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Editorial Note

It is a matter of immense pleasure to present the inaugural Volume of the Research Journal of Ramswarup Ramsagar Multiple Campus (RJRRMC), published by the Research Management Cell, Ramswarup Ramsagar Multiple Campus, Tribhuvan University, Janakpur, Nepal. The publication of this Volume marks an important step toward strengthening a culture of research, scholarly inquiry, and academic excellence flourishing in campus and within the wider academic community.

The journal has been established as a scholarly platform for disseminating original research, critical perspectives, and evidence-based knowledge across diverse academic and social domains. The contributions in this volume reflect researchers' intellectual engagement with contemporary issues and demonstrate the importance of research in advancing knowledge and informing academic and professional practice. The Editorial Board sincerely acknowledges the valuable contributions of all the authors whose scholarly works have enriched this volume. We also extend our appreciation to the reviewers and subject experts for their careful evaluation, constructive comments, and commitment to maintaining academic standards. Our sincere gratitude is also extended to the Patron, Chief Editor, Editorial Board, Advisory Board, faculty members, and the Research Management Cell for their guidance and perennial support in bringing this volume to publication.

We hope that this volume will stimulate further research, encourage meaningful academic dialogue, and contribute to creation and dissemination of knowledge. The Editorial Board welcomes constructive suggestions from scholars and readers to help the journal continue to improve.

Editorial Board

Research Journal of Ramswarup Ramsagar Multiple
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Content

Awareness Regarding Chronic Kidney Diseases Among Adults Attending Patan Hospital, Lalitpur District of Nepal: A Cross-Sectional Study –	1- 11
Pratiksha Badal, Rekha Timalsina	
Half Cauchy-Modified Exponential Uncertainty Quantification for Tethered Satellites Using the Kalmag Geomagnetic Field Model	12- 20
Lal Babu Sah Telee, Dhirendra Kumar Yadav	
Landscape of the Vocational Project for Self-Employment and Entrepreneurship Promotion in Ramechhap	21-31
Dipak Ghising	
Breadwinner Men in Patriarchal Society : Privilege or Burden?	32-37
Sabita Chaudhary	
Prevalence of Stress, Anxiety and Depression Among Home-Isolation COVID-19 Patients in Kathmandu Valley, Nepal	38-44
Pashupati K. C., Keshab Parajuli ² , Khem Raj Bhatta	
Nutritional Status and Body Image Dissatisfaction Among Adolescent Girls of Barahathwa Municipality, Sarlahi District	45-53
Jay Ram Mahato, Rupesh Mishra, Luna Maharjan, Bhikha Mahato, Sangita Kumari Mahato	
Analyzing Contribution of Remittance on Socioeconomic Transformation –	54-64
Gyanendra Kumar Mallick Jagannath Chaudhary	
Sulphate ion content in each soil samples collected from Batasedanda - Tansen Buspark – Parvas roadways area.	65-72
Jagadish Khadka, Shova Sigdel, Madab Gautam	
Practical Measures of Benefits of Education: An Analysis of Systematic Review	73-82
Min Raj Paudel	
Revisiting the Aim of Education in the 21st Century: A philosophical Inquiry	83-90
Ajita Singh	
School Factors Affecting Food Practices among Adolescent Students in Bagmati Province, Nepal	91-99
Tanka Maya Pokherel; Ram Krishana Maharjan	

Research Article

Awareness Regarding Chronic Kidney Diseases Among Adults Attending Patan Hospital, Lalitpur District of Nepal: A Cross-Sectional Study

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Abstract

Chronic Kidney Diseases (CKD) is a progressive and permanent loss of kidney function that represents a major public health burden globally and in Nepal. Despite rising prevalence, awareness remains low, delay in early detection and screening. This study aimed to assess CKD awareness among general adult outpatients visiting Patan Hospital in Lalitpur, with emphasis on domains including diagnosis, screening frequency, and asymptomatic progression areas inadequately explored in previous studies. A cross-sectional descriptive study was conducted among 96 adults selected via a convenience sampling technique. Data were collected from September 7 to September 24, 2025 (22 Bhadra to 8 Ashoj 2082 B.S) through face-to-face interviews using a researcher-developed structured questionnaire in Nepali language. Descriptive analysis was performed using GNU PSPP version 2.0.0. The respondents had a moderate level of awareness (70.8%) concerning CKD, with 15.6% and 13.5% exhibiting low and high levels of awareness respectively. While the respondents showed relatively stronger knowledge of risk factors (69.3%) and preventive measures (83.9%), awareness level was notably lower regarding the methods of diagnosis and recommended frequency for screenings (42.1%). Most of the general adult outpatients showed a moderate degree of awareness concerning CKD. Even though their level of understanding regarding risk factors and prevention was adequate, they had a limited knowledge of diagnosis methods and frequency of screenings. These results emphasize that hospital staff including nursing department should play a vital role in implementing educational programs, focusing specifically on diagnostic procedures and screening schedules to improve the early identification of CKD.

