COPD) accounts for 19% of the deaths, while lung cancer makes up 6% of deaths related to COPD in developing nations. Indoor air pollution is responsible for 23% of adult COPD fatalities. Furthermore, the reliance on kerosene or solid fuels for household energy results in pollution that contains carcinogenic substances, which are linked to around 11% of lung cancer deaths among adults, as reported by the World Health Organization in 2019.

A 2017 WHO report highlighted that household air pollution contributed to the loss of 86 million healthy life years, disproportionately affecting women in low- and middle-income countries. Women and children, who typically handle household tasks like cooking and gathering firewood, suffer the most from the health impacts of these polluting fuels and technologies. There is a strong correlation between poverty and reliance on polluting energy sources, especially among rural populations (World Health Organization, 2017). The WHO has said that the smoke that women and children are subjected to breathe from polluted fuels and stoves that includes smoking 400 cigarettes within an hour (Sandra Ortellado, 2018).

1.2 Pakistan's Context

However, in developing countries like Pakistan, having in mind that numerous populations literally suffer from the problem of poverty as well as energy shortage and therefore, people are unable to get clean fuels such as kerosene, gasoline, natural gas, liquefied petroleum gas or even coal etc.(Stonner,2021). Hence, they opt for biomass fuels the commonly include animal dung, crop residues, and firewood. These biomass options are generally cheap and more easily accessible and for this many rural communities have resorted to the use of traditional non efficient stoves which are poorly ventilated (GIZ, 2018).

Economic challenges have led to these manufacturers failing to pay attention to enhancements of these stoves through which dangerous emissions can be minimized. This scenario has adverse impacts on health such as the respiratory system and eye inflammation, heart diseases, and is a major cause of environmental pollution(Raju,2020). This type of pollution not only causes current health issues, but also continuous declining in the both physical and mental health of the people and productivity losses of people living in rural areas and future generations (Sidharthan,2020).

In many developing countries, biomass is the main source of energy for cooking and heating, although it is a household activity that gives rise to considerable indoor air pollution. As a result, people spend most of their time indoors, particularly in their houses, and from this vantage point, this aspect has adverse effects on health. While indoor air pollution remains a major cause of decline in health in many of these poorer nations, it has not received the attention it deserved (McCormac,2020).

In Pakistan agriculture plays one of the important roles as leading source of livelihood and 68% of the population of the country lives in rural areas (Alvi,2018). here such Lane unclean cooking fuels as firewood and dung are used, which are a cause of serious health complications especially to women. These fuels produce toxic smoke that can lead to respiratory diseases, eye problems, and even lung cancer. Women, who usually handle cooking and household chores, are particularly at risk because they spend more time in the kitchen. Approximately 75% of the rural population relies on biomass fuels for cooking, which worsens chronic respiratory conditions and increases the risk of illnesses linked to indoor air pollution (Breda & Kyobe,2022).

Energy poverty drives the reliance on dirty fuels, especially in rural Pakistan, where many people live below the poverty line. As of 2021, about 38.3% of the national population was below the poverty threshold, with 30.4% of the rural population living in severe poverty. Studies show a strong link between the use of biomass fuels and health issues like low birth weight and high infant mortality rates in rural areas (Alkire, Kanagaratnam &suppa,2023)

Burning solid fuels emits harmful gases like carbon dioxide, methane, and sulfur dioxide, which not only harm health but also contribute to deforestation and climate change (Mohyuddin,2019).

The combustion of solid fuels generates a variety of gases, including carbon dioxide, methane, carbon monoxide, and sulfur dioxide, which are harmful to human health and cause damage to forests, climate change, global warming, soil erosion, and biodiversity loss (Acharya,2018). Pollution in indoor environments is one big problem in Pakistan, where it claims one percent of its gross domestic product per annum. Indoor air pollution contributes to 82% of deaths and 18 % of illnesses due to this type of pollution leading to 1,320,000 DALYs lost every year. This means that poverty and, poor health among women in the rural areas are complementary of each other (Shabbir, Malik, Rizwan &Hashim,2019).

The rate of poverty is very high in Sargodha of Pakistan particularly women, who find it difficult to make ends meet. The continued use of unclean cooking fuels can have severe health impacts on women through use of cross sectional studies to review the literature on poverty, impure cooking fuels and their health consequences on women in rural Sargodha.

Signed by 193 countries in 2015, the United Nations' Sustainable Development Goals (SDGs) are a set of goals supposed to address various challenges currently facing our world, in the next 15 years. In order to reach those aims and combat climate change, it is necessary to continue research of cheap and effective interventions at the household level that target underlying issues and have significant economic impacts.

Available literature shows that within Pakistan people with large families and those having agriculture plots rely more on biomass fuels for preparing their meals (Vishal Doggar,2022). This fuel choice has been associated with several sickness conditions especially to women who dominate its usage. Despite what these women do, they spend most of their time preparing meals and because they cook under a closed structure, they are exposed to polluted air, which in turn causes such diseases as respiratory diseases among others (Kausar,2023). Fuelwood also utilized in cooking has also been associated with increasing total world carbon emissions (Shehzad,2023).

While women are crucial for cooking and care giving roles in the administration of households in Pakistan their health is not a priority. Smoke from burning fossil and biomass fuels in kitchens produces toxic components and, since women spend considerable time in these areas, they are at high risk (Muhammad,2020). It was established that education plays an important role in minimizing adverse impacts on the environment as those families who are aware of the nature of indoor air inflammation and have an access to API-s, including cleaner stoves, do not

report health complaints (Muhammad,2020). Sadly, there is little available support and focus on rural regions needed to address these issues. This is even more true for women because education remains a major area of deficiency throughout the country (Taillie,2018).

1.3 Research Gap

This paper will seek to establish the consequences to women's health from using biomass fuels and analyze the fuels used in the Bhalwal area of Sargodha district in rural Pakistan. Prevailing research has also focused on energy poverty and the impacts of unclean fuels, such as the impact on women's health, but there is still a gap. These include:

To the best of my knowledge, no study has explored the links between gender, energy poverty, and women's health and unclean cooking fuel in rural Punjab, Pakistan. In the current research studies, there is a lack of understanding of the interrelation between energy poverty/health disparities and gendered social factors.

Energy poverty is a problem that affects millions of people in the region, respectively villages areas of underdeveloped countries. This poverty is contributed to by the reliance on dirty cooking fuels, including biomass, liquid oil, and charcoal. Two fuel choices in the rural Bhalwal district of Sargodha, Pakistan. While there have been numerous studies addressing energy poverty and the use of unclean cooking fuels and their effects on women's health, significant research gaps remain. These include:

There is a lack of comprehensive research specifically examining the connections between gender, energy poverty, and women's health related to unclean cooking fuel usage in rural Pakistan. Existing studies often focus on energy poverty or health impacts in isolation, neglecting the interplay of gender dynamics and social implications.

Energy poverty is a pressing issue affecting millions globally, particularly in villages areas of underdeveloped countries. The reliance on dirty cooking fuels such as biomass, liquid oil, and charcoal is a significant contributor to this poverty. Nevertheless, the gendered aspects of energy deprivation and its consequences on women's health have received little attention.

In Bhalwal district, MPI in the energy sector is a reality, and people rely on unclean cooking fuels. Cooking using these fuels is done mainly by women who are also responsible for other

household chores and are thus affected by these fuels in their health than men are. Burning these sources emits smoke that causes respiratory diseases, eye infections and diseases among other diseases. To the best of the authors' knowledge, few studies have explored gender roles in the selecting of poor fuel for cooking in Bhalwal and their repercussions on women's health. in the rural Bhalwal district of Sargodha, Pakistan. While there have been numerous studies addressing energy poverty and the use of unclean cooking fuels and their effects on women's health, significant research gaps remain. These include:

There is a lack of comprehensive research specifically examining the connections between gender, energy poverty, and women's health related to unclean cooking fuel usage in rural Pakistan. Existing studies often focus on energy poverty or health impacts in isolation, neglecting the interplay of gender dynamics and social implications.

Energy poverty is a pressing issue affecting millions globally, especially in villages areas of underdeveloped countries. The reliance on dirty cooking fuels such as biomass, liquid oil, and charcoal is a significant contributor to this poverty. However, the gender-specific dimensions of energy poverty and its impact on women's health have not been extensively explored.

In Bhalwal district, energy poverty is prevalent, and the use of unclean cooking fuels is common. Women, who are primarily responsible for cooking and household chores, face more severe health repercussions from using these fuels. Exposure to smoke from these sources can result in respiratory ailments, eye infections, and other health concerns.

There has been limited research examining how gender roles influence the choice of poor fuel for cooking in Bhalwal and its effects on women's health. Further research is required to examine the implications of energy poverty on women, as well as looking for specific approaches that will help women alleviate the situation.

In addition, it has emerged that there is a desperate need to something else different energy sources that could support women and minimize their vulnerability to health complications. This may require the use of better stoves, solar derived energy and other source energy that has no nasty impacts on the environment. Such studies may help design of future policies and programs that could address women's health issues and support sustainable development needs.

Therefore, it critical to review the empirical evidence on the specific socio-cultural, economic and environmental determinants of women's consumption of energy for cooking and the health consequences that flow from use of un-clean fuels. To this, one samples the practical way gender is manifested through norms, decisions, and access to clean energy technologies amidst women.

There is already primary data pointing to the negative impact of dirty cooking fuels on health; however, more empirical work is required to produce a better understanding of the exact problems women in rural Pakistan face. This includes reading on how often and how serious respiratory diseases, eye diseases, and other diseases linked to the use of unclean cooking fuel are.

There is a need to draw research to review those practices and strategies that could be implemented to control gender disparities in energy poverty and consequently women's health. This entails evaluation to select the cleaner fuel for cooking as well as the advanced technologies, considering potential social and economic impacts of the shift to using cleaner energy sources, and understanding the challenges and enablers of effective interventions.

Filling these research gaps will improve knowledge about how gender defines energy poverty and its impact on rural women in Pakistan. This, in turn, will foster the establishment of research-based intervention measures in tackling the above challenges.

1.4 Problem Statement

Energy poverty highly influences the practice of improper fuel in the rural areas of Sargodha, Central Punjab, Pakistan affecting the health of women. This they end up suffering from respiratory diseases, irritated eyes and skin diseases which greatly reduces their quality of life.

Pakistan is the fifth most populous country in the world according to the United Nations Women Asia and Pacific with the economy depending considerably on agriculture. And having high population density the Bhalwal district is among the most populated area in Sargodha (Government of Punjab) I chose Punjab because it is the largest province in the country and approximately 68% of the population of Punjab still lives in rural sites (Hussain et al., 2018). Energy poverty is a fundamental issue causing people in these regions to rely on biomass for their household fuel needs. The reliance on biomass fuels and coal poses significant public health challenges (Kalak, 2023). Sargodha, an agricultural district, ranks among the twelve

most populous cities in Pakistan, with a rural poverty rate of approximately 26% (Ansar Abbas et al., 2018).

Many residents in Sargodha rely on a variety of unclean cooking fuels, including wood, charcoal, grass, straw, wheat husks, and various land residues. The use of wood for cooking has particularly negative effects on women's health. According to the Bureau of Statistics (2019-20), Sargodha is among the top five districts in Punjab, with 61% of women using solid fuels for meal preparing and heating. This finding is further corroborated by a report from the Urban Unit of Punjab.

Further, the northern region of Sargodha city has been recognized as significantly polluted area mainly on account of carbon monoxide from house smoke. WHO (2018) has noted that like several other countries of the South, Pakistan suffers from critical air pollution problems and is one of the most impacted developing countries. Some common respiratory symptoms that women of Punjab often feel include coughing, asthma, shortness of breath, and tightness in the chest these symptoms get worsened with time (Jamali et al., 2017). This shows and or implies that poverty is highly correlated with the degeneration of the health status of women in the villages.

According to the World Bank, indoor air pollution causes 40 million people cases of respiratory diseases and about 28,000 deaths in Pakistan every year. The country comes out third for air quality in the world, having an average AQI score of 159 from World Air Quality Index (IQAir). One of the causes of such poor air quality is high use of unclean fuels for cooking in the form of woods and Animal dung which emits suspended matter and pollutants into the air respectively. Such products are most dangerous for women, who spend more time cooking and thus risk getting ill from the hazardous particulates (Shu Wu, 2021).

Rural areas of Pakistan also use unclean cooking fuels, and this is due to energy poverty of the population. The main cause for which the residents of Punjab depend on the biomass is a cause of one sort or the other; poverty. This reliance on coal and biomass has adverse effects to the health of the populace (Farah, Khan, 2019). Some of the diseases affecting women caused by ineffective use of unclean cooking fuels are; lung diseases, eye infections among others as well as physical injuries. The shifting towards sustainable sources of energy could enhance women's health, mitigate the levels of indoor air pollution and contribute towards the achievement of sustainable Development goal 3 (SDG 3).

1.5 Research Objective

RO1. To evaluate the impact of using solid cooking fuel on various health outcomes of residents of rural areas of Bhalwal district Sargodha, Pakistan.

RO2. To assess the factors that affect the choices of users of cooking fuel in households.

RO3. To assess the suitability and effectiveness of house site design features for cooking activities, considering safety, ventilation, and accessibility.

1.6 Research Questions

RQ1.What is the effect of unclean cooking fuel on the health of women in rural areas of Sargodha, Pakistan?

RQ2.What are the factors affecting the use of biomass fuel in rural areas of Sargodha?

RQ3.To what extent does the house site design promote proper ventilation during cooking?

1.7 Significance of the Study

The following are the main reasons why it is crucial to emphasize the importance of this work on the use of unclean cooking fuels and their impact on women's health in the areas of Bhalwal, District Sargodha, which may be considered underdeveloped.

First, unclean cooking fuels are still widely used in many of the rural areas of Pakistan, mainly because they remain relatively cheap. Many families in the studied areas lack access to cleaner forms of fuel, such as LPG or electricity, and as a result, women are exposed to traditional and unhealthy energy sources for cooking and heating.

Second, because they are the main consumers of these toxic fuels, women are most at risk of poison gases and chemicals such as carbon monoxide, soot and other volatile emissions. This exposure has a huge effect on their health hence experience respiratory diseases, poor eyesight, skin complications and other diseases.

Furthermore, the health impacts resulting from the use of dirty kitchen fuels are not only individual violating basic human rights, but also hampers the overall development of the rural settlements in Bhalwal area. Those women with respiratory diseases or eye defects will find it

difficult to manage their homes, look after their young ones, or even perform their earning activities. This creates lower quality and quantity of work output from poor staff performance, decreased effective staff utilization through to lowered quality of life impacts on women and their families.

It is important to investigate the impact of unclean cooking fuels on female health in rural Bhalwal. It can generate rather precise data on the level of use of traditional fuels for cooking and home heating and the health effects attributable to it. This sort of data could be used to inform specific measures and policies on how best to increase access to clean and affordable energy sources that may improve people's health and quality of life in such places across Pakistan.

Research on gender and energy poverty, specifically exploring the link between unclean cooking fuels and women's health, will benefit several groups:

Direct Beneficiaries:

1. Women: This is the most crucial group. Improved understanding of the health impacts of unclean cooking fuels, particularly respiratory, reproductive, and other health problems, will help advocate for policies and solutions that alleviate their burden. Specifically, women who use these fuels will directly benefit from solutions that either reduce or eliminate their use (e.g., improved access to cleaner alternatives).

2. Children: Children exposed to indoor air pollution from unclean cooking fuels suffer from increased respiratory illnesses, impacting their health and development. The research will help develop interventions to protect them.

3. Families: The reduction in illness and improved health outcomes for women and children will have a positive ripple effect on family well-being and economic productivity.

4. Public Health Organizations: This research provides a stronger database to justify public health initiatives and policies that aim to mitigate the health risks associated with unclean cooking fuels.

Indirect Beneficiaries:

1. Governments: The research provides evidence to support policies and programs aimed at promoting sustainable energy access and health improvements. Governments can use the research to inform budgeting and prioritization for projects designed to address energy poverty.

2. Non-governmental organizations (NGOs): NGOs involved in providing clean cooking solutions and health services will benefit from targeted information and evidence for policy

advocacy and program development.

3. Energy companies: The research might reveal new opportunities for clean energy technologies or fuel distribution models that cater to women's needs.

4. Researchers: Further research in this area could yield discoveries and innovations that create solutions to the problem.

Wider Societal Benefits:

1. Economic development: Improved health leads to increased productivity and reduced healthcare costs, which can spur economic growth.

2. Gender equality: By addressing the disproportionate impact on women's health, research promotes gender equality and empowerment.

3. Environmental sustainability: Addressing the issue of unclean cooking fuels contributes to reducing air pollution and its impact on the environment.

4. Global health equity: This research highlights the global scale of the issue and can inform international collaboration on health and development.

In summary, the research benefits a wide range of individuals, organizations, and society as a whole, highlighting the interconnectedness of energy access, women's health, and overall well-being

1.8 Rationale of study

Blending gender, energy poverty, unclean cooking fuel, and women's health in the rural Area of Bhalwal to is both intricate and significant.

These areas women in particular, continue to embrace traditional cooking methods whereby they use fuel such as firewood, residue from crops, and animal dropping. This dependence results to environmental pollution through emission of bad gases and particles which are hazardous to women health since they are exposed for long periods. It is both complex and crucial.

In these regions, women frequently rely on old and outdated cooking methods, utilizing resources such as firewood, crop residues, or animal dung. This dependence leads to air pollution, which adversely affects women's health due to prolonged exposure to harmful pollutants.

This is due to energy poverty in most of these areas and because access to cleaner sources such as LPG or modern cooking stoves remain out of reach for many households. This situation therefore remains a continuing challenge to the health of women in such societies.

Breathing contaminated indoor air from sooty and dirty fuels is the chief cause of many diseases, for instance sickness of the respiratory tracts, cardiac ailments, eyes irritation, and problems to pregnant women. These risks are much more significant for women living in rural areas.

It is therefore important to consider broader implications of unclean cooking fuels effects drawn from women's health as stated below. Ill health defeats women in their ability to meet the needs of a household, and it hinders their chance to education as well as employment prospects. This process perpetuates poverty and inequality and it is experienced in the society/economy.

To support policy makers and planning programs for women's health in developing countries analyzed using a gender lens, exploration of how the influence of gender moderates these four variables: energy poverty. It is possibly to suggest that tackling these problems together may lead to cooperation between the policymakers and strategists working on the development of thought processes to enhance women's health and status in rural regions.

By the virtue of achieving these objectives, the research seeks to unveil many facets of hardship facing women in these communities because of energy poverty and the use traditional fuels. Finally, the conclusion made towards the findings could create a premise to a new way of conducting more empirical research based on practical planning and policies for improving women health, narrowing down the gender marginalization gap, as well as arising and vending sustainable energy practices.

1.9 Scope of Research

This research is limited to analysis of factors that affect biomass fuel consumption in rural Bhalwal, Sargodha district of Pakistan. It points out the major difficulties and questions with suggestions for addressing those concerns. The findings of this study will be the government's useful guide in the right direction on how best to put into practice policies that will make a positive impact in the community.

1.10 Organization of Study

This thesis is structured into six distinct sections. Chapter 1 introduces the study's background, reviewing global information from the World Health Organization before narrowing the focus to the context of Pakistan. It outlines the central issue, defines the research aim, and presents the key questions while discussing the importance of study scope and extent to the research. Chapter 2 comprises a Literature Review, exploring the connection between gender and energy deprivation, as well as the impact of unclean cooking fuels on women's health in the rural areas of Bhalwal district, Sargodha, Pakistan. Chapter 3 discusses the conceptual framework and research design, while Chapter 4 provides a detailed analysis of the qualitative data collected. Chapter 5 poses the research results and policy, Chapter 6 summarizes the conclusions and offers recommendations based on the study's outcomes.