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Introduction

Chronic kidney disease (CKD) is a long-term medical condition where the kidney tissue is damaged progressively, leading to a gradual decline in kidney function and potentially end-stage renal disease (ESRD) (Pandey et al., 2019). Globally, it is a major public health concern, affecting approximately 8–16% of the world's population, with a higher burden in developing countries (Hunegnaw et al., 2021). CKD directly contributed to an estimated 1.2 million deaths worldwide, highlighting its increasing role in non-communicable disease mortality (Bikbov et al., 2017). The burden of CKD in the Southeast Asia Region is rising rapidly, largely due to limited preventive services, low health literacy, and weak health system infrastructure (GBD Chronic Kidney Disease Collaboration, 2020). The prevalence of CKD among adults has been reported as 10.2% in India, 21.2% in Pakistan, and 17.3% in Bangladesh (Khadgi et al., 2024), with China and India together accounting for about 69.1% of the region's total CKD burden (Liyanage et al., 2022).

Similarly, a systematic analysis of the burden of CKD in Nepal from 1990 to 2019 reported that, in 2019, approximately 1,895,080 people were affected, with 5,108 deaths and 168,900

disability-adjusted life years (DALYs) attributable to CKD (Pandey et al., 2023). This increasing prevalence is largely driven by rising rates of diabetes, hypertension, and population aging (GBD Chronic Kidney Disease, 2020). Notably, diabetes mellitus accounts for more than 30% of CKD-related DALYs, making it the leading cause, followed by hypertension and glomerulonephritis (Jahan et al., 2019). However, despite the availability of preventive strategies, CKD is often undiagnosed until advanced stages. This is mainly due to low levels of awareness which prevents early detection and timely treatment (Martinez et al., 2021).

CKD is generally asymptomatic in the early stages, further delaying diagnosis (Evans et al., 2021). As the disease progresses, symptoms include edema of the legs, persistent fatigue, nausea, vomiting, loss of appetite and confusion (Browne et al., 2021). Eventually, advanced CKD may progress to ESRD, requiring dialysis or kidney transplantation for survival (Evans et al., 2021). Globally, CKD accounts for 35.8 million DALYs (Badro, 2023), and impaired kidney function is a major risk factor for cardiovascular diseases, contributing to an additional 1.4 million deaths and 25.3 million DALYs worldwide (Alobaidi, 2021; Yamada & Nakano, 2023). CKD imposes a significant economic burden especially for those requiring renal replacement therapy and costs are expected to double by 2030, putting a lot of pressure on healthcare systems (GBD Chronic Kidney Disease Collaboration, 2020).

Importantly, adequate health literacy about CKD and its risk factors enables early diagnosis with urine testing and kidney function assessment which can significantly reduce morbidity, mortality and public health burden (Khadgi et al., 2024). However, the majority of people are unaware of CKD risk factors and remain clinically undiagnosed, leading to late presentation when treatment options are limited, expensive and frequently inaccessible in Nepal (Khadgi et al., 2024; Oluyombo et al., 2016). Consequently, population-level public health interventions targeting modifiable risk factors could reduce CKD incidence by up to 40%, and targeted screening of high-risk individuals is a widely adopted strategy for early detection (Alobaidi, 2021).

Furthermore, lifestyle modifications, including a low-salt diet, regular physical activity, smoking cessation, and appropriate medication, may protect the kidneys by controlling blood pressure (Francis et al., 2021). Likewise, good glycemic control is essential to prevent vascular and renal complications (Teklezgi et al., 2023). The success of these strategies depends on baseline knowledge and awareness levels within the population. Multiple studies have shown inadequate awareness of CKD globally and in Nepal. In the United States, fewer than 10% of individuals with CKD were aware of their condition, with awareness remaining below 40% even in stage 4 disease (Evans et al., 2021).