1.11 Summary of Chapter

The use of dirty cooking fuels has been a part of human history for a long time. This reliance on unclean fuels has negative effects on women's health. Women hold a crucial position in our society, and the context of this study highlights specific health issues in the areas being examined. It also explores the connection between gender and energy deprivation, and how these factors affect fuel choices and usage in kitchens across Pakistan. The goals of the study are outlined in the research objectives and questions. The significance and scope of the study are as follows:

To identify the issues and give some appropriate suggestions to better society.

CHAPTER NO.2

LITERATURE REVIEW

Energy is central to human development; yet, the majority of the demand comes from rural settings of Pakistan where people still use unclean energy sources such as biomass for cooking and lighting. It has a worse impact on the females since they are most of the time assigned the duty of managing the home energy source and therefore exposed to the effects on their health of those fuels. This literature review focuses on gender, energy poverty and health implications on women in rural areas of Pakistan.

Literature has revealed other factors that include, household wealth, family size and gender, and income from South Asia (Khandker, Barnes & Samad, 2012; Nasir, Murtaza & Colbeck, 2015; Rao & Reddy, 2007; Yasmin & Grundmann, 2019). All the researched conclusions suggest that minuses of not having access to clean and affordable energy affect women in rural parts of Pakistan the most. A major strand of energy poverty is the reliance on lighting and cooking with dirty energy sources which affect women's health (Nasir, Murtaza, & Colbeck, 2015; Aryal et al., 2019). The study has also found out that the impacts of energy poverty are gendered with women being most affected. The cooks being mostly women, this resulted into high level of indoor air pollution from the fumes developed when these fuels are burnt (Rao & Reddy, 2007).

However, on an average, IAP is not considered a great environmental problem in Pakistan, which is why there are no standards that limit its impact on homes. Surprisingly, few studies have been conducted on women's health and fertility in relation to climate variability. Global 2 million fatalities related to air pollution, about 1.2 million of indoor air pollution related fatality. Different governments, NGOs and other institutions have tried to optimize the use of stoves to mitigate these impacts, but much more integrated efforts must be made. It is, therefore, the responsibility of the government of Pakistan to come up with robust policy

measures, in concordance with various political actors, at federal, state and provincial level to address this topical question. Besides, there is also the need for developing more research in relation to effects of IAP with particular attention to women and children. In this way, the government can predict the impact of its indoor air pollution by making use of modern technology and equipment in the process (Fatmi, Rahman, Kazi, Kadir, & Sathiakumar, 2018).

2.1 Health Impacts of Unclean Cooking Fuel

The major sources of solid fuels are biomass, and coal. Burning of these fuels has been subject to a lot of concerns due to its effect on the environment and health. It was all over established that a large population of the people still rely on the use of solid fuels for cooking and heating most especially in the developing countries (Wu, 2021). In one of the works that showed that exposure to most of the conventional biomass fuels such as firewood and agricultural residues lead to emissions of high indoor pollutants an impact on the respiratory health of women. Research shows that women who use these bad fuels have higher incidences of chronic obstructive pulmonary disease (COPD), acute lower respiratory infections (ALRI), and asthma (Aithal, 2022; Farah et al., 2023).

Furthermore, constant use of these fuels that causes Indoor Air Pollution have adverse implications on the health of women and new-born children. Mother who is exposed to these pollutants are more likely to give birth to preterm babies, low birth weight, and higher the rate of mortality among newborns (Bekkar et al., 2020). Sight can also be affected, effects include: cataract, conjunctivitis and eye redness (Hossain et al., 2016; Zost et al., 2020).

Biomass energy therefore originates from different products such as wood, charcoal, agriculture residues or animal dung. Despite the fact the biomass energy sources are predominantly used in rural areas, agriculture significantly contributes to their provision. In most cases, some residues arising from agricultural processes are harnessed and used to provide energy for home use. In the regions where non-agricultural source of energy is available like forest region, firewood and charcoal also plays quite an important role (ESMAP, 2000).

Cross sectional descriptive epidemiological studies have provided evidence of the association between indoor biomass smoke and health risks. Studies show that about 40,000 child deaths happen per year in Europe as a result of these problems (Muhammad, 2020). Some of the pollutants that result from burning of biomass fuels have been implicated in respiratory and

cardiovascular diseases. More research should be carried as to exhaustively assess the implication and health risks associated with biomass combustion and to encourage the use of safer means (Sigsgaard et al., 2015).

Indoor air pollution has a different impact in different age groups of people. For example, the effects can range from simple allergic reactions in children to respiratory ailments and irritation of the mucous membranes traceable to formaldehyde (Wickramasinghe & Jayatilaka, 2006).

The provision and management of energy in households proves that some social justice and health equality problems still exist. Due to the fact that women are usually charged with the responsibility of managing energy in their homes they are most affected by the general health effects of unclean fuels. Many of the attempts made by them to avail energy for their families lead to adverse health impacts. Lifting fuel and transportation requirements, coupled with traditional gender roles in charging with domestic work, underscore the importance of enhanced concern for human access to power as well as safety in workplace (Wickramasinghe & Jayatilaka, 2016).

Studies have established that family members living close to sources emitting SO₂, NO₂, H₂S are more likely to complain of asthma than those living in areas with low emissions. This shows that there are severe health ramifications associated with the typical indoor air quality pollutants in residence including those in regions such as United Arab Emirates. To have enhanced comprehension of those health effects, subsequent explorations into pollution exposure and health evaluation are paramount (Yeatts et al., 2012).

2.2 Energy Poverty and Empowerment

Some scholars may capture ‘energy poverty’ as lack of adequate choice and availability of higher quality, economic and sustainable energy services needed for development (Reddy, 2000).

Table 1 : Different conceptualizations of energy poverty

Energy poverty is simply the lack of access to modern energy	IEA (2010)	
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The inability to perform the use of electricity and clean cooking systems like fuel and stoves that have no impact on bad indoor air is major hurdles for households.	Bravo et al. (1979); Krugmann and Goldemberg (1983). Goldemberg (1990); Pachauri and Spreng (2004); Foster et al (2000); Saghir (2005)	
Lack of access to affordable and reliable clean energy, technologies and solutions constrains the capacity to meet the energy demand of cooking and other electricity based activities, which are vital for economic and human development.	Rao et al (2012)	
Energy poverty is considered as a shortfall of energy consumption (in Tonne of Oil Equivalent) from threshold level	Pokharel (2006)	
Energy poverty can also be measured with reference to per capita energy consumption about which it has been asserted that a baseline level of energy use is 500w per person per day, which relates to meals and lighting only	Goldemberg et al (1990)	
There are no reasonable options for accessing sufficient, affordable, reliable, high-quality, safe and environmentally friendly energy. Services to promote business and human development	Reddy (2000)	

With reference to energy poverty, therefore, there are three views that may be taken depending on the direction that is preferred: the spending direction, the accessibility direction, and the usage direction. It is commonly referred to as the lack of affordable, clean, and reliable energy—especially in the emerging markets (Mayer et al., 2014). The correlation between energy consumption and human security is important because energy is central to the fulfillment of human rights, including access to clean air and water, health, literacy, and economic activity in all sectors of the economy. However, there is no consensus in the literature regarding the definition of energy poverty.

Normally, those that face challenges in paying for energy for heating or cooling are considered as energy poor. This term encompasses multiple dimensions of energy-related deprivation. The International Energy Agency (IEA) identifies energy poverty as a situation marked by heavy reliance on biomass, which leads to pollution, alongside limited access to electricity and clean fuels. The Energy Poverty Observatory (2021) defines it as the lack of essential energy services for individuals and households. Meanwhile, Winkler et al. argue that energy poverty arises when a significant portion of household income is spent on energy-related costs. According to the UK government, as per Hills' definition, energy poverty occurs when the expenses for basic energy needs exceed the social average, resulting in disposable income falling below the recognized poverty line. Another viewpoint defines energy poverty as the insufficient energy required to maintain a standard of living. Gonzalez-Eguino emphasizes that it pertains to having adequate energy to fulfill essential needs.

Amartya Sen highlights that assessing poverty involves two main steps: identifying those affected and aggregating the relevant data (Sen, 2006). Aggregation requires identifying common characteristics to establish a single metric, while identification can be achieved using a poverty line. Day et al. characterize energy poverty as the inability to attain necessary capabilities due to lack of access to affordable, reliable, and safe energy services, considering alternative ways to meet these needs. There is no universally accepted standard for defining energy poverty, as regional variations lead to the use of different indices for measurement.

In many developing nations, particularly in rural areas, women are typically in charge of cooking and therefore need access to clean cooking fuels, a necessity that may not be prioritized by men. Moreover, the impact of energy poverty can differ between men and women within the same household, making a deeper analysis essential. A multidimensional framework for measuring energy poverty is more appropriate. While researchers often concentrate on cooking fuels and lighting due to their significant influence on daily life, energy poverty also affects socio-economic progress and health. The Total Energy Access (TEA) model from Practical Actions (2010) includes needs beyond cooking and lighting, such as heating, cooling, and income generation, establishing a minimum standard for energy access that can be evaluated for sufficiency.

Energy poverty predominantly affects low-income economies and rural populations. In the last 15 years, the number of individuals lacking electricity has decreased by about 35%, from 1.7 billion to 1.1 billion. During this period, approximately 1.1 billion people gained access to

electricity, surpassing the global population growth of 600 million. India has made significant strides, with over 33 million individuals gaining electricity access each year. However, progress in securing clean cooking fuels has not been as consistent, with 2.3 billion people still lacking access to clean cooking fuel over the last two decades. Transitioning to cleaner cooking options is generally more complex than the switch to electricity, with the latter transition occurring at a faster rate in most countries.

Roughly 95% of individuals without reliable electricity and clean energy sources reside in developing nations across sub-Saharan Africa and Asia. The 15 countries facing the most severe energy shortages are in Africa, where electricity access varies between 65% and 92%, and between 95% and 98% of the population lacks clean cooking energy. The largest concentrations of energy poverty are found in India and China, with around 239 million people in India alone lacking electricity (22% of the global total). Together, these two countries account for 1.3 billion individuals without access to clean fuels, representing 48% of the global need. Generally, access to energy is correlated with a country's economic status; in low-income countries, only 10-40% of the population has electricity, compared to 40-80% in low-middle-income nations. Additionally, only 5-30% of people in low-income countries have access to clean cooking fuels, in contrast to 30-50% in low-middle-income countries. A considerable majority (87%) of individuals without electricity live in rural areas, with this figure rising to 96% in certain Asian nations.

The International Energy Agency anticipates that the global population without electricity will decline from 1.1 billion in 2016 to 700 million by 2030, assuming current levels of investment continue. However, without prompt action, the rate of decline may slow between 2030 and 2040. Regional trends differ: while India is expected to achieve universal grid access by 2030, Africa may experience a decrease in grid access due to rapid population growth, potentially increasing the number of people without electricity in Africa from 600 million to 700 million by 2040. This shift would require an additional \$391 billion in investments across various innovations. The outlook for clean cooking fuels is similarly discouraging, with a projected decrease of only 7% in the global population lacking access to clean fuels from 2016 (2.8 billion) to 2030 (2.6 billion). Achieving universal access to clean fuels would necessitate a fourfold increase in global investment, with approximately 30% allocated to Africa (A.T. Kearney, 2018).

Douglas Perkins has extensively examined the notion of empowerment within the fields of social work, community psychology, health promotion, and organizational studies. Unfortunately, the term has often been overused in policy and counseling discussions, leading to vague interpretations. This chapter aims to clarify the concept and emphasize its importance for political and civic engagement.

So, what defines effective empowerment? Various methodologies have been utilized to articulate and assess it; however, a significant concern is the frequent absence of clear definitions in policy contexts. Empowerment is typically understood as a process that allows marginalized individuals to gain better access to and control over vital resources, promoting personal autonomy, community participation, and a greater understanding of their environments. It stresses the importance of community engagement, mutual respect, critical reflection, care, and collective support (Perkins & Zimmerman, 1995).

2.3 Measuring Energy Poverty

Energy poverty is in fact measured differently based on adoption and accessibility of economical energy sources according to the regions, climate, and general living conditions of people. While nutrition can be something that can gladly measured against some scientific measurements it is, energy poverty does not have standard measure. Due to the continuous changes in technology, there is a need to review indexes used in evaluating energy poverty. One such method is the famous Boardman ten percent rule where any household that uses more than 10 percent of its income or expenditure on energy is considered energy poor. Although this approach is simple, it has several limitations: It responds swiftly to the changing fuel prices, entails bias assessments during fuel price fluctuations, is pegged on the use of a baseless cut-off point, and is ill-suited to changes in households' income level.

This remains a sharp problem in many developing countries including Pakistan (Arora et al., 2005). Energy poverty can therefore be defined as the lack of clean, affordable and accessible energy for basic domestic uses for instance cooking, lighting, heating as well as carrying out productive activities. updated in 2020, the World Bank reported that Pakistan still notably suffers energy poverty that take its toll on the population and hinders the social and economic growth of the state. Clean fuel for cooking and other resources not only become healthy to women, but make them empowered as well. There is a possibility that cleaner fuels may help

to reduce time constraints for women and improve productivity signals for such women as well as offer them a chance to engage in income-generation activities and education.

There is little work on energy poverty; however, energy poverty exists in developing countries such as Pakistan wherein people suffer from income poverty, and often the problem of energy poverty and the potential to eradicate income poverty seems to take a backstage in comparison to other emerging nations (Dil Bhadur, 2022). Mirza and Kemp mention that firewood, dung cakes are some of the common fuels used in rural Punjab in rural Punjab, the proportion of the population below minimum cooking fuel expenditure is mainly influenced by household head occupation and geographic isolation and not the income level. Analyzing the Multidimensional Energy-poverty index (MEPI) relying on the Pakistan Social and Living Measurement (PSLM) 2007-08, the percentage of the energy poor had been identified to be 71% in rural areas, and 29% in urban area as stated by Sher et al.

This paper also confirms that energy poverty primarily impacts women and households led by them (Hagenmaier, 2023). Women are at the forefront at home due to cultural beliefs such that if they have to work, they work from home hence they feel the pain of energy poverty most. As a rule, female clients have less opportunities for earning their living and are more vulnerable to social exclusion than males. They are also physiologically more vulnerable to developing disorders that health to temperature conditions. However, women remain most relevant to issues tied to energy poverty, and they must be given a primary mandate to lead the fight against the same. The ADB (2018) and the World Bank (2020) convey that access to clean cooking fuels and improved energy sources not only transforms the health of women but can also empower them by making them more productive people who can shift into performing income-generating activities and education.

2.4 Reasons for Energy Poverty in Pakistan

2.4.1 Insufficient Energy Infrastructure

The primary reason for energy poverty in Pakistan is the low density of energy resources. Presently, the global electricity grid is old, ineffective, and expensive and cannot meet the increasing demand. This causes a large voltage between supply and demand due to implemented power cuts and load shedding especially the rural and the poor populace.

2.4.2. Limited Access to Modern Energy Services

A large population of Pakistan and particularly the rural population lacks access to modern energy services to the fullest extent. Firewood, dung and agricultural residues are the primary fuel used by many families for cooking and heating. These energy sources are inefficient, exacerbate indoor air pollution and therefore have adverse effects on public health (Ali et al., 2021).

2.4.3 High Dependence on Fossil Fuels

Currently, Pakistan's energy sector is mainly based on the fuel type, especially natural gas and oil for power production. On the same note, this has led to energy crises and hampered the endeavor to build up the renewable energy sector across the nation. Also, the variation in prices of oil stocks and geopolitical situations influences the procurement and costs of fossil energy, which deepens energy poverty (A. Awan, Abbasi, Rej, Bandyopadhyay, & Lv, 2022).

2.4.4. Inequitable Distribution of Energy Resources

Due to inadequate proportionate distribution of energy resources, energy poverty in Pakistan is compounded. There are also areas where the proportion of electricity consumption grows due to a relatively stable supply of power, albeit with certain fluctuations: these are the urbanized territories. However, there are territories that suffer from severe deficiency of electricity, and their power is far from meeting the requirements of the population: these are the remote and underserved territories. This situation even widens the disparities in the energy consumption status of different communities and regularly propels poverty in underprivileged regions (Lee et al., 2021). People with below the poverty line standard cannot have any adequate electricity supply system and cannot get any other fuel such as petrol, LPG, or biogas. They have no option but to burn the unsatisfactory, deleterious biomass fuels that emit CO₂ and other substances which are injurious to the health of the people and are also hazardous to the environment.

2.5 Impact of Energy Poverty

Some studies were done to find out the impact of energy poverty such as:

2.5.1 Economic Constraints

Energy poverty significantly impedes economic progress and productivity in Pakistan. Frequent power outages disrupt businesses, manufacturing operations, and agricultural activities, resulting in financial losses and stunted economic growth. Companies struggle to

function effectively and attract investment due to an unreliable energy supply (A. Awan & Bilgili, 2022). A dependable, safe, and affordable electricity supply is essential for any nation's prosperity. Currently, Pakistan's energy conditions do not meet these criteria, hindering our ability to compete globally in manufacturing and mass production. Consequently, our imports continue to rise while exports decline sharply, leading to a growing trade deficit. This situation forces us to seek assistance from national and international financial institutions and allied countries, often at the expense of our national interests.

2.5.2 Health and Environmental Impacts

The reliance on traditional biomass fuels for cooking and heating contributes to indoor air pollution, which in turn leads to respiratory issues, premature fatalities, and chronic health conditions, especially among women and children. Additionally, the inefficient combustion of these fuels accelerates deforestation, environmental degradation, and carbon emissions, intensifying concerns about climate change (A. Awan & Bilgili, 2022). Deforestation disrupts climate patterns, adversely affecting agriculture and pushing many individuals below the poverty line. This situation forces people into unsanitary living conditions and reliance on fossil fuels, which creates a range of health problems for women, livestock, and crops alike.

2.5.3 Educational Challenges

Energy poverty significantly hinders educational opportunities in Pakistan. Inadequate access to consistent electricity in schools disrupts both teaching and learning. Students struggle to study in poorly lit classrooms or without essential technologies such as computers and internet connectivity. This situation adversely affects educational outcomes and reinforces socio-economic disparities (A. Awan & Bilgili, 2022). Students from disadvantaged areas often attend classes suffering from sleep deprivation, illness, and malnutrition, which impairs their ability to absorb the lessons taught by their teachers.

2.5.4 Social Injustices

Energy poverty disproportionately affects the most vulnerable segments of the population, worsening social inequalities within communities. Marginalized groups, particularly those in rural areas, face considerable challenges in accessing energy services. This deficiency not only diminishes their quality of life but also hinders their participation in social, economic, and political activities (A. Awan & Bilgili, 2022).

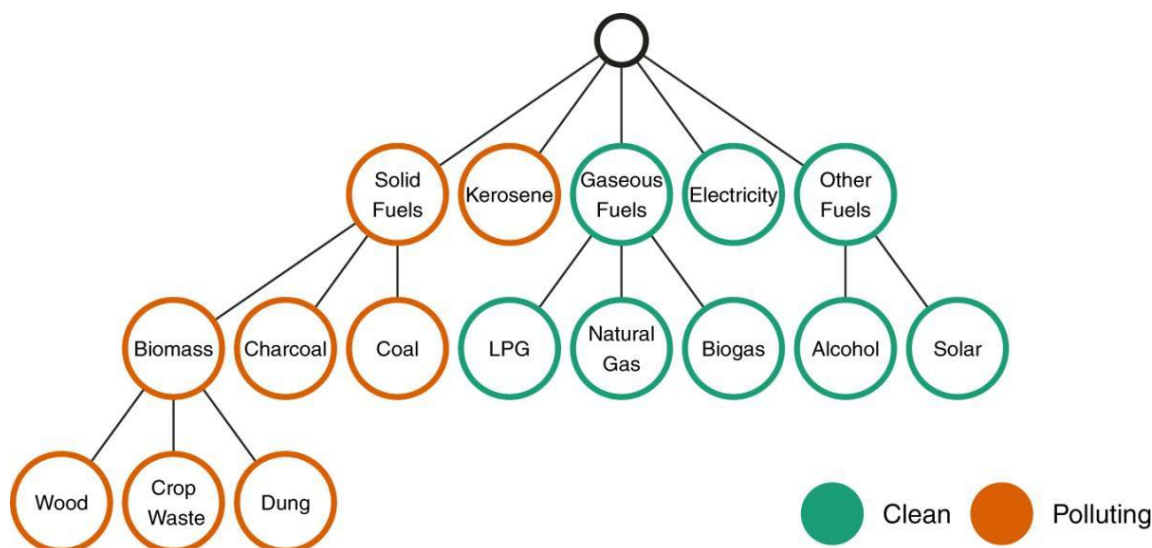
The European Union characterizes energy poverty as a condition where individuals do not have adequate and affordable energy resources to fulfill their basic needs for cooking, heating, and lighting. In rural Pakistan, this problem is especially acute, with many households relying on unclean fuels like wood, dung, and agricultural residues for cooking. These traditional fuel sources are not only inefficient but also release harmful smoke, posing serious health hazards, particularly for women who generally spend more time in cooking environments (Rehfuess & Organization, 2006).

Prolonged inhalation of these toxicants enhances the prevalence of chronic destructive pulmonary disease and respiratory morbidity among women, which contributes to greater mortality among females in these rural communities. On the same note, more women die due to burn incidents caused by the use of an open flame while cooking in the traditional way (Akhtar et al., 2019). Therefore, energy poverty in Pakistan is complex issue with a stable root causes, which also have vast impressions (Okitasari et al., 2019).

2.6 Clean vs unclean cooking fuel

Desirable clean cooking fuels are therefore those that produce less indoor and outdoor emissions as well as being cheap and effective. These fuels conform with the WHO prescribed values for PM_{2.5} emission and CO level emission (Ouyang et al., 2022). Examples of clean cooking fuels are LPG biogas and both the ethanol and electrical power. They are cleaner burning and yield minimal pollution, a factor that has greatly minimized the effect of toxic health effects occasioned by traditional means of cooking especially for women and children who spend most of their time near the cooking hearth (Who, 2021).

On the other hand, dirty cooking fuels include biomass, kerosene, coal and emit high levels of indoor air pollution, and are energetically inefficient, wasting resources while contributing to deforestation and greenhouse gas emissions (WHO, 2021). These traditional fuels cause smoke, which has adverse repercussions to individuals who spend many hours in confined cooking spaces such as women and children (Siddiqui et al., 2023). This smoke consists of carbon monoxide and particulate matter, which cause respiratory diseases, cancers, other diseases, and many maladies (WHO, 2021).



Source: Oliver Stoner, 2021

Figure 1 ***Cooking Fuel Categorization***

2.7 A brief overview of household energy Transition

Household cooking fuels can be classified into three main categories according to (Malla & Timilsina, 2014). The first category consists of traditional fuels, including plant materials, animal waste, and firewood. The second category, medium fuels, encompasses wood powder, charcoal, briquettes, coal, and kerosene. Lastly, modern fuels LPG, biogas, electricity, vegetable oil, and solar energy. Different fuels contribute to varying levels of pollution; for example, using wood in old and out dated stoves produces significantly more air pollution compared to gas or electric stoves. The health risks associated with dirty fuels are exacerbated by poor ventilation and stove designs lacking chimneys, resulting in hazardous indoor air quality (Hanna-Attisha, LaChance, Sadler, & Champney Schnepf, 2016).

In areas like rural Bhalwal, many individuals rely heavily on biomass fuels due to a lack of access to the other two fuel categories, often against their preferences. This situation requires urgent attention from the government to address the needs of these communities.

2.8 Whole scenario clean vs unclean cooking fuel usage in Pakistan

According to these maps, Pakistan is grappling with a significant issue regarding the use of clean versus unclean cooking fuels. In various provinces and regions, traditional fuels like wood, crop residues, and animal dung are frequently utilized for cooking, contributing to

indoor air pollution and associated health problems. However, to some extension, there have been efforts to promote cleaner cuisines using clean fuels including LPG and Natural Gas. The extent to which these cleaner options are available and used, varies from one province or region of the country (Ahmad et al., 2023).

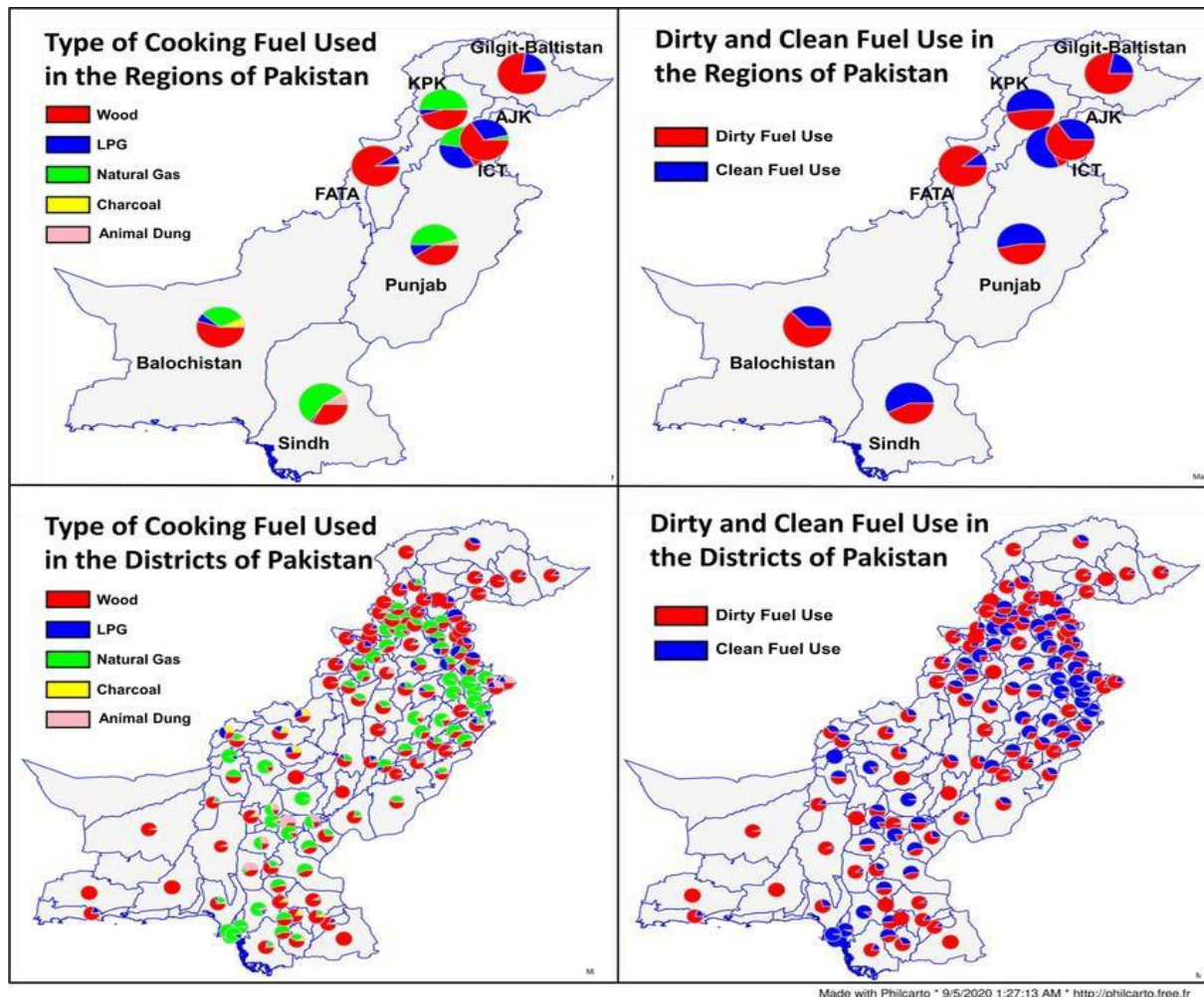


Figure 2 Scenario of clean vs unclean fuel in Pakistan

2.9 Reasons behind the usage of unclean cooking fuel in rural areas of Pakistan

According to (Rahut, Ali, Mottaleb, & Aryal, 2020), there are several reasons why women in Pakistan use solid fuel for cooking, including the following:

Lack of Infrastructure: In many regions of Pakistan or even in the rural areas people have no access to the modern energies such as natural gas or electricity. As such, many households use solid fuels such as wood or crop residues, charcoal or charcoal to prepare their meals.

Cost: They are cheap than other sources of energy hence they can easily able to satisfy the needs of families that are living in poverty.

Cultural Norms: Grilling is another style of cooking that is considered, for a number of reasons particularly cultural, appropriate and traditional in many areas of Pakistan.

Convenience: Its availability is easily accessible from the environment and can be used conveniently by families in Pakistan's rural areas.

2.10 Poverty in Pakistan

Harold defines poverty as twofold: economically, it refers to external conditions that shape a person's behavior in transactions related to consumption, service provision, and professional advice. Culturally, it focuses on the internal attitudes and behaviors an individual brings to various circumstances. Thus, one perspective sees poverty as rooted in a person's external situation, while the other attributes it to character traits.

The World Bank describes absolute poverty as the most severe form of poverty, also known as extreme or abject poverty. As of 2018, individuals living on \$1.90 a day (approximately £1.40) fall into this category.

The United Nations characterizes poverty fundamentally as a denial of choices and opportunities, which undermines human dignity. It encompasses the lack of basic capacities to engage fully in society, such as insufficient resources to feed and clothe a family, absence of educational and healthcare facilities, and lack of access to land or employment. It leads to insecurity, powerlessness, and social exclusion, increasing susceptibility to violence, and often relegating people to fragile environments lacking clean water and sanitation.

In many rural regions of Pakistan, poverty is a primary driver behind the reliance on unclean fuels. According to the World Bank report, approximately 24.3% of the population, which makes Pakistan one of the poorest nations in the world. Yet, poverty has been realized most keenly in the rural regions contrary to the urban regions (World Bank, 2021). The BPL households cannot financially cover the initial costs related to the clean cooking fuels and normally are not connected to modern energy services which make them continue to use traditional stoves that consume unclean fuels. Income This variable was obtained by multiplying the current yearly household income, by 12, to represent the average income per year that the household earns Wealth as this wealth increases, so does the willingness to purchase better fuel types which are expensive but cleaner, and therefore the willingness to shift towards these fuel types (Rahut et al., 2020). The size of household is also another important determinant of poverty status in the country.

In a developing country such as Pakistan, the picture is a bit worrisome because of a combination of increasing population, few human resources. FIGURE 6 POVERTY RATE BY FAMILY SIZE Larger families are often linked to poor people's status. The country has been struggling with poverty since as far as in the 1950s and today, 24,3% of the population is still living below the poverty line, closely to \$ 1.90 a day. This is however significantly worse in the rural areas, as more than 36% of the people in these regions live in poverty, and women make up a considerable proportion of these poorer citizens.

The factors appreciable to poverty in Pakistan comprises education standards, unemployment, inefficiency, instabilities and unavailability of health services. Aid, for instance flood and earthquake, increase poverty levels since they destroy properties, and displace the affected population.

To cater the needs of the poor government has adopted different policies to eradicate poverty such as Benazir Income Support Program, which is categorized as unconditional Money Transfers to the Poor Households. But such efforts have been criticized for being inadequate and inclusive of the vulnerable segments of the population only.

In conclusion, poverty in Pakistan Stands as a course that needs constant aspersion, commitment and collaboration of the Pakistani government, civil society and the international society to eradicate poverty in Pakistan.

2.11 Role of poverty in fuel choice for cooking

Fuel poverty is an important problem, as far as Md. Moniruzzaman's explanation. It has to do with the proportion of the household's total expenditure on energy bills. Based on the UK definition, a household is classified to be in fuel poverty when it spends over a decade of its resources for energy needs including heating (DTI, 2002; FPDD, 2009).

Explaining the rural poor's selectivity for cooking fuels, poverty is established as the main determinant. What is well understood is that the majority of the low-income households cannot afford to switch to cleaner and efficient sources like electricity or LPG or biogas. Thus, they spend resources on traditional and high-emission fuels like biomass including wood, charcoal and the agricultural residues (WHO 2018).

The following main causes help explain this continued dependence on the conventional fuels. The price of these modern cookery means such as LPG or electricity to the family and connections among others is relatively higher than the means the traditional cookery employs. Hence, the traditional types of fuels become cheaper to use than the new renewable sources, notwithstanding their negative impacts on the health of the users and the environment.

Also, the poverty level limits the availability of the other types of fuel. modern cooking fuels may not be accessible especially to the people in the rural area since there are no structures whereby the fuels will be transported. Further, the capital investment in the adoption of modern cooking technologies is some time prohibitive for impoverished households to afford the initial investments. Reduced cost of energy is one of the factors, which influences the usage consumption by the most affected people in the rural areas. Some families rely on a number of traditional biomass resources such as firewood, agricultural wastes, and animal dung since the former is cheap while the latter is easily accessible (Masera, Saatkamp, & Kammen, 2000).

In addition, the population of the Rural areas is not enlightened as to the importance and benefits of integrated clean cooking fuels and technologies hence continue to use the traditional options. This leads to poverty and limited access to capital – there is poverty, and subsequently, limited access to capital to support access to clean cooking solutions (Lindgren, 2020).

2.12 Prevalence of the Use of Unclean Cooking Fuel

The survey, Pakistan Social and Living Standards Measurement Survey 2018-19 indicates that there is a large part of the population in rural zones that use biomass fuels such as wood, crop residues and animal dumping for cooking. Among all the possible fuels that are used by the rural households 59% of them depend mainly on woods for their cooking needs. This use of unclean cooking fuels is worst felt amongst the low-income households, of which eighty percent depend on wood for cooking.

2.13 Factors Influencing the Use of Unclean Cooking Fuel

In rural Pakistan, poverty key to the use of unclean cooking fuels according to the statistical data compiled. Going for the cleaner source of energy is out of reach to lowest income families due to the prohibitive cost; they cannot afford LPG or electricity. Thus, they are able to utilize biomass fuels, which are easily obtained and cheap in the process. Other reasons for this rely on factors such as; unavailability and availability in affordable prices of clean fuels, ignorance of the health consequences of burning unclean fuels, and tradition (Haleem, Khan, & Athar, 2020).

2.14 SDG 1&3: Good Health and Well-Being &No Poverty

The effects of the use of mixed cookery fuel on the female health in a Rural Pakistan lends support to the need to tackle poverty and access to better stoves. According to the six sustainable development goals which are to be undertaken the goal of shifting to cleaner fuels will help achieve goal 1 and goal 3 of eradicating poverty and promoting good health. When using modern kinds of energy for cooking such as LPG and biogas, cases of respiratory diseases, eye infections, as well as burn injuries can be minimized (Rosenthal et al., 2018).

2.15 Impact on the Environment

Its use of solid cooking fuels also creates severe health issues, and it affects the environment in a negative way. When wood and charcoal is burned, they release gases such as carbon monoxide, nitrogen oxides as well as particulate matters that anyway leads to poor air quality and at the same contributes to climate change. In addition, these fuels help to contribute to deforestation since trees are chopped down in the process of supplying wood and charcoal (Oluwatosin et al., 2022).

2.16 Impact on the Economy

Any collection, usage of solid cooking fuels may originate from forest resources, leading to the increase in deforestation which in turn disperses deserts and reduces the number of species. In this process the environment is gotten to be non-friendly and even turn out to be toxic in a manner that affects the economy by encouraging people to exploit the available resource in the natural world. Also, depending on the solid fuels can be costly, as most are purchase from vendors at inflated prices. Time devoted to sourcing for these fuels takes away the time that could otherwise be spent in school, and in productive endeavors such as being employed.

The use of solid fuel is also found from studies to differ widely with indicated statistic showing the rates of use in the developed countries and others as shown below. Present data show that the highest usage rates are reported in sub-Saharan Africa (SSA), South East Asia (SEA), and the western pacific region including rural China. According to WHO (2015), in 2013, approximately 79% of the SSA population, 63% of the SEA population, and only 40% of the population of the Western Pacific still used solid fuels for cooking. The biggest reduction in the use of solid fuels has been registered in Western Pacific region: 74 percent in 2003 and 40 percent in 2013. Nevertheless, compared to any other area, the percentage of households using solid fuels barely declined within SSA from 77 percent in 2003 to 79 percent in 2013. According to the survey conducted among rural residents of different countries, 95% families use solid fuel; 91% of which low-income families rely on biomass for cooking and heating (Shupler et al., 2022).

From the studies done in Sargodha, Pakistan, it has been realized that poverty influences the daily lives of many people especially women. One major consequence of this poverty is the reliance on unclean cooking fuels such as wood, charcoal, and animal dung, which can adversely affect women's health. This literature review aims to examine the connections between poverty, wood fuel consumption, and the health of women in rural Sargodha (R. U. Awan, Sher, & Abbas, 2013).

Table 2 : Area of impact and negative externalities

Area of impact	Negative externalities
Health	▪ Many types of health conditions can be related with HAP ▪ Injuries sustained in the body of a household member due to old fuels/ cooking equipment ▪ acerbated respiratory and acute physical illness due to firewood collection
Environment	• Greenhouse gas emissions due to inefficiency in fuel production and that emanate from the actual consumption process. • Black carbon emission generated from solid fuel cooking and its influence on catalytic warming. • Sustained pressures from fuel harvesting as well as felling of trees for lumbering, charcoal production etc. • Reduction in crop yields owing to habitat and c) Utilization of dung as fuel through destruction and manure burning
Economic development	▪ massive expenditure on solid fuel consequent on reliance on non-efficient fuels and stovesvery low chance of earning a living because of the time spent in collecting fuel and very low chance of earning an income because of extra time spent cookingnd very low opportunities for income generation due to extra time spent cooking ▪ very low opportunities for education from lost time (due to fuel collection and cooking) particularly for women and girls, which in turns impacts on future earnings.

<i>Gender</i>	▪ HAP and health effects such as burns and firewood collection injuries ▪ Negatives on educational outcomes/improved time at school/studying ▪ Loss of market employment and its concomitant status in the household. ▪ Reduced leisure time ▪ Violence committed when people are going out to gather woods
<i>Other social effects</i>	▪ Other adverse consequences for esthetics (e.g. insufficient lighting and home environment contaminated with soot) ▪ Nutrition loss because of partly prepared food or little food budgets ▪ Hunger and poverty pull off another act because the scarce resources are channeled to pay for fuel.

2.17 Gender and Development

For a long time, the term "gender" was synonymous with "sex" (Siwal, 2008). Gender encompasses the roles and expectations assigned to men and women based on cultural norms (Oakley, 1972). Beyond societal influences, biological factors have minimal impact on gender distinctions (Kessler and MacKenna, 1978; Lorber, 1994). Lucal (1999) describes gender as "the cultural framework of behaviors, attitudes, and expressions associated with individuals of the same sex." This concept carries both social and economic implications for personal relationships (Mukhopadhyay, 2003).