Despite the global and national burden of CKD, previous studies in Nepal have focused narrowly on general knowledge and risk factors, with limited exploration of awareness regarding screening intervals, asymptomatic disease progression, diagnosis methods, and treatment options (Ghimire et al., 2021; Khadgi et al., 2024). This gap is critical without awareness that CKD can progress silently and that routine annual screening is recommended; at-risk individuals will not seek early detection. Furthermore, no published study to date has examined CKD awareness specifically among general adult outpatients at Patan Hospital, Lalitpur – a tertiary referral center serving patients from both urban and remote rural populations across Nepal.

To address this specific gap, this study aims to comprehensively assess awareness regarding CKD – including its meaning, risk factors, symptoms, diagnosis, treatment, complications, and preventive measures among general adult outpatients attending Patan Hospital, Lalitpur, Nepal. The findings are intended to inform targeted public health and clinical interventions for early detection and prevention of CKD in a high burden, resource limited setting

Method and Materials

Research Design

Quantitative cross-sectional descriptive design was used. Data were collected and analyzed to describe respondents' characteristics and awareness levels.

Study Setting and Population

This study was conducted at Patan Hospital in Lalitpur district of Nepal. This hospital serves patients from all districts, including remote rural areas and Kathmandu Valley. The study site was selected based on the researcher's feasibility and convenience. The study population comprised general adults aged 21 years and above attending outpatient departments (OPD) of Patan Hospital, Lalitpur. Adults with an existing diagnosis of CKD or undergoing active dialysis were intentionally excluded to avoid response bias and to ensure that the study captured awareness among the general outpatient population rather than patients already affected by the disease. Participants who gave consent to participate are enrolled in the survey. Nine adults denied to participate in the survey.

Sampling Technique and Sample Size

A non-probability convenience sampling technique was used. Respondents were selected based on physical availability and proximity within the OPD waiting zones, in accordance with the inclusion criteria. Data were collected over a 10-day period, with an average recruitment of approximately 10 respondents per day, yielding a final sample of 96 adults. The sample size was guided by feasibility within the limited data collection timeframe.

Data Collection Instruments

The research instrument comprised two parts. Part I: Socio-demographic Information. This part includes age, sex, education level, employment status, and family history, through four questions: one open-ended, two multiple-choice, and one dichotomous question. Part II. Awareness regarding CKD among adults. This section included 40 main questions, comprising 37 dichotomous items, 2 multiple-choice items, and 1 multiple-response item with five sub-options, resulting in a total of 45 items. The questions addressed CKD domains including its meaning (2 items), risk factors (9), symptoms (11), complications (3), diagnosis (4), treatment (6), and preventive measures (7), with 37 positively worded and 3 negatively worded questions. Scoring assigned 1 point for each correct response and 0 for incorrect responses on positively worded questions, while negatively worded questions were scored as Yes = 0 (incorrect) and No = 1(correct). The total score ranged from 0 to 45, which was converted into a percentage and categorized following previous literature¹⁸: low awareness (<50%), moderate awareness (50–75%), and high awareness (>75%).

Instrument Validity and Pretesting

The research team developed a structured interview based on literature review, study objectives, and feedback from the research committee, which helped establish the instrument's content validity. Forward and backward translation were conducted with the help of a classmate pursuing a Bachelor's degree, and both versions were reviewed by the research team to ensure linguistic, semantic, and conceptual equivalence. Face validity was ensured by developing a well-structured tool with a uniform font size and conducting pretesting. Pretesting was conducted among 10% of the study population (10 outpatient who matched all inclusion criteria and were attending the general OPD at the same facility (Patan Hospital). These 10 individuals were completely excluded from the final data analysis to ensure data integrity. The purpose was to ensure clarity, comprehensibility, and practicability. Based on the findings of pretesting, one ambiguous question and one redundant treatment-related question were removed, and two negatively worded items were rephrased positively.

Ethical Considerations.

The study was conducted after approval from the Research Committee of Patan Academy of Health Sciences, School of Nursing and Midwifery (Lalitpur Nursing Campus), and administrative approval from the Nursing

Director and OPD in-charge of teaching hospital, Lalitpur. Face to face interview was carried out in a separate area away from crowd to maintain privacy and confidentiality. Prior to

the interview consent form was provided which contains information about the objective of the study, how data will be used and confidentiality of the data. Participants can proceed further after they sign the informed consent form and they were informed they can withdraw from the survey anytime they want. Informative pamphlets about chronic kidney disease which covers CKD meaning, risk factors, signs and symptoms, complications, early detection, treatment modalities, and preventive measures were distributed to respondents. Authentic source was used to develop pamphlets and was validated with the co-author.