Sabates-Wheeler and Kabeer (2003) provide a more expansive definition of "gender," viewing it as the relational dynamics between men and women within a society. These dynamics in turn influence the differential participation in areas such as sports physical activity, social relationships and responsibilities. Therefore, thinning out gender, it only becomes apparent that these inequalities and distinctions exist across the world. Leadership opportunities, development, and environmental services are other reasons leading to gender work disparities. In addition, it is evident that cultural context and communication environment cause gender

inequality. It is important to have a good understanding of what is meant by the term ‘patriarchy’, since it is a principle cause of gender inequalities. Additionally, recognizing the diverse behaviors and characteristics of individuals in social and recreational contexts is important for understanding the nuances of gender and its implications for the LGBTQ+ community (Pollert, 1996).

2.18 Gender and useful resource allocation

In many developing countries, gender has traditionally influenced the allocation of valuable resources (Agarwal, 1994). This distribution system has primarily benefited men, while women's rights, particularly regarding land and resource allocation, remain inadequately protected by law (Haddad et al., 1997). Additionally, the exchange of goods between genders is often influenced by the status of marital institutions (Whitehead, 1981; Guyer, 1988). A significant factor contributing to the unequal distribution of economic resources is the persistence of legal frameworks that have replaced moral laws in various regions. For example, in India, where the majority of the population identifies as Hindu, inheritance laws are primarily dictated by Hindu religious principles, which complicates matters for those influenced by Islamic traditions.

2.19 Processes linking gender hierarchies and fuel choice

We contend that gender inequality influences power dynamics within the household, particularly altering the perceived value of women's time, which subsequently affects fuel-related decisions. Historically, women have shouldered a significant amount of unpaid labor, including domestic chores, childcare, and the informal procurement of goods and services (Agarwal, 1997; England, 2005). The tasks commonly referred to as "domestic drudgery" offer few inherent rewards, compelling women to gather resources like phragmites to cut costs, despite the irreplaceable benefits of managing households and caring for children (Agarwal, 1986). If access to fuel could enable women to devote more time to paid work, households would be more inclined to invest in fuel. Given that women disproportionately bear the time and health burdens associated with traditional biofuels, households where women have greater negotiating power are more likely to favor products that enhance their health and convenience, such as clean cooking fuels. A comprehensive review by Köhlin (2011) in the 2012 World Development Report on Gender Parity and Development supports the idea that access to clean

cooking fuel significantly enhances women's quality of life. However, the authors caution against implementing broad policy measures without considering local energy alternatives, prevailing gender norms, and the decision-making processes within households.

2.20 Adverse Health Effects Due to IAP

Numerous complicated compounds are released when biomass fuels are not completely burned in simple stoves. Suspended particulate matter, formaldehyde, carbon monoxide, nitrogen dioxide, ozone, and polycyclic aromatic hydrocarbons are examples of pollutants.

Table 3: *The health effects of indoor air pollution exposure in developing countries*

Indoor Air pollutants and their potential health effects	
POLLUTANTS	HEALTH EFFECTS
Particulate matters (PM-10/2.5)	▪ Respiratory infections ▪ COPD & exacerbation ▪ Wheezing, asthma ▪ Excess mortality including CVD
Carbon monoxide (CO)	▪ Low birth weight ▪ Increase perinatal deaths
Benzopyrene	▪ Lung cancer ▪ Cancer of mouth, pharynx, larynx
Formaldehyde	▪ Increase infections ▪ May lead to asthma
Nitrogen oxides (NO _x)	▪ Wheezing ▪ Respiratory infections and reduced lung functions
Sulphur oxides (SO _x)	▪ Wheezing, asthma ▪ COPD, CVD
Smoke	▪ Cataract

2.21 Energy Poverty and Climate Change

Energy poverty significantly impacts women, particularly in the context of climate change. In rural areas, women are primarily responsible for securing food and energy for their families, which makes them heavily reliant on local natural resources. However, climate change and its associated extreme weather events can disrupt these vital resources, affecting food availability and the overall stability of food systems.

As a result, women often have to travel greater distances to find fuelwood and clean drinking water. Increased flooding, for instance, can lead to soil contamination with arsenic, compromising groundwater quality. This situation disproportionately affects women and children, who traditionally bear the burden of collecting clean water.

Moreover, rural women frequently miss out on the benefits of technological advancements. Limited resources, low income, lack of decision-making power, and inadequate property rights hinder their ability to utilize technologies that could provide access to clean water or modern energy sources, such as solar energy and liquefied petroleum gas (LPG) (C. Pavithra, 2021, Observer Research Foundation).

2.22 Role of Women in Clean Cooking Transition

Target to achieve global access to clean cooking by 2030, it is essential to involve women at every level of the value chain, as they play a crucial role in the clean cooking sector. Globally, women and girls are primarily responsible for daily cooking tasks, and transitioning to clean cooking can significantly alleviate the economic and health challenges they face (Women & CSA). Women are not only the main users but also the managers of household energy systems, making their involvement vital. They endure a disproportionate burden from traditional cooking methods, facing issues such as indoor air pollution, the time spent collecting fuelwood, and the health risks associated with using low-quality fuels.

The effects of energy poverty are worst experienced by women and girls since their potential to achieve decent human life is restricted by inadequate availability of energy for use in the areas of health, schooling, nutrition, protection and livelihood. It is clear that in order to advance gender equality and ensure sustainable energy for all we need to focus on women's

leadership, employment and especially the entrepreneurship within the energy sector outlined in the SDG Action 2023.

In order to tackle these obstacles, it is imperative that women are included in the formulating of clean cooking technologies and interventions. They should play an active role in how clean cooking interventions are framed, delivered, and assessed, based on their roles as managers of home energy (WECS, 2020). However, it is important for women to assume specific and clean cooking initiatives leadership. This includes procurement from women owned enterprises in clean cooking sectors, is capacity building for promoting more training and development for the improvement of capabilities and markets for clean cooking, and for engaging women as champions to drive demand for clean cooking solutions (WECS, 2020).

Catherine Rampell, a writer for The New York Times, notes that on an average day, 66.6% of men and 85% of women report engaging in some form of household activity. Globally, women and girls predominantly carry out daily cooking responsibilities, and switching to clean cooking fuels can help mitigate their disproportionate health issues and financial burdens.

In Pakistan, especially in rural areas, women and girls are typically in charge of household tasks, particularly cooking. While they face the severe challenges of clean energy poverty, their essential role in promoting sustainable development is increasingly recognized, aligning with Sustainable Development Goals 1 and 3. Besides having to gather biomass for energy, women in these regions also suffer from respiratory health problems due to exposure to harmful smoke (Dr. Abid Qaiyum Suleri, 2013).

Women and girls are the primary consumers and buyers of household energy services, bearing most of the health-related costs associated with using dirty and inefficient energy sources. The prolonged exposure to harmful air pollutants puts them and their children at greater risk of health issues. The reliance on polluting fuels and technologies can lead to serious health consequences, including burns, injuries, poisonings, cataracts, chronic headaches, and other adverse effects.

The following points developed from the literature appointments show that in many LMICs, most female population or women are responsible for the collection of fuel. They are exposed to safety hazards while gathering and processing fuel, and are also under much time pressure that limits the hours available for learning, leisure or work (WHO, 2016).

2.23 SDGs related to gender and affordability of clean energy

Sustainable Development Goals four of them; 5th SDG is about gender equality while the 7th SDG is about affordable and clean energy where the effects of dirty cooking fuels are highlighted as a menace to women's health. Many Goals of the SDG are interrelated with each other Goals, however, two goals are as follows Goal 7 focuses on Affordable, Reliable, Sustainable and Modern energy for all and Goal 5 addresses on Gender Equality and Women Empowerment for all. Burning of polluting cooking fuels tends to cause indoor pollution, subsequently, impacts the health of women and children. In the event that these challenges are effectively addressed it should thus be possible to improve the health of the target and beneficiary females in vulnerable communities thus contributing to of the said SDGs.

2.24 Human Security to gender and clean energy fuel

Traditional security was defined in the context of external threats following recent wars; some scholars extended the notion of security to embrace the protection of people from domestic brutality. Traditionally, security was understood as protecting a territory from the outside threats, that issue was recently coined in the context of threats of weapons of mass destruction, mainly nuclear ones. This shift must mean that security should is/ must be more humane after that; this is why such weapons are so devastating if used one day (Kofi Annan, 1995).

Individual security is best known as a concept which views people's security, protection, and quality of life as more valuable than state security. The proponents of human security posit that matters of poverty, disease, hunger, displacement, environmental degradation, and social exclusion threaten global security (by Cristina Churrua Muguruza). From the Global Partnership for the Prevention of Armed Conflict (GPPAC), human security is defined in the sense that people's protection is a human right. This concept refers to fear, hunger and the absence of humiliation, and affects how we do conflict analysis and design of peace interventions.

People security now quickly becomes a significant part of the emphasis on how exactly gender, energy poverty, unclean cooking fuels, and women's health interrelate. One of the concepts of security, that looks closely at protection of persons and their groups, human security is geared towards preventing threats against the lives and integrity of people. In the context of energy poverty, clean cooking fuel is a necessity for the health of women.

The effects of energy poverty are worst felt by females since they are usually charged with the responsibilities of preparing food and fetching fuel within the homes. As the traditional approach to cooking in many developing countries, fuels used are often unclean and include wood, charcoal and kerosene which emit bad fumes when burning. This exposure causes respiratory diseases, eye complications and others, and these affects women and children, who spend most of their time in the kitchens, most.

Furthermore, it will constrain women constructive engagement in other activities by the time they spend in collecting fuel and using the traditional stove and techniques in other activities such as education and other income generating activities as well as other activities that may quality their lives.

In order to address such challenges, let us insist on human security in the fight against energy destitution. This entails guaranteeing that women cook using clean fuels and proper and efficient cooking stoves that reduce women and children's vulnerability to emissions. It also needs to respond to global imperatives associated with increasing inequity between women and men and energy poor and low literacy and livelihoods.

Altogether, the relationship between gender at energy poverty, unclean cooking fuels and women health reveal the centrality of human security in energy poverty. Reducing the impact of destructive fuels and increasing the supply of clean fuels and energy efficiently for women and girls in particular will help improve their quality of life, empower them and allow the world to achieve sustainable development goals.

2.25 Summary

The use of biomass fuel affects the health of women and children massively and is a challenge to humanity since 49% of the global population uses biomass fuel. For example, in Pakistan, more than 70 percent of the population uses biomass fuels for cooking. The literature for my thesis topic shows that although there are numerous research articles showing the adverse health effects of biomass fuel use, there is little research done on what contributes to energy-poor conditions. Moreover, women's health and well-being are also area of interest in this research as they independently assess both poverty and unclean cooking fuels' impacts on the status of women's health.

CHAPTER No. 3

FRAMEWORK AND METHODOLOGY

3.1 Theoretical Narrative for The Study

This paper identifies that there are many ways to learn about the association between impure fuel and energy poverty.

3.1.1 Dependency Theory

This research would be best addressed by using a framework derived from Dependency Theory. Studying the dependency of rural Sargodha with unclean fuels and energy-related poverty through the lens of Dependency theory exposes the complexity of the relationship between the two. This theory presumes that third world countries, including Pakistan, is reliant upon the first world countries in regard to their economic growth and hence tooyo poverty. When explored in relation to current Sargodha rural setting the dependency theory can well embody the structural factors that caused widespread use of unclean fuels and the ongoing problems that increases difficulty in access to cheap efficient and clean sources of energy in the rural areas. (Frank, A. G. (1970). As far as the dependence context of the rural Sargodha is concerned, dependency theory can explain the following:

3.1.2 Energy Poverty Theory

Global energy poverty might be described in simple terms as the inability of households to afford energy to meet their basic needs, as defined by the IEA. That includes both energy availability and the cost of getting it. Referring to the rural population, energy poverty could be defined as inadequate supply and demand of electricity, use of firewood, dung, and other traditional fuels, and high expenditure on energy. (IEA-2023)

3.1.3 Relevance to the Study

This study also encompasses energy poverty theory as well as environmental justice theory. Energy poverty can help to identify obstacles with reference to reasonable supply and demand of energy resources in rural households. The theory of environmental justice helps in explaining the impact of using unclean fuels among the rural people. By the help of these theoretical frameworks the study can examine relationship between unclean fuel and energy

poverty in rural area of Bhalwal, district Sargodha, Pakistan.

3.1.4 Energy Ladder Model

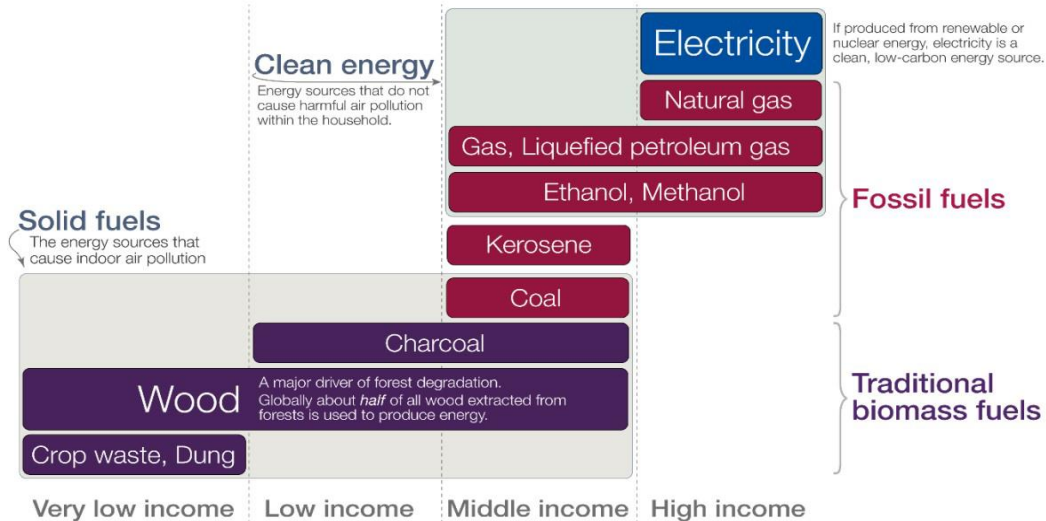
It is a ladder model that depicts the final user's shift from the use of traditional fuel such as wood and animal dung, to the modern fuels that include electricity and natural gas. Traditional biomass use is still dominant in countries like Pakistan where absence of electricity for the majority of the population is still a fantasy in the realm of the impossible.

These unclean fuels have a poor impact on the health of women in the rural areas of Pakistan. Burning of these fuels exposes the women to indoor air pollution hence they are highly prone to respiratory diseases. Also, they have to deal with certain risks to burn and eye injuries. They are also vulnerable owing to a demanding process of collection of fuel wood which not only leads to injuries but also low output. The Energy Ladder Model by Schurr and Newberger show that as families gain income they are more likely to shift to less polluting energy that may improve indoor air and reduce exposure to toxic fumes. Primary prevention measures may also be used for promoting awareness of health risks related to the use of unclean cooking fuels and in transforming the use of clean energies.

Thus, the Energy Ladder Model should be viewed as a helpful conceptual tool when comprehending the current problem of energy poverty throughout Pakistan and its implications for the health of women in rural areas. Adoption of clean renewable energy could help to minimize the health adverse effects arising from the utilization of unclean cookery fuels among women in these societies.

The 'Energy Ladder'

The dominant energy source for cooking and heating, by level of income



Based on: WHO – Fuel for life: household energy and health.
OurWorldinData.org – Research and data to make progress against the world's largest problems.

Licensed under CC-BY by the author Max Roser

Source: Max Roser, 2021

Figure 3 Energy Ladder Model

3.2 Conceptual framework

The paper finds that Energy poverty remains a major issue of concern for many developing countries among which is Pakistan. In rural areas, it was ascertained that a significant fraction of the population uses unclean fuels for cooking namely, wood, animal dump and agricultural residues. These fuels release fumes that are very unhealthy to the health of man, much more to women who spend most of their time in the kitchen cooking and doing other chores.

The following diagram shows a conceptual model derived from the current literature for analyzing research questions and possible solutions. It points out that poor energy access in Pakistan has adverse impacts on the health of women and that energy poverty is connected to climate change impacts (Nawaz, 2021). Moreover, energy poverty also impacts the other social vices and, therefore, reduces the speed of economic development (Shahbaz, 2018). This framework has the predisposition to explore gender relations and energy poverty by examining how unclean cook fuels are harsh on women's health.

The conceptual model comprises three key components: Energy poverty, gender, and Health can be summarized as the main aspects of cross-impact, while each component is split into segments to provide a better understanding of their connection.

Income stands out as one of the most important drivers affecting fuel selection, which will be perfectly explained by the Energy Ladder Model. The first findings presented on the two preferences have revealed the relevance of household income (Ateba, 2018). Nonetheless, Whitfield (2018 cited in Prinsloo) pointed out that although income is a key determinant, energy research has paid scant attention to other dimensions that affect household fuel choice. More so, Van der Kroon et al. (2013) postulates that the location of a particular household greatly influences the opportunities as well as possible income of the same.

Heltberg (2005) and Davis (1998) both supported the point that the income is not as suitable a variable as the expenditure when considering the decision about fuel choices. Fashion in energy consumption is completely different in low-income households and high-income households. Modern fuels are typically expensive coupled with other transaction costs election makes it hard for the low income families to access these sources of energy frequently.

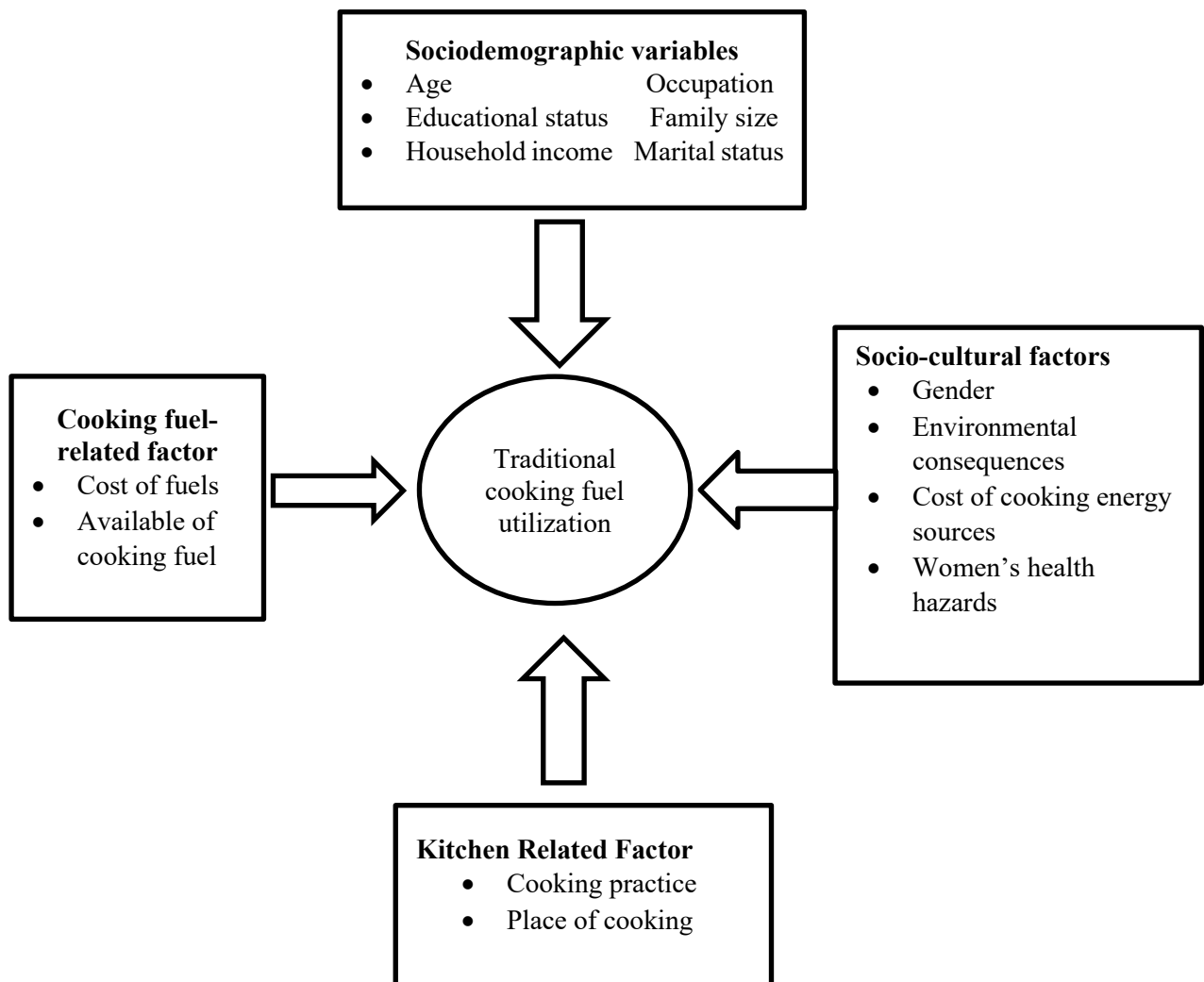
The financial burden of fuel for a household largely depends on the price per unit of fuel consumed (Fourie, 2018). An increase in household income facilitates the transition to more sustainable fuels, subsequently enhancing overall energy consumption (Mestl & Eskeland, 2019). Link et al. (2012) highlighted that minimum wage levels influence reliance on biomass fuels. Rao and Reddy (2013) argued that higher household incomes resulting from employment opportunities increase the likelihood of opting for cleaner energy sources. Additionally, Van der Kroon (2013) pointed out that the choice of fuel is also shaped by the household's capital resources.

Kowsari and Zerriffi (2011) noted that the energy consumption of a household is influenced by its size. Larger households tend to adopt multiple energy sources more readily than smaller ones. Ado (2016) emphasized that the number of occupants in a household plays a crucial role in determining energy choices, with larger households being more inclined to switch fuels.

In patriarchal societies like Pakistan, women often bear a disproportionate share of domestic responsibilities, including cooking and cleaning. Gender significantly affects fuel choice; in households where men are the primary earners and decision-makers, there may be less emphasis on the benefits of clean cooking fuels (Schlag & Zuzarte, 2008). Treiber (2015) echoed this sentiment, noting that cultural norms may lead women to favor traditional energy sources. Research indicates that women prefer using charcoal and fuelwood for tasks like making chapattis, as these options provide consistent heat and enhance flavor (Treiber, 2015).

Van der Kroon et al. (2013) found that in many Southeast Asian regions, women and children are the primary gatherers of firewood. Balmer (2007) discussed how gender roles dictate specific household responsibilities, leading to distinct task divisions between men and women. Living standards depend on various energy types for essential activities, including cooking, lighting, heating, and cooling (Welsch & Biermann, 2017).

The lack of energy and the effects of extreme weather also contribute to health challenges in Pakistan. The country faces a dual crisis of inadequate energy supply and the adverse impacts of climate change (Fahad & Wang, 2020). Eckstein et al. (2019) ranked Pakistan as the fifth most vulnerable nation to climate change effects. Nawaz and Iqbal (2020) reported that approximately 86% of the population relies on traditional fuels, primarily wood, for their cooking needs.



Conceptual Framework of the study

Factor affecting usage of unclean cooking fuel and its impact on women's health

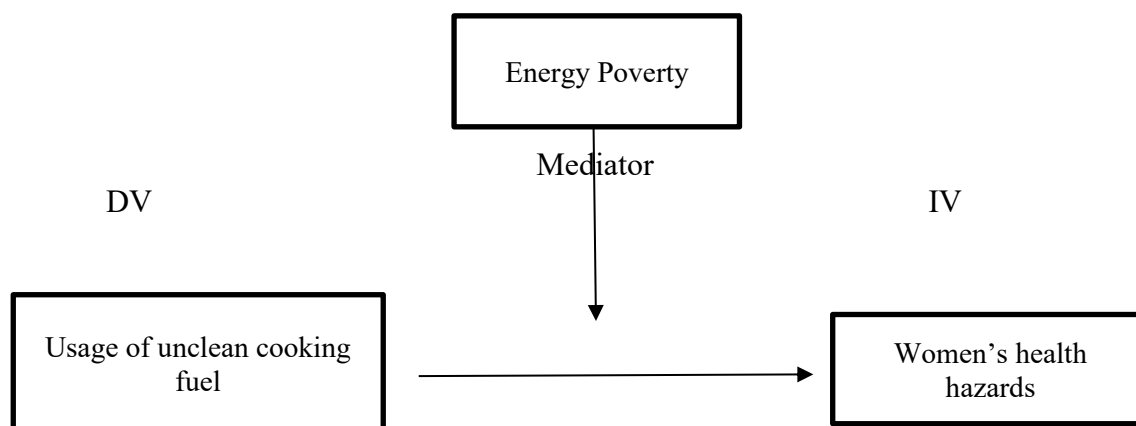


Figure 3.2: Based on Shuwu 2021, Alkire,2023 Suppa,2023 Bluffstone,2015

3.3 Operational Definitions

Unclean Fuel: It shows even nonrenewable resources utilization such as biomass (wood, crop residue), coal, kerosene used and being highly injurious to health in rural areas (World Health Organization, 2020).

Energy Poverty: Among all states, there is no state in which households have no, or limited, access to reliable and clean energy services. These include lack of power light and their reliance on avertible sources of energy like dung cakes and sticks in rural Sargodha (Pachauri et al., 2013).

Unclean Fuel Use: Unclean fuel is defined as fuel derived from traditional sources as biomass (such as wood, crop residues, animal dung) and coal. These fuels are usually employed in the developing countries since they are cheap and readily available though they give severe effects. (WHO-2018).

Health Impacts: The effects of using unclean fuels have found to cause respiratory and cardiovascular diseases, because women and children are more exposed to the effects of indoor air pollution. Sulphur dioxide and particulate matter, carbon monoxide and other noxious chemicals are emitted when crops and coals are burned. School Based Health Care Centers: Where Students Go for Medical Treatment and Health Promotion Services (Ezzati, & Kammen, D. M. 2001).

Socio Economic Effects: Dirty fuel use puts a lot of pressure on the finances of households by expending much cash on fuel and on the development of a neighborhood by the health related loss of productivity and polluting of the environment. (Smith & Mehta, 2003)

Environmental Consequences: The use of dirty fuels raises the emission of air borne pollutants that cause air pollution and aggravate climate change and environmental depletion. Such emissions can be in form of carbon dioxide, methane and black carbon. (Bond, Sun 2005)

Fuel Use Characteristics and Household Characteristics: How people use unclean fuel and other types of fuel depends on characteristics of the household such as their income, education and geographical location. Of course, knowledge of these patterns is useful in the creating of niche interventions. (Bhattacharya & Smith (2004) Other sources of energy are also relevant and can be tend in order to get free from the unclean sources of energy as well as to raise the availability of energy for the people to utilize. (REN21. 2022)

Local Activities: Donations for other local activities, for example local cooperatives for clean energy or energy efficient technologies should also be used towards the reduction of unclean fuels. (Practical Action. 2020)

Unclean Fuel Use (Mitigation): Mitigation efforts include promoting the use of alternative energy sources and improving access to modern energy services through various programs and initiatives. (UNDP 2020)

3.4 Research Paradigm

The use of biomass fuel is a social phenomenon that has a direct impact on human health through environmental factors. This phenomenon has no one truth; instead, it is interpreted, socially produced, subjective, and subject to multiple beliefs. Thus, interpretivism serves as the research paradigm for this study. According to the interpretative perspective, facts cannot be divorced from people's values and ideas (Kincheloe, McLaren, & Steinberg, 2011). From an interpretive perspective, basic relationships shape or clarify particular facets of the society that the study is focusing on. This technique uses the research findings to construct reality rather than looking for a precise match between them and reality. Reference: Bowen (2009); Kincheloe et al. (2011).

This paradigm is highly suitable because the research explores the interrelationship and experiences of women regarding unclean cooking fuel and their health.

This research focuses on lived experiences. It allows for understanding the subjective realities of women, their perceptions of health risks, coping mechanisms, and the social and cultural factors influencing their choices and experiences with cooking fuel. It also helps researchers delve into the meanings women attribute to their health issues and the role of cooking fuel in their lives. In a Social context, it acknowledges that gender and energy poverty are socially

constructed concepts and that their impact on health is shaped by social norms, power dynamics, and access to resources within communities.

For the topic "GENDER AND ENERGY POVERTY; EXPLORING THE INTERRELATIONSHIP BETWEEN UNCLEAN COOKING FUEL AND WOMEN'S HEALTH," Interpretivism is the most fitting primary research paradigm. It allows researchers to explore the complex social, cultural, and political factors that contribute to this issue and to understand the lived experiences and perspectives of the women affected. A study using an Interpretivist approach would focus on understanding the meanings and experiences of women. However, the core of the research, given its focus on gender, poverty, and lived experiences, would likely be rooted in the philosophical assumptions of Interpretivism.

Therefore, to ensure that researchers capture real opinion from the people, two research paradigms namely constructivism and interpretivism are being used to make sense of societies' norms and cultures. In this regard, the researcher can generate new ideas based on others' perceptions and experiences according to the paradigm indicated below (Gregg et al., 2001). In this study, the interpretative paradigm will enable us to unravel some of the variables operating as barriers to energy poverty by correlating different diseases affecting women and dirty cooking fuel.

3.5 Research Design

Research design is a mapped out plan for the whole research process (Creswell; 2014). It outlines the specific path for the complete research journey, and it should be followed based on the type of research inquiries (Creswell, 2014; Creswell & Clark, 2011; Leech & Onwuegbuzie, 2009). Researchers and scholars recognize the importance of selecting appropriate research methods that align with the objectives and nature of the study being carried out. This study investigated the factors that explore the relationship between the usage of biomass fuel and its impact on women's health in this study, as the title depicts, where the qualitative survey method is used. Because the research topic is exploratory, a qualitative design was chosen to focus on women's health due to the usage of biomass fuel and the factors that affect the Fuel choice. Detailed research design is explained in the following table:

Table 4 : Research Design

Research Objective	To evaluate the impact of using solid cooking fuel on various health outcomes of residents of rural areas of Bhalwal district Sargodha Pakistan.
Research Question	What are the prevalence and patterns of usage of unclean cooking? fuels among women in rural areas of Bhalwal district Sargodha?
Sampling Technique	The technique is purposive sampling
Data Collection	Data is collected through a qualitative survey method.
Data Analysis	Data is analyzed through descriptive statistics

3.6 Research Approach and Strategy

Clean cooking fuel adoption is a social phenomenon worldwide. It is directly correlated with the health of women and the well-being of society and to reducing energy poverty. This phenomenon is constructed socially and is subjective and there may be multiple beliefs regarding this. So an interpretative and constructive approach is adopted.

3.6.1 Justification of the Research

The study examines the connection between unclean cooking fuel, women's health, and gender disparities in energy poverty. The study seeks to add to the current body of research by pointing out the differences between health concerns and types of cooking fuel, as well as obstacles to switching to clean cooking fuel (Rasel, 2024).

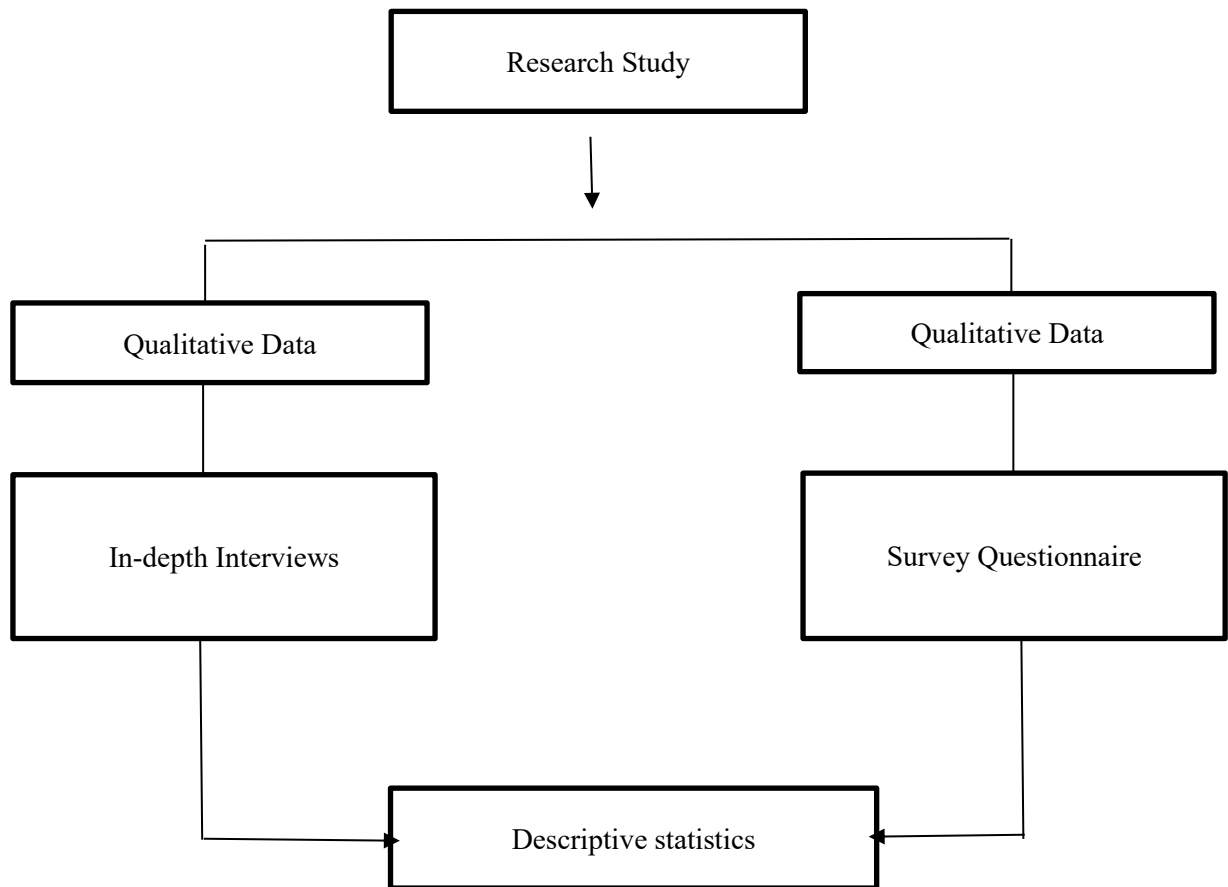
Most importantly, this research focuses on the particular problems in a specific area - the investigation of issues and challenges to women's health caused by the use of dirty cooking

fuel in rural areas of Bhalwal district Sargodha, Pakistan. The problem required a thorough examination that could not be accomplished using alternative research techniques. Moreover, this method allows for a variety of statistical techniques and survey questionnaires to be utilized for data collection and analysis, as highlighted in the study by Muhammad (2017). The goals and methods of the research resulted in the choice of the study location. When it comes to collecting information through survey questions, the method is flexible. (Muhammad, 2017) must be referenced. The research are analysis of gender and energy poverty exploring the relationship between unclean cooking fuel and women's health. The research aims to provide to the existing literature by highlighting the comparison between health issues and cooking fuel categories along with barriers to adopting clean cooking fuel (Rasel,2024).

First, this study explores the specific problems and challenges of women's health due to the use of unsafe cooking fuel in rural areas of Sargodha, Balwal District, Pakistan. This was a problem that required in-depth analysis that could not be accomplished with other research methods. This approach is also more flexible in the methods used to collect and analyze data, including the multiple statistical methods and survey questionnaires used in this study (Muhammad, 2017). The research's aims and procedures led to the selection of the study area. When it comes to gathering data using methods like survey questions, the technique is adaptable. (Muhammad, 2017).

3.7 Framework of the Methodology

The methodological framework integrates various qualitative data collection methods to explore the issues of unclean fuel use and energy poverty. The framework includes semi-structured interviews, surveys, and observational methods to capture a wide range of perspectives and experiences from the rural population of District Bhalwal, Sargodha.



3.8 Qualitative Approach

The qualitative approach utilizes the survey questionnaire method to statistically explain attitudes by selecting samples from the intended population. There are four types of qualitative survey questionnaires: open-ended, close-ended (static), close-ended (dynamic), and task-based (sauru,2018). This research employed qualitative survey methodology to investigate research questions RQ1, RQ2, and RQ3 focusing on the factors that affect women's health due to the usage of unclean cooking fuel and also highlighting the major factor to their fuel choice preference in rural areas of Bhalwal District Sargodha, Pakistan.

3.8.1 Population

The targeted population for our study consists of the total population of district Bhalwal that is 206,194 according to the census 2023.

3.8.2 Data Collection

Pakistan is primarily a rural nation with approximately two-thirds of its population residing in rural areas. areas with restricted access to commercial and clean fuel energy, relying on traditional fuel methods and using biomass such as wood, straw, dung, charcoal, and coal. primary options for household cooking fuel. When burned in the open air, wood releases harmful toxins and chemicals, negatively impacting health. (Muhammad,2017). As the Bureau of Statistics 2019-20, Bhalwal was declared the most populated area, and according to the 2017 census shows a brief picture of the district Bhalwal, that mostly population nearly 69 % lives in rural areas. Hence, this is the main reason for the selection of a sample.

The research relies on primary data. I have gathered survey-related information from the households residing in the rural regions of District Bhalwal, Sargodha. A total of fifteen (15) villages of the district Bhalwal are chosen for the household survey. The open-ended survey questionnaire is categorized into various sections covering socio-demographic details, diseases resulting from biomass fuel use, household history, types of biomass fuel, stove features, income sources, kitchen structure, and healthcare resources.

The data for this study were collected through the use of Survey questionnaires from the households of rural areas of district Bhalwal Sargodha, Pakistan. To gather data, a survey approach was created. Data will be gathered mostly using the survey method's questions. The majority of the survey's questions were closed-ended, but some questions were open-ended.

The questionnaire is broken up into sections that include sociodemographic data, diseases that can arise from using biomass fuel, the trajectory of a house, the types of biomass fuel that can be used, the features of stoves, and the resources that are available to treat health problems. A pre-written statement or set of questions is used to document the participants' responses as suggested (Syed Waqas Shabbier, 2021). The questionnaire was adjusted to take into account factors described in the literature. The appropriate scale was used for data collection that depend on what specific constructs you are measuring.

3.8.3 Sampling Technique

Sampling is a technique to use a sample that truly aligns with the overall goal of the study.

In this study, purposive sampling was the method of sampling. Purposive sampling, according to Kassiani Nikolopoulou (2022), Purposive sampling encompasses a collection of non-probability sampling methods where units are chosen based on attributes that are necessary for your sample. Put differently, purposive sampling involves "on purpose" unit selection.



Figure 4 Sample Technique

The main focus of this study is to collect the information for effected women's and give opportunities to each age of woman in rural areas. The size of the sample was 120. According to Qualitative research standards (Guest,2006) data saturation is often reached between 60-120 interviews, depending on the topics complexity. In my case saturation was achieved 110 participants but I include 120 to ensure comprehensive coverage of different income group of fuel patterns. The study was conducted in a regional language (Punjabi), which may pose a language barrier for participants who do not speak or understand English. Moreover, the responses of the participants in their local language will further be reproduced in the English.

3.8.4 Data Analysis

The method for managing and collecting the data to address research question was through descriptive statistics. The in-depth interviews and survey questionnaires were described statistically.