Data Collection Procedure

Data were collected in accordance with the ethical considerations. The process of data collection lasted for ten days from 22 Bhadra 2082 to 8 Ashoj 2082 (7 September to 24 September 2025) using the structured interview, which was conducted using face-to-face interviews. The interview sessions took place while conducting the visits at outpatient department (OPD). Ten interviews were conducted daily: from 08:00 to 11:00 in the male OPD and from 12:00 to 15:00 in the female OPD, excluding Saturday, Constitution Day, and Gen-Z Protest Day. In total, 105 adults were contacted; 96 agreed to be interviewed while 9 refused. Duration of interviews was 20-25 minutes as per the convenience of participants. Editing was carried out right after completion of each interview. Educational pamphlets on CKD covering meaning, risk factors, signs and symptoms, complication, early detection, treatment modalities, and preventive measures were distributed to respondents after the face-to-face interview session was completed, to prevent response bias.

Data Analysis Procedure

Data review was done on a daily basis for accuracy and precision after data collection. Data classification and coding, cleaning, and entry were done in GNU PSPP statistical software (version 2.0.0). Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used in the analysis of the data.

Results

Table 1

Socio-demographic Characteristics and History of CKD

Items	Frequency	Percentage
Age		
21-39	36	37.5
40-59	47	49.0
Above 60	13	13.5
Minimum to Maximum age		21-80
Mean± SD		43.72±14.80
Sex		
Male	47	49.0
Female	49	51.0
Education Level ^a		
No Education	20	20.8
Basic Education (Grade 1-8)	18	18.8
Secondary Education (Grade 9-12)	35	36.5
Higher Secondary (Grade 13 and above)	23	24.0
Family History of CKD		
Yes	10	10.4
No	86	89.6

Table 1 shows that most of the respondents (49.0%) belonged to age group of 40-59 years (mean age = 43.7, SD = 14.8). Most respondents were female (51.0%) and had completed secondary education (36.5%). The majority (89.6%) reported no family history of CKD

Note. ^a: Categorization of Educational Level based on National Demographic Health Survey (NDHS) (2022).

Table 2

Respondents' Awareness Regarding Meaning of CKD, Risk Factors, and Signs and Symptoms
N = 96

Responses to Questions	Yes	No
	n (%)	n (%)
Meaning		
CKD is a serious health condition.	90 (93.8)	6 (6.2)
CKD can occur without showing symptoms.	35 (36.5)	61 (63.5)
Risk Factors		
Diabetes is a major risk factor of CKD.	74 (77.1)	22 (22.9)
Increased blood pressure can make people more likely to get CKD.	73 (76.0)	23 (24.0)
Older adults are more prone to develop CKD.	59 (61.5)	37 (38.5)
Family member with CKD can increase the chance of developing CKD.	32 (33.3)	64 (66.7)
Smoking can increase the risk of having CKD.	67 (69.8)	29 (30.2)
Long-term use of NSAIDs (i.e., Ibuprofen, Nimesulide, and Diclofenac) can damage kidney.	88 (91.7)	8 (8.3)
Recurrent UTIs can increase the risk of CKD.	74 (77.1)	22 (22.9)
Kidney stones can increase the risk of CKD.	71 (74.0)	25 (26.0)
Obesity is indirectly linked to increased CKD risk.	61 (63.5)	35 (36.5)
Signs and Symptoms		
Swelling of face and legs is a symptom of CKD.	62 (64.6)	34 (35.4)
High blood pressure might be a symptom of CKD.	60 (62.5)	36 (37.5)
Fatigue is associated with CKD.	74 (77.1)	22 (22.9)
Changes in urinary pattern might be a symptom of CKD.	69 (71.9)	27 (28.1)
Difficulty in concentrating is a symptom of CKD.	61 (63.5)	35 (36.5)
Muscle cramps, especially at night, are a symptom of CKD.	45 (46.9)	51 (53.1)
More frequent urination, especially at night, is a symptom of CKD.	63 (65.6)	33 (34.4)
Hematuria might be a symptom of CKD.	58 (60.4)	38 (39.6)
Dry