Using descriptive statistics in a qualitative survey method on gender and energy poverty provides a foundational overview of the data, helps identify significant patterns, and enhances the depth and clarity of understanding regarding how unclean cooking fuels impact women's

health. It bridges qualitative insights with quantitative summaries, enabling a more holistic analysis of the interrelationship between energy practices and health outcomes.

3.9 Ethical Considerations

Research ethics are the essential component that permeates every step of the process, from choosing and approving a research topic to gathering and analyzing data to disseminating findings at the end (Resnik & Elliott, 2016). According to Pietila, Nurmi, Halkoaho, and Kyngas (2020), ethical issues include the idea of subject protection and conducting research based on moral principles.

The research has considered ethical aspects. The research subjects did not experience any form of harm at all. The privacy and respect of the research participant's information was upheld. The participants granted permission for the interviews to be conducted and recorded. The confidentiality of the data was preserved by maintaining the anonymity of the survey questionnaire. Before involving the participants, the research goals and objectives were thoroughly explained, and their consent was obtained before obtaining the data. The research participants were guaranteed that the study was not associated with any organization and did not receive any financial support.

3.10 Summary of Chapter

This chapter outlines the theoretical Framework, conceptual framework, and methodology for exploring the relationship between unclean fuel and energy poverty in rural areas of Bhalwal district Sargodha. It employs a qualitative approach, research, and interpretivism to gather and analyze data. The methodology includes detailed data collection methods, and sampling techniques, to understand the impact of unclean fuel on energy poverty. Ethical considerations ensure the research is conducted responsibly and respectfully.

CHAPTER No 4

DATA ANALYSIS AND FINDINGS

4.1 Qualitative Survey Method

The qualitative survey method means the research strategy that is based on closed-ended questions with the ultimate purpose of discovering the details of the respondents' experience, opinion, or point of view. Three quantitative survey indicators include especially open-ended questions, limitation to small number of people and thorough analysis. But for the data collection and research in this thesis, we limit our questions to the open-ended only to get the results.

A quantitate research design, using open-ended questions in order to explore the interconnection between gender, energy poverty and women health in district Bhalwal Sargodha Pakistan is suitable. Since participants are afforded an opportunity to expound on their experiences in their own words it becomes easy for the researchers to develop an understanding of the challenges that assume women in this region.

4.1.1 Developing Open-Ended Questions

It is, therefore, very important that one is able to develop good open ended questions to enable them get good data. Here are some key considerations:

Clarity and Simplicity: When designing questions, those used should be understood by everybody and as such, no complicated or technical terms should be used in the process.

Open-Ended Format: They should not have posed in a way that the resultant response will always be either yes or no from the respondent.

Relevance: Questions should be derived from the set research questions and objectives and should specially tackle the aspect of gender, energy poverty and women's health.

Sensitivity: It is hence appropriate not to ask questions in certain general interest areas such as diseases since this may cause uneasiness.

The data obtained from the respondents on the question of Gender and energy poverty linkage between unclean cooking fuel and women's health are presented in this chapter and key concepts of the research have also been explained. The themes are based on data collected in the survey from respondents. The survey was conducted of those respondents who used biomass fuel for cooking and heating purposes.

The survey was conducted to analyze the patriarchal aspect of rural life which leads females to

spend a long period in kitchens. Being a developing country, poverty in Pakistan (energy poverty is one of the major issues especially in rural areas of Pakistan), its complexities, and challenges of women regarding usage of biomass fuel in rural areas of Bhalwal district Sargodha in the current situation have been analyzed in detail.

These themes highlight the current phenomena of gender and energy poverty linkage between unclean cooking fuel and women's health. The data taken from the respondents has been categorized as social and economic factors which include poverty, levels of education, the power and role of gender in decision-making, and causes and impact of usage of biomass fuel on women's health.

4.2 Age of Respondent

The data shows that the age of respondents who were interviewed ranged from 18 to 52 years. They were divided into three groups age-wise and the difference of age among all groups was 11 years. The first age group ranges from 18 to 28 years which comprises 49% of all respondents. While the 2nd group ranges from 29-39 years containing 37% of interviewers. Moreover, the 3rd group age starts from 40 to 52 with a ratio of 14% of total sampling.

Table 5 : Age Distribution

Age Group	Number of Participants	Percentage of Total (%)
18-28 years	59	49%
29-39 years	44	37%
40-52 years	17	14%

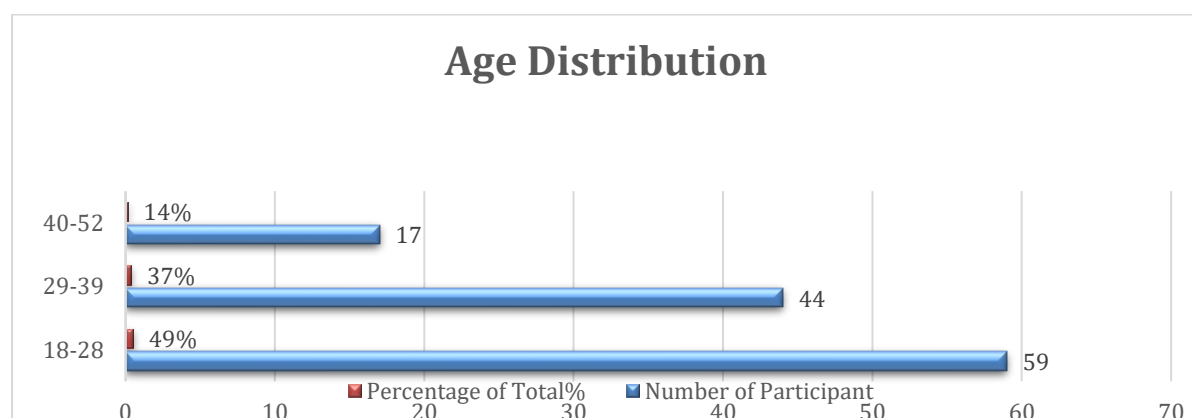


Figure 5: Age Distribution

4.3 Gender Role in Household Leadership and Financial Management

The result of the Present study indicates that men led 96 % of the sample population and males were dominant, representing their families and making all family financial decisions. However, only 4% of women were making decisions about their lives independently because their husbands had passed away.

Table 6 : Household and Decision Maker

Household and Decision-maker	Number of Participants	Percentage of Total (%)
Male	115	96%
Female	5	4%

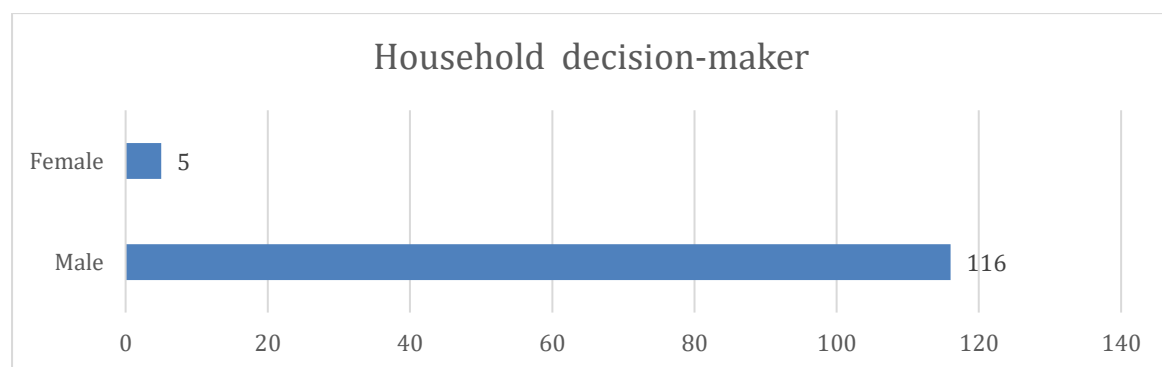


Figure 6: Household decision-maker

4.4 Relationship with Household

This Data illustrates the respondent's family relationships, a large portion of interviewers consisted of spouses (wives) 68%, out of which 20 % were daughters of these spouses and 12% percent daughters-in-law were interviewed.

Table 7 : Interviewer Relationship with household

Interviewer Relationship with household	Number of Participants	Percentage of Total (%)
Spouse	82	68%
Daughter	24	20%
Daughter in law	14	12%

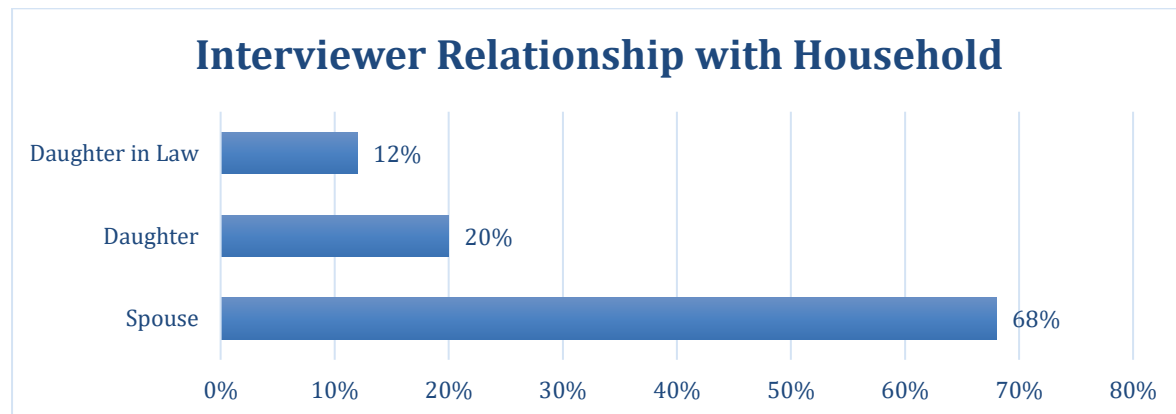


Figure 7: Interviewer Relationship with Household

4.5 Family Type

According to data, collected in survey, 79 % of families preferred to live in the joint family system due to insufficient sources of income and only 21% of people were living in a nuclear family set up.

Table 8 : Family Type

Family Type	Number of Participants	Percentage of Total (%)
Joint	95	79%
Nuclear	25	21%

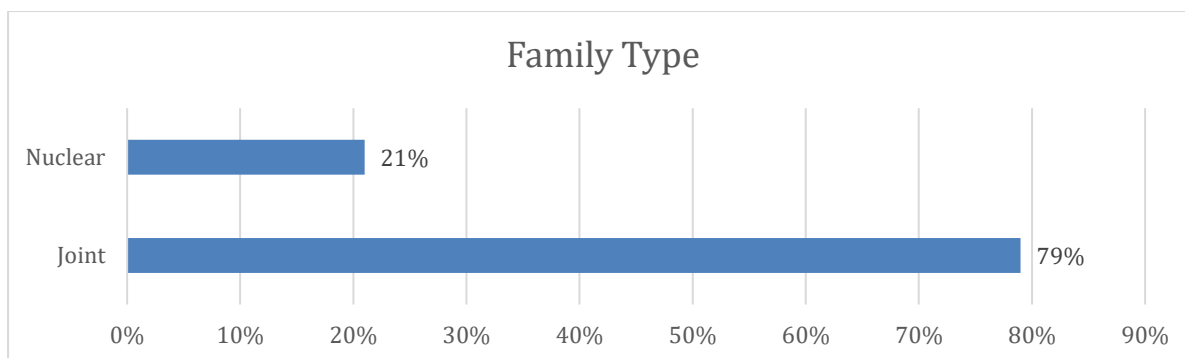


Figure 4.4: Family Type

4.6 Family Size

As data in graphics reflects, three-quarters of the families have twelve family members, whereas 25% of the total sample population comprises ten people, 15% families have eight members, and 21% consisting of six persons.

Table 9 : Family Size

Family Size	Number of Participants	Percentage of Total (%)
12 Member	47	39%
10 member	30	25%
8 member	18	15%
6 member	25	21%

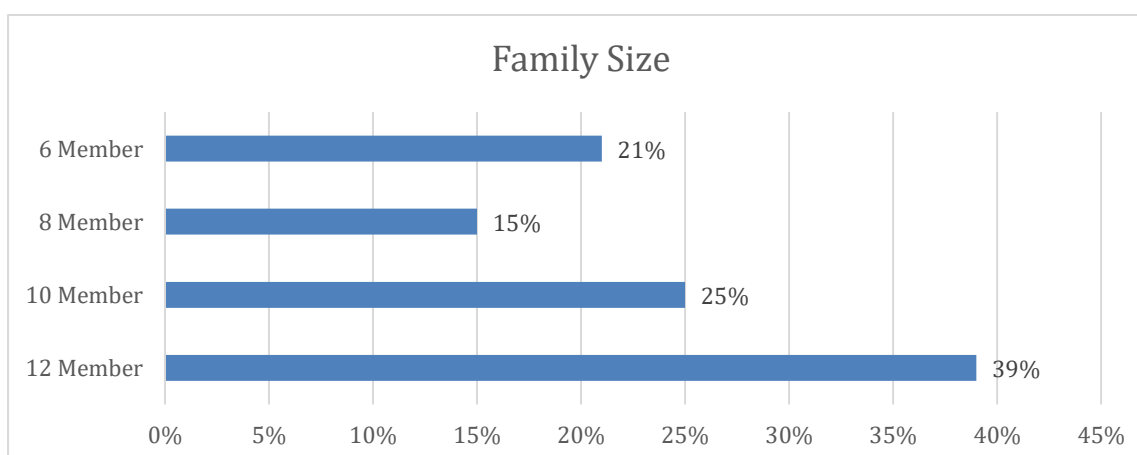


Figure 8: Family Size

4.7 Marital status & Occupation

In our present study, 58% of women are unmarried and 42 % are married. the percentage of unmarried women are too much high due to a lack of resources and income level.

Table 10 : Marital Status

Marital Status	Number of Participants	Percentage of Total (%)
Unmarried	70	58%
Married	50	42%

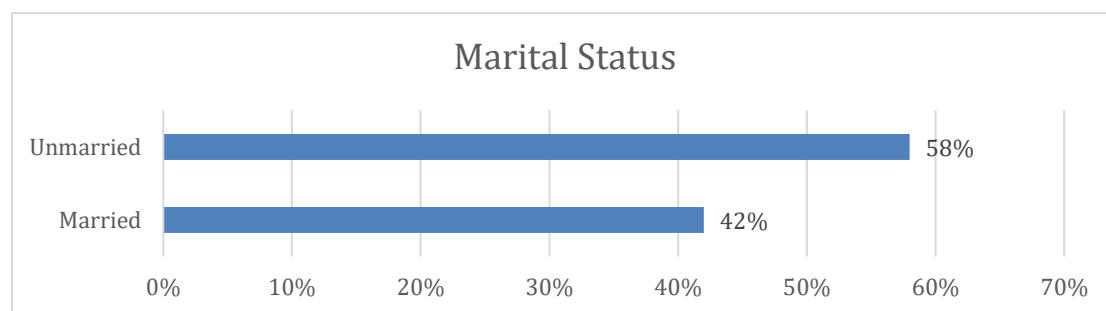


Figure 9 : Marital Status

Occupation

In our study 82% of the population were land laborers, the remaining 18% portion of the village population works as street hackers, barbers, shoemakers, and shop workers. So due to low income, they could not buy firewood, so they spent extra time in the fields with their male family members, gathering phragmites for cooking and heating.

Table 11 : Occupation

Occupation	Number of Participants	Percentage of Total (%)
Work on land	98	82%
Other professional	22	18%

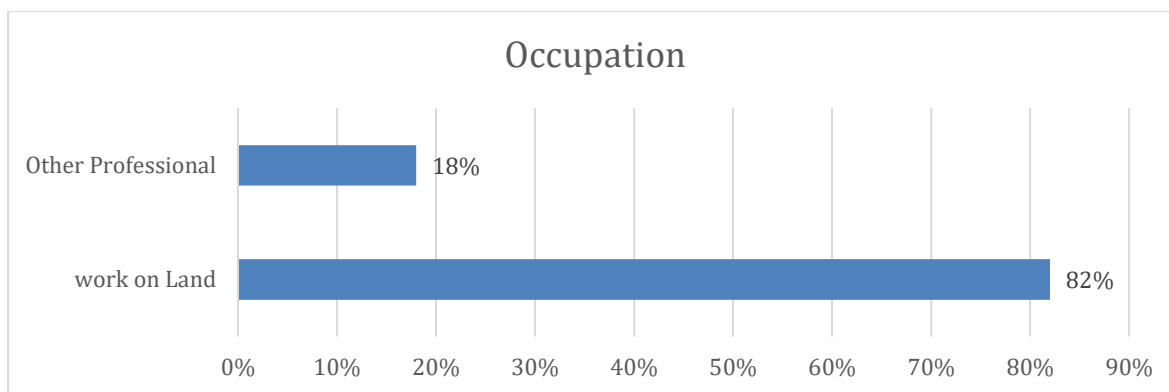


Figure 10: Occupation

4.8 Education Level

The result of the present study shows that only 20% of the respondents in the study area are educated whereas, the rest of the 80% of respondents are illiterate.

Table 12 : Education level

Education Level	Number of Participants	Percentage of Total (%)
illiterate person	96	80%
Literate Person	24	20%

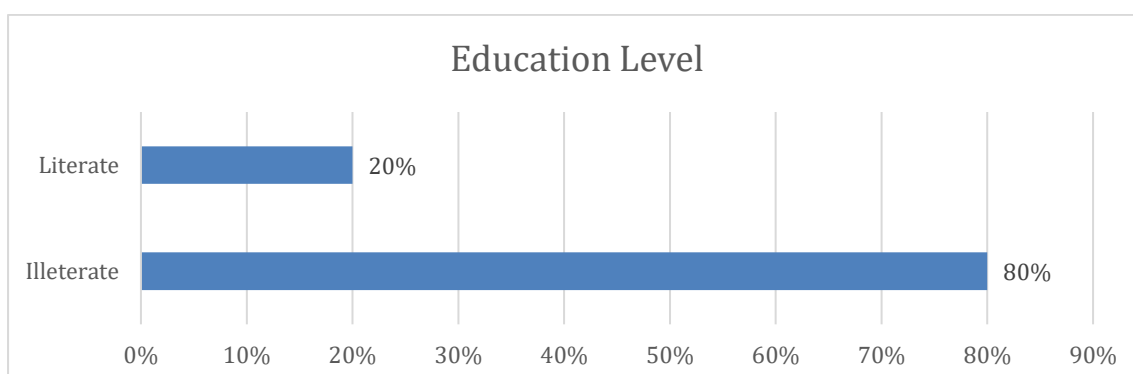


Figure 11 : Educational Level

4.9 Women's vital role and spending time in kitchen

Women spend most of time in kitchens and remain busy in household works. The perceived role of women as homemakers, caregivers, and child bearers is also extremely significant. The results show that there is a difference in the time range, women spend in the kitchen based on raw materials, they use for cooking and heating. The women who use crop residue for cooking

and heating purpose, spend 10 hours in the kitchen whereas women spend 8 hours in the kitchen whose heating source is animal dung and Females spend 6 hours in the kitchen using wood for cooking.

Table 13 : Women Spending Hours in kitchen

Women Spend Time in Kitchen	Hours	Percentage of Total (%)
Crop residue	10	8%
Animal Dung	8	7%
Wood	6	5%

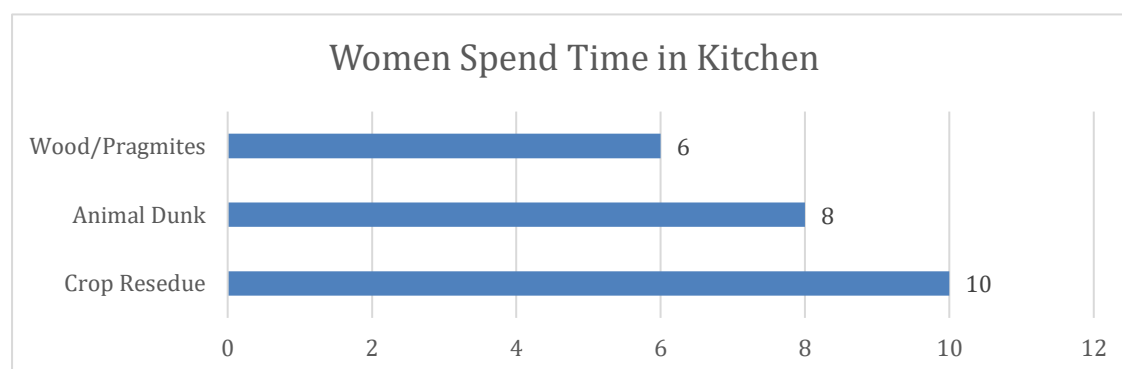


Figure 12 : Women Spend Time in Kitchen

4.10 Income of household

Unemployment, illiteracy, and poverty are the major problems of our country which hampers the progress of the country massively. It has also been observed in our study that poverty affects even the lowest tiers of our social strata, having a direct impact on low-income households.

One of our respondents explained that “our family has very limited resources and they have to work hard, being farmers the lion’s share of their income goes to the landowners and they received a meager amount for cultivating lands. Due to the scarcity of financial resources, most of the land laborers use biomass fuel for cooking and heating.”

Another respondent also stated that “most of our family members are working on daily wages and there is no fixed income, they are hardly earning 300 to 500 rupees daily depends on the availability of labor” so fiscal uncertainty is also there.

4.11 Analysis

4.2.1 Usage of biomass fuel

Table 14 : Biomass fuel

	Animal Dung %	Wood %	Crop Residue %	Plastic Bags %
Ameen Abad	65	25	7	3
Fateh Abad	61	14	20	5
Usman Abad	58	29	10	3
Kikran Wala	47	34	16	3
Gogani	72	22	5	1
Faiz abad	31	44	20	5
Kot Hakim Khan	59	22	18	1
Chak Balochan	28	65	6	1
Chak Malai Wala	39	55	5	1
Din Pur	25	65	7	3
Chak Misran	39	57	3	1
Ali Pur	36	55	6	3
Sardar Podnoo	29	65	5	1
Balochan	60	21	17	2
7 Chak	27	56	12	5
Grand Total	676	629	157	38
% of Biomass Fuel	45.07	41.93	10.46	2.54

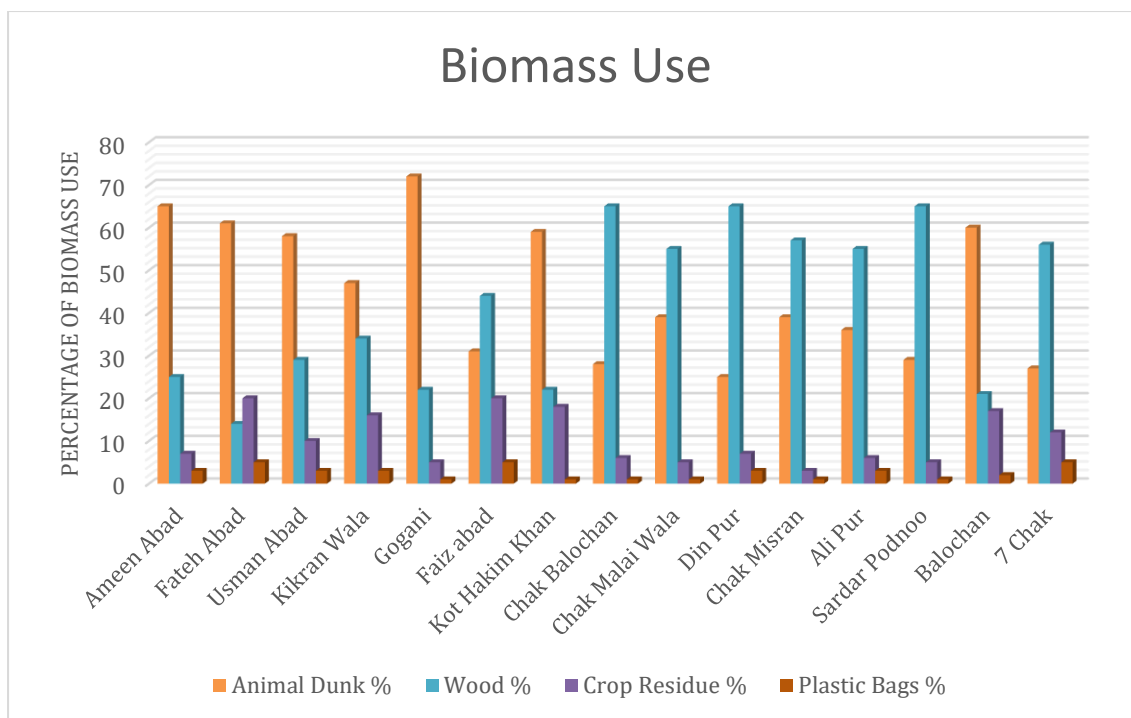


Figure 4.10: Usage of biomass fuel

During the present studies in our study area, results after interviewing the concerned women, I found that 45.06% of interviewers used animal dung in their daily use.



Figure 13: Animal Dunk

While 41.93% used Woods of different types they collect from different fields of their areas

(Figure 14). While only 10.46% of crop residue and 2.53% of plastic materials like shopping bags are used for burning/cooking in their houses. It is also observed that shopping bags are usually used only at starting because they catch fire quickly and help to burn other materials.



Figure 14: Phragmites

It has also been shown in results that mostly animal dung is used in very remote agricultural areas where trees and other wood materials are less available while the areas alongside the roads or where the villagers have comparatively better economic conditions use wood material as biomass fuel.

4.12 Diseases

As far as diseases are concerned, eye irritation was the most prominent disease in the locality of our researched area with the figure of 35.86%, followed by skin burn, 32.6%, cough 15.6%, chest infection 10.13%, and 5.8% asthma respectively.

Table 15 : Disease

Skin burn %	Eyes Irritation %	Cough %	Chest Infection %	Asthma %
25	45	12	11	7
23	48	15	10	4
18	41	7	21	13
31	22	33	12	2
31	35	12	17	5

17	28	18	17	20
26	41	14	10	9
42	31	17	8	2
46	36	13	4	1
39	42	3	8	8
45	32	12	9	2
30	41	19	5	5
51	27	13	7	2
17	51	21	8	3
48	18	25	5	4
489	538	234	152	87
32.6	35.86	15.6	10.13	5.8

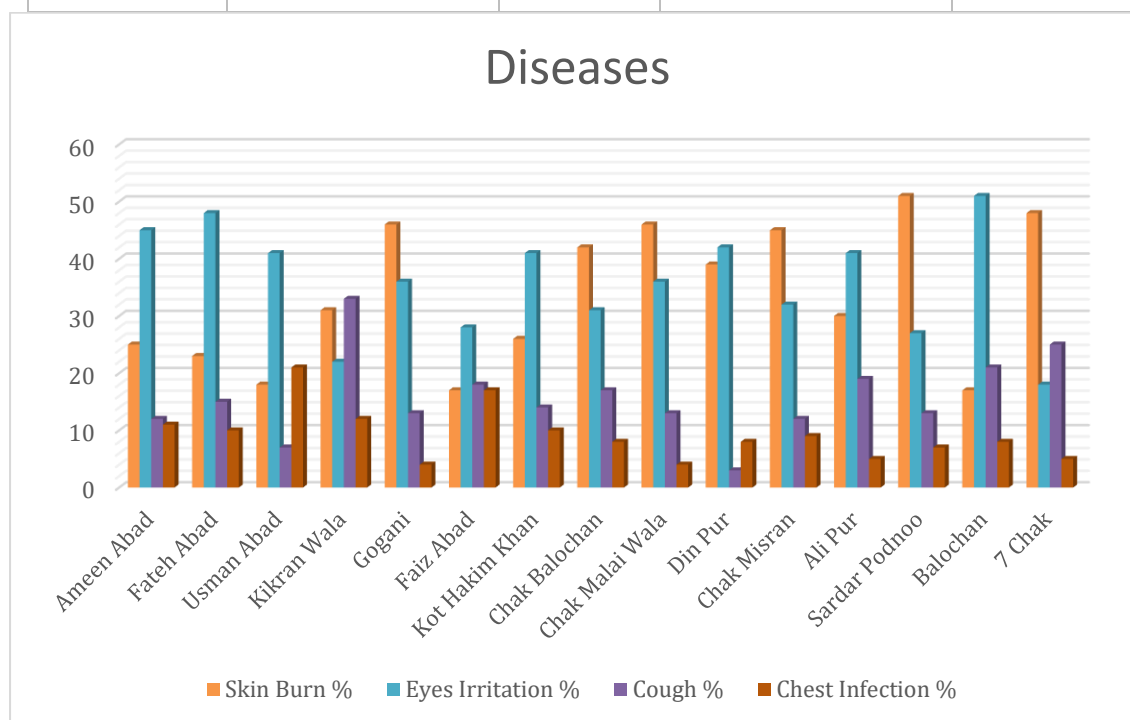


Figure 15: Diseases

According to present studies in different localities, overall, eye irritations and skin burns are the two most prominent diseases that appear in females spending their time in cooking. It is noticeable that it happens by using both wood and animal dunks. The main reason of spreading these two major diseases is some sort of mixing in animal dunk and low-quality wood because, by the use of both dominant biomass fuels, smoke appeared in either their kitchens or in open

places. Skin burn is followed by 32.6% and it resulted that skin burns mostly appeared by the use of wood material due to uneven flames at different times, which burn either the skin of females or their clothes sometimes. The sudden spark that appeared in the woods also sometimes make small holes in the clothes of the females. According to interviewer females, different types of cough and chest infections are also faced by 15.6% and 10.13% females respectively using biomass fuel while only 5.8% of females suffering from asthma in these areas which needs to be investigated further.

4.13 Structure of the kitchen

The kind of kitchen (TOK) was a question posed by the respondent because closed or semi-closed kitchens have a detrimental impact on human health since they spread smoke and carry dangerous substances in absence of proper ventilation (Figure 15).



Kitchen from outside

Figure 16 :

Walls and Ceiling: kitchens are generally made up of mud or mud bricks, with a thatched or tin roof. The walls are usually plastered with mud and straw mix, which keeps the inside cool during summers



Figure 17 : Roof of Kitchen

Size: Kitchens are smaller in size because usually cooking is kept separate from the other living areas and lack of resources for construction of proper kitchens is also major reason of small cooking areas.

Size Stove: Traditionally, stoves are made from clay or brick and are built slightly above the ground level. These stoves, known as "Chulha", are usually fueled with wood or cow dung cakes. Some rural households have started using gas stoves, though they are not predominant.



Figure 18: Stove

Utensils: The utensils used are typically made of steel, iron, or sometimes clay. However, clay utensils have become less common due to durability issues.



Figure 19 : Utensils

Lighting and Ventilation: most of the kitchens do not have electricity and thus rely on natural light in daytime. Ventilation is typically provided by small windows or gaps in the walls or roof.

Storage: There are typically open shelves, wooden boxes, or clay pots to store grain, spices, and other food ingredients.

Flooring: Many rural kitchens have earthen, clay floors and sometimes they use bricks, but it's less common due to the high costs.



Figure 20 : Flooring

CHAPTER NO.5

Discussion

In this chapter, we will discuss the findings of our research on the relationship between gender, energy poverty, and women's health in the district of Bhalwal, Sargodha, Pakistan. We used a qualitative survey method with open-ended questions to gather detailed information from women to understand their experience better who use biomass fuels such as animal dung, wood, crop residue, and plastic bags for cooking and heating. This approach allowed us to gain a deep understanding of their experiences and challenges.

The utilization of solid fuel greatly impacts the health of people in various low and middle-income nations, such as Pakistan. To our knowledge, this research is the initial investigation of its kind, encompassing fifteen villages in district Bhalwal Sargodha Pakistan, to explore the relationship between health issues and the type of cooking fuel used, as well as obstacles to adopting clean cooking practices. Solid fuel usage was found to be closely linked to variables like education level, monthly household income, geographic divisions, and length of residency. (chapter no.04). As a result, using solid fuel was strongly linked to health issues like coughing, chest tightness when breathing, eye irritation, diabetes, asthma, and allergies, and respiratory (chapter no.04). Identified as a main obstacle, economic issues hinder clean cooking efforts among other barriers. Global research on solid fuel consumption reveals varied statistics, with approximately 80.5% of rural families in India (Thakur,2019), 95% in rural Pakistan (Yasmin,2019), 95% in rural Myanmar (Aliani,2021), and 73.3% in Bangladesh (Siddique, 2024) utilizing solid fuels. Reasons for using solid fuels include financial issues, ignorance of the dangers of solid fuels, and social, demographic, and cultural influences. (chapter No.02)

During the present studies in our study area overall results after observations and interview from the concerned women, because here is strong relationship between gender role and poverty. Mostly Women spending considerable amount of time in kitchen to manage kitchen and household and also collect make the animal dunk for useable of heating and participant with household to collect the wood. We found that 45.07% interviewers used animal dunk in their daily use while 41.93% used Woods of different types they collect in different fields of their areas. While only 10.46% crops residue and 2.54% plastic materials, mostly used shopping bags used for burning ignite in their houses. It is found that shopping bags used only in start because they caught fire and helps to burn other materials quickly. They used the mostly animal dunk due to poverty and due very low income (chapter 4), it's very accessible and no

any price pay for animal dung and wood, because animal dung collected from buffalo house and wood collect from agriculture field. Its main relationship poverty with health. This is resulted that mostly animal dung is used in very remote and agricultural areas because it is easily available source and majority of users have their own livestock in their houses. Where the trees and other wood material are in less availability while the areas along the roads or those villagers which are comparatively better economic conditions used wood material as biomass fuel. As result from used of animal dung and wood as for diseases are concerned, eyes irritations are the most prominent disease reported in the locality, 35.26%, followed by skin burn, 32.06 %, cough 15.06 %, asthma 5.08% and chest infection 10.13% respectively. In overall studies in different localities, eyes irritations and skin burns are two most prominent diseases appeared in the females spending their time in cooking. It is noticeable that these happened by using both by animal dung and woods. The maximum percentage of eye irritations were reported in Gogani, 45%, where the use of animal dung was on maximum 72%, followed by Chak Balochan and Chak Misran, 42% each where the use of animal dung was 55% and 57%

each. Surprisingly the use of animal dung Kot hakim Khan 59% and Balochan 60% but the ratio of eye irritation was 39% and 37% respectively. Skin burn is the second most common disease reported in the areas by the residents. 46% skin burn was appeared in Chak Malai Wala where the use of woods was 55% and 32% in Chak Misran where the use of woods was reported 39%. The main reason for these two forms of diseases due to some sort of mixing in animal dung and low quality of woods, because by the use of both dominant biomass fuel, smoke appeared in either their kitchens or in open places. By investigation in Kot Hakim Khan and Balochan less eye irritations but the use of animal dung is at high ratios, which need to investigate further. Skin burn is appeared mostly in the areas where the use of woods in the kitchens or outside at high percentage. Skin burn is followed by 26.53% and it is resulted that skin burns are mostly appeared by the use of woods material due to uneven flames in different times, which burn either the skin of females or burn their cloths sometimes. The sudden spark appeared by woods also turn small holes in the cloths of the females.

Education Level

A strong connection was found between not being able to read and write and using solid fuel, which aligns with a previous study in Pakistan (Muhammad, 2017) showing higher rates of solid fuel use among those with no formal schooling. Comparable trends have also been

recorded in various other parts of the world, such as in India and Bangladesh. (Muhammad Raseel, 2024).

Our study showed that 20 % were educated but most of the women, I interviewed were illiterate in rural areas of Bhalwal district Sargodha. In response to my queries for knowing the causes of their illiteracy, one of my respondents explained that “the school is very far away from the village and our parents did not allow us to go outstation for study purposes.” (Sobia, 17-dec-2023). Another respondent replied, “If we go to school, people in village point finger on them and start to talk about their characters” (Shazia, 18-dec-2023). It is unfortunate that even in this modern era, our culture has been eroded to that level where girls' education is treated as a stigma in rural areas, and questions are raised about the character of those girls who challenge so called rural traditions by entering into educational institutions. In the present era, women's education remains a pressing issue in rural areas, the patriarchal society in Pakistan, particularly in rural areas, is one of the major stumbling blocks on the way of women's education and emancipation. Education plays a crucial role in understanding the health impacts of different fuels. In areas with lower education levels, people may not be fully aware of the dangers associated with biomass fuels. Limited education can lead to less knowledge about the benefits of cleaner energy sources and how to manage health risks. Our study area has a high reliance on traditional fuels, which may be partly due to a lack of education about alternative energy options. This lack of information can prevent women from making healthier choices and adopting safer practices. One of the interviewers responded that due to poverty, my parents decided to start work at home as a tailor and engaged other labor work as well to generate income to meet our expenses” (fouzia, 17-dec-2023).

5.1 Gender and Energy Poverty

Our study shows a clear link between gender roles and energy poverty in Bhalwal. Here's a closer look at what this means

Women's Responsibilities: In Bhalwal, women are mainly responsible for cooking and heating the home. They spend a lot of time managing these tasks because their households rely on traditional biomass fuels like animal dung and wood. In our study we founded that woman spending time in the kitchen is, who use animal dunk spending 10 hours in kitchen and who used the wood that spending 8 hours in the kitchen and who use crop residue is 6 hours in kitchen. most of time spending in kitchen, then clean the house and collect then animal dunk from buffalo house then it makes it proper form. In our study we found that women spend an

average of 2-4 hours daily collecting and managing biomass fuels. This time could otherwise be used for education, work, or other economic activities. and also similar report by World health organization and United nation reported that women spending 2-4 hours in collecting the fuel. Women responsibility in the mostly developing country is very tough. That why health of women disturbs due to tough work and take a very short rest and health issue create very high in the villages area of developing country. He responsibility for managing biomass fuels places a significant burden on women, impacting their health and limiting their time for other activities. gender role means that women are exposed to the negative effects of biomass fuels more than men.

Energy Poverty: Many women use these traditional fuels because they are cheap and readily available. However, this reliance on biomass fuels reflects a broader issue known as energy poverty, where people don't have access to modern and cleaner energy sources. This is often due to the lack of access to cleaner and more efficient energy sources. In many developing areas, including Bhalwal, poverty restricts people's ability to buy better alternatives, such as liquefied petroleum gas (LPG) or electricity. The high cost of modern energy sources means that poorer households rely on traditional fuels. This study unveils that many women use those fuels an aspect that reflects their economic hardships. These tasks are assigned based on gender roles actively practiced in many societies around the globe." Like in other areas like the community of Bhalwal, it was the women's duty to prepare the meals for the family, wash clothes and perform other household chores while the men were supposed to go out and fend for the family. Besides, this division of labor also gives the women a raw deal and cuts down their possibilities of being educated, employed or getting other requirements that can alter their standards of living. But the story is like this in all other developing countries rather than the Pakistan; women are suffering from the same problems. For example, in rural parts of India, Nepal, and Bangladesh, women also spend a significant amount of time managing biomass fuels. (Rai & Yadama (2016) india , (Joshi & Vaidya (2017) Nepal , (Hossain & Rahman (2015) Bangladesh . Studies from these regions show that women experience high levels of exposure to indoor air pollution, which leads to health problems. In Africa, women are responsible for collecting and using firewood, and the smoke from these fuels contributes to health issues such as respiratory infections and eye diseases. According to World Bank and United nation reports that Approximately 70% of the world's poor are women, according to various global reports. This means that women are disproportionately affected by poverty. In the developing country like Pakistan, India, Nepal, Bangladesh women are 60 -70 % liven under the poverty line. And this very significantly higher than men. Many women are illiterate

due to poverty, women hold does not afford the education of her women due to lack of income. According to World Bank and UNESO report education level of developing country like Pakistan, India, Nepal and Bangladesh are respectively 40 -50 %, 50-60% ,50-60% and 60 - 70% literacy rates in rural areas. And mostly in Pakistan girl's dropout is to high due to lack of income and other issue.

Health Risks: The time women spend managing these fuels is not just a matter of workload; it also affects their health. The smoke from burning biomass fuels can cause various health problems, such as eye irritation and skin burns. Other factor that effect on the health of women are kitchen layout or design which also mention in the (chapter 04) with picture, mostly kitchen has no any ventilation. This issue is not unique to Bhalwal; it is a common problem in many developing countries where women face similar challenges due to energy poverty.

In summary, women in Bhalwal have a heavy burden due to the reliance on traditional fuels. This situation underscores a wider problem where women often bear the negative effects of inadequate energy access and its health risks. Because women are the primary users of these fuels, they are more exposed to the harmful effects of smoke. Biomass fuels release pollutants when burned, including particulate matter, carbon monoxide, and other toxic substances. Women are often in close proximity to the smoke while cooking or heating the home, leading to chronic exposure. This can cause a range of health issues, including eye irritation, skin burns, respiratory problems, and more serious long-term conditions.

The health issues reported by women in Bhalwal align with what has been found in other studies. Here's a detailed look at these health impacts:

Eye Irritation and Skin Burns: A significant number of women reported problems like eye irritation and skin burns. This is consistent with earlier research, such as studies by Smith et al. (2004) and Bruce et al. (2008). These studies have shown that using solid fuels like biomass leads to poor air quality indoors, which can cause respiratory problems and other health issues. And in our study eye irritation are found 35.86 % that was too much high from smoke and air pollution, and skin burn ration is 32.6 % are second largest ration obtain from data. It's all disease are due to biomass fuel and its smoke, and women are most affected factor due to most of time spending in the kitchen for cooking and heating. (WHO - 2014)

Respiratory Problems: Previous research indicates that burning biomass fuels can lead to serious respiratory problems due to the smoke and pollutants released. While our study also found that eye irritation and skin burns are common, the lower level of reported asthma cases might be unexpected.

Possible Reasons for Low Asthma Rates: The relatively low number of asthma cases in our study could be due to several reasons. In some cases, people might not report asthma symptoms accurately or might not recognize them as asthma.

5.2 Comparison with Existing Literature

Our study on the health effects of biomass fuels in Bhalwal shows that women face significant health problems. Here's how our findings compare with previous research:

Our study supports Ezzati and Kammen 2015 findings, showing similar health issues such as eye irritation and skin burns among women in Bhalwal. This alignment confirms that the health risks associated with biomass fuels persist.

Our results are consistent with Smith 2017. findings. We also observed high rates of eye irritation and respiratory problems among women using biomass fuels in Bhalwal.

Our study aligns with Bruce 2019 research. We found that biomass fuels are linked to health problems such as coughs and skin burns, reflecting similar issues identified in their study.

Our study found a high rate of eye irritation (35.86%) in Bhalwal, which is higher than the rates reported by Treshow and McBride 2020. This suggests that specific local conditions in Bhalwal might exacerbate health problems.

Our study reports a higher rate of skin burns (32.6%) in Bhalwal compared to Rehfuess's findings 2018. This discrepancy may be due to the types of biomass fuels or the burning practices prevalent in Bhalwal.

Our study supports Pritchard et al.'s 2020, findings, showing high rates of respiratory issues and related health problems among women in Bhalwal, similar to their observations.

Our findings confirm Campbell's 2021, research, as we also observed significant health issues such as eye irritation and coughs among women in Bhalwal, consistent with their report.

Our study is in line with Huong 2022, findings, as we observed similar health problems, including eye irritation and coughs, among women using biomass fuels in Bhalwal.

5.3 Recent Reports

Our study aligns with the WHO report 2023, showing that women in Bhalwal experience significant health issues due to biomass fuels, including respiratory problems and eye irritation.

Our findings are consistent with the World Bank's observations. The health problems faced by women in Bhalwal reflect the economic and health challenges described in the report.

The high rates of eye irritation and skin burns among women highlight the need for cleaner energy solutions, my finding align with as advocated by the UN report 2023.

Our study supports these NGO reports, showing that women in Bhalwal face significant health issues due to biomass fuels. This reinforces the need for cleaner energy solutions and supports the recommendations made by various NGOs.

CHAPTER NO.6

RECOMMENDATIONS AND CONCLUSION

6.1 Recommendations

Based on the issues highlighted and discussions made, the following recommendations are given.

Awareness and Education: A campaign should be launched to Increase awareness about the health risks associated with using unclean cooking fuel. This task may further be accomplished by starting educational programs targeting rural communities in the Bhalwal District of Sargodha, Pakistan. Women, in particular, should be educated on the impacts of indoor air pollution on their health and their family's health.

Social media: we are living in era of social media which can play a vital role to inform women in rural areas about the hazards of smoke and its impact on our youth and next generation. It is suggested that state should get serious in this regard and awareness campaigns should be carried out on the print & social media for results which should be made reach to the common man. ads are often better and have quick impacts than seminars, workshops etc.

Clean Cooking Solutions: Encourage better cooking utensils, these are LPG or biomass cook stoves than three stones fire as it is cleaner. This could involve provision of incentives to encourage usage of cleaner fuels, provision of microcredit facilities to offset the cost of such endeavors or undertaking any other activity that would enable the rural and impoverished households.

Monitoring and Evaluation: A also comprises continuous assessment, monitoring and evaluation of the impacts of these interventions with the health of women. This will also help in making policies as well as help in improving the practice that is used in the effective implementation of a policy.

Gender-Specific Policies: The following recommendations relate to energy poverty – Gender specific approaches should be adopted and applied in order to meet the needs of the different genders. Women are often disproportionately affected by energy poverty due to traditional roles in household chores, such as cooking. Ensuring their concerns are addressed specifically can help mitigate such health risks.

Infrastructure Development: Working on infrastructure development can also help to provide better access to women for clean cooking fuels in rural areas.

Local Production: Encouragement of local production of clean fuels and efficient cook stoves can also ensure accessibility and jobs creation at local level as well.

Community Participation: Involvement of community in the planning and implementation process, and empowering women in decision-making can also help in this regard.

Keeping in view foregoing recommendations, it is proposed that NGOs and government departments, social workers, and volunteer students at universities particularly students of social sciences may take steps to launch robust campaigns to create awareness among the masses about the issues and facts highlighted above and suggested solutions like the earthen stove may also be taken into consideration. Moreover, proper training arrangements may also be made in rural areas to train the people regarding usage of biomass fuel.

Recommendation Linked to SDGs:

Linked with SDG 3, SDG 5, SDG 7, and SDG 13

Based on the issues identified and field insights gathered during this study, the following actionable and policy-relevant recommendations are proposed:

Awareness and Education Campaigns (SDG 3, SDG 5)

Launch targeted educational programs in rural communities of Bhalwal to raise awareness about the adverse health impacts of unclean cooking fuels. These campaigns should focus on women, emphasizing the link between indoor air pollution and health risks for themselves and their families.

Use of Social and Print Media (SDG 3, SDG 13)

Leverage social and traditional media platforms to disseminate health messages regarding household air pollution. Government and NGOs should prioritize visual media (e.g., infographics, public service ads) for broader and quicker impact, especially among women with limited formal education.

Promotion of Clean Cooking Technologies (SDG 7)

Encourage adoption of cleaner cooking solutions like LPG, biomass stoves, or improved earthen stoves. This can be supported through:

- Microcredit schemes
- Government subsidies or incentives
- Partnerships with private sector or development agencies

Monitoring and Evaluation (SDG 3, SDG 5)

Implement ongoing monitoring of health impacts and policy outcomes related to clean fuel initiatives. Gender-disaggregated data should be collected to inform future policies and improve implementation.

Gender-Specific Energy Policies (SDG 5, SDG 7)

Formulate energy poverty interventions that are gender-responsive. Since women bear the brunt of indoor pollution due to cooking roles, their needs and voices must be incorporated into policy design and program execution.

Infrastructure and Accessibility (SDG 9, SDG 7)

Invest in rural infrastructure to ensure the availability and affordability of clean fuels. This includes expanding distribution networks and setting up rural energy access points.

Local Production and Job Creation (SDG 8, SDG 13)

Encourage local manufacturing of efficient stoves and cleaner biomass fuels. This not only improves accessibility but also provides livelihood opportunities for rural youth and women.

Community Engagement and Empowerment (SDG 5, SDG 11)

Promote community-led energy initiatives by involving women and local leaders in planning, implementation, and decision-making. Train women as "clean energy ambassadors" or master trainers to scale impact.

Role of Academic Institutions and NGOs (SDG 4, SDG 17)

Mobilize university students, particularly from social sciences, in collaboration with NGOs and local departments to run awareness and training programs. Practical demonstrations of cleaner cooking methods and low-cost biomass fuel solutions (e.g., improved earthen stoves) can be scaled across villages through hands-on training.

The said task may be accomplished by involving the master trainers for providing the required training to build this model in the vicinity of different villages. These steps will be extremely beneficial for the local populace and will be highly effective method to make the biomass fuel having less financial burden to both, volunteers and villagers.

6.2 Conclusion

Research on indoor air pollution and other aspects such as infectious diseases, child mortality, women's health, and wealth, etc., has been conducted in the past and still continues. The function of communication technology as a mediator between fuel choice, poverty, and income has not been the subject of any such studies. so that it would be simple for Pakistani households to maintain their standard of living. Thus, this research will assist us in understanding how fuel choice and household air pollution in Pakistan are influenced by poverty, as well as how ICT might help reduce household air pollution.

The report also emphasizes how, from Pakistan's perspective, knowledge and technology may help to combat poverty. The main object of this study is to determine the next factors influencing fuel choice in Pakistan to explain how poverty affects exposure to home air pollution. A binary logit analysis was used to forecast the variables influencing fuel selection. The results show that Pakistan's fuel choice is influenced by several important characteristics, including household size, location and area, socioeconomic status, low rates of human capital, and access to essential utilities. According to the study, wealthy families tend to be smaller and have higher levels of education, whereas impoverished families typically have larger households. Above all other factors, poverty status has been identified as one of the most important determinants of fuel choice. The probability impact of utilizing a single fuel type on the household was primarily determined by other considerations. Additionally, education has a big part to play.

The main object of this study is to determine the next fuel decision factors in Pakistan to investigate the necessity of implementing a family unit of air contamination. Out of all the factors, the most important one that determined fuel choice was found to be poverty status. The most significant probabilistic influence on a family's decision to choose a single fuel type came from different components. Similarly, the main object of this study is to determine the next factors influencing fuel choice in Pakistan and to explain that how poverty affects exposure to home air pollution and how it is detrimental to the health and lives of people.

Research Innovation and Contribution:

This research makes a significant contribution to the growing discourse on gender and energy poverty by empirically exploring the interrelationship between the use of unclean cooking fuels and their impact on women's health in rural Pakistan. Unlike previous studies that focus broadly on energy access or environmental impacts, this study uniquely centers women's lived

experiences, positioning them not merely as passive recipients but as key informants and agents affected by energy decisions within households. It adopts a gender-sensitive qualitative survey method to capture nuanced health effects—including respiratory issues, eye irritation, and fatigue—that are often underreported in national statistics. By concentrating on rural Bhalwal, a relatively understudied area, this research introduces localized evidence that can inform district-level interventions. The integration of health outcomes with energy poverty metrics offers a novel interdisciplinary approach, linking gender equity, environmental justice, and public health. Moreover, the findings serve as a micro-level input to broader Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 5 (Gender Equality), and SDG 7 (Affordable and Clean Energy).

6.3 Research Limitations

Geographic boundary: The study was limited to northeast rural areas of Sargodha, Pakistan only.

Population: The study focuses on women residing on the northeast border of Sargodha, Pakistan who use unclean cooking fuel for cooking, heating, and lighting.

Timeframe: The study was conducted during a particular period, and the findings may not reflect the conditions or circumstances during other time periods.

Language barrier: The study was conducted in a regional language (Punjabi), which may pose a language barrier for participants who do not speak or understand English. Moreover, the responses of the participants in their local language will further be reproduced in the English.

Sample size: The sample size of the research or study will be conducted on 120 household women, which may lead to the generalization of findings.

6.4 Future Research

After having a details discussion on this topic, we have identified that there is very limited research available for gender and energy poverty linkage between unclean cooking fuel and its impact on women's health in Bhalwal district Sargodha. The following areas can be considered for future research:

1. **Detailed Impact Assessment:** A deeper investigation into the specific health impacts of unclean cooking fuel on women in rural Pakistan can be conducted. This could include both physiological and psychological implications.
2. **Intersection of Gender and Poverty:** Further research could explore the intersection

of gender and poverty about energy poverty. This could shed light on how multiple forms of deprivation interact and how they can be addressed collectively.

3. Efficacy of Interventions: Future research should consider assessing the efficacy of current or proposed interventions aiming to reduce reliance on unclean cooking fuels. This includes exploring which measures have had the most success and why, in addition to identifying potential barriers to their implementation.

4. Longitudinal Studies: Longitudinal studies tracking the shift from unclean to clean cooking fuels and its impacts on women's health would provide valuable insights for policymakers and intervention designers.

5. Case Studies: Case studies of successful transitions to clean cooking fuels in similar rural contexts worldwide could guide local strategies in the Bhalwal District.

6. Policy Analysis: Research analyzing the effectiveness of current energy and gender policies, and their implementation could highlight gaps and areas for improvement.

7. Socio-Cultural Factors: It would be beneficial to study the socio-cultural factors that influence the use of unclean cooking fuels and the potential resistance to shifts toward cleaner alternatives. These findings could then inform the design of culturally sensitive interventions.

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Annexure

Annex – I



**DEPARTMENT OF GOVERNANCE AND PUBLIC
POLICY NATIONAL UNIVERSITY OF MODERN
LANGUAGES (NUML) ISLAMABAD**

Introduction

This is Ayesha Iftikhar Ahmed from the Department of Governance and Public Policy at the National University of Modern Languages (NUML), Islamabad. I am conducting my M. Phil study on the topic of “Gender and energy poverty explores the relationship between unclean cooking fuel and women's health.” You are requested to be a part of this research for the betterment of the society.

Objective of the Study

This study is being conducted to analyze the impact of using solid cooking fuel on various health outcomes of residents of rural areas of Sargodha Pakistan and to assess the factors that influence the choice of cooking fuel in households furthermore to evaluate the design of the houses site for cooking used.

Type of Research Intervention

This research will involve the subjective experience of women in Bhalwal district Sargodha, Pakistan who rely on unclean cooking fuel. Data could be collected through survey questionnaire. That will take twenty to thirty minutes.

Participants Selection

Women from various households across Bhalwal district Sargodha, Pakistan who use biomass fuels for cooking randomly selected to participate. This ensure that the sample is representative of the large proportion.

Voluntary Participation

Having freedom of expression, you are being invited to participate in this study on voluntary basis, you can choose between being of part of this study or not.

Procedure

You are being asked questions related to gender and energy poverty linkage between unclean cooking fuel and its impact on women’s health in rural areas of Bhalwal district Sargodha Pakistan. Women’s can be answered by maximum available inputs from your side. You can offer additional comments on the topic as well.

Duration

Research will be concluded in two years.

Risks

The research does not entail any risk as you participate. No person will be harmed physically, psychologically, or emotionally. Neither any equipment nor any vehicle or any other installments will be affected during the conduct of the research.

Benefits

There will be no direct benefits to you, but your valuable inputs will help us achieving objectives of the study.

Confidentiality

The data provided by you will only be used for research purpose and will not be provided to anyone else for any purpose. Identity of the respondents will be kept confidential and will not be shared with anyone outside this study.

Sharing the results

Results of the study can be shared to the respondents. Information provided by you will not be shared to any irrelevant person or institution.

Right to Refuse / Withdraw

You do not have to take part in this research if you do not wish to do so. You may stop participating in interviews at any time you wish, and responses can be withdrawn before concluding the study as well.

How to Contact

Queries related to the study can be addressed by contacting the women's directly in my research area or through supervisor Dr. Athar Rashid, coordinator of Department of Governance and Public Policy, National University of Modern Languages, Islamabad at atharrashid@numl.edu.pk. This study will be reviewed and approved by NUML Faculty Board of Study which is a committee responsible for ensuring the protection of participants. If you do have any further questions please contact Dean Faculty of Social Sciences, Professor Dr.

Muhammad Riaz Shed through email dean- fss@numl.edu.pk.

Annex – II

CERTIFICATE OF CONSENT

I have been invited to participate in research titled as “*GENDER AND ENERGY POVERTY; EXPLORING THE INTERRELATIONSHIP BETWEEN UNCLEAN COOKING FUEL AND WOMEN’S HEALTH*” I have read the forgoing information, or it has been read to me. I have had the opportunity to ask questions and any questions I have been asked and have answered to my satisfaction. I give my consent voluntary to be a participant of this study.

Name of Participant: _____

Signature of Participant: _____ Date: _____

Annex – III

STATEMENT BY THE RESEARCHER

I have accurately read out the information sheet to the potential participant and to the best of my ability made sure that participants understand the details of the research. I confirm that the participants were given an opportunity to ask questions about the study, and all the questions asked by the participants were answered correctly and to the best of my ability. I confirm that the individuals have not been forced by any means to give consent, and that consents have been given freely and voluntarily.

A copy of this informed consent form has been provided to the participant.

Name of Researcher: **Ayesha Iftikhar Ahmed**

Signature of Researcher: _____

Date: _____

Sample Identification

Personal general information to be answered by the respondent

1. Name of the Interviewee: _____
2. Gender
 - a) Male
 - b) Female
3. Age:
Years _____
4. Gender of the head of the household (most important decision maker)
 - a) Male
 - b) Female
5. Relationship to the head of the household: _____
6. Who makes the final decisions about the household budget? _____

Household Socio-Economic Characteristics

7. Total number of people normally living in the house: _____

8. Total number of people living in the house:

Gender Status	Marital	Occupation (HW=0, Job=1, Farmer=2)	Income per Month	Time Spend in Kitchen (Hours Per Day)	Education Level

9. Tick the disease that you have felt in the last six months and mention how many times you feel that.

AGE	Frequency in last 6 Months					
	Eye Infection	Respiratory Irritation (Asthma, Tuberculosis, cough)	Headache	Heart Diseases	Cancer	Skin Irritation

1. Which type of fuel do you use in cooking and heating purposes?

ID	Fuel Name	Give a Reason Why You Use It.	Expenditure for collection in (Rs.)
1	Wood		
2	Tree/Crop Residue		
3	Animal Dunk		
4	Charcoal		

5	Other		
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Characteristics of kitchen

2. roofing material

1.Tile. 2.Thatched 3. Concrete 4. Corrugate iron 5. Others specify -----

12. Wall construction material

1. Brick wall 2. Thatched 3. Concrete 4. Corrugate Iron 5. Wood 6. Mud 7. Others specify---

13. Floor construction material

1. Concrete 2. Brick 3. Wood 4. Mud 5. Bamboo 6. Others Specify_____

House ventilation-related factors for the kitchen

14. No. of walls in the kitchen. -----

14. No. of windows in the kitchen. -----

15. No. of doors in the kitchen. -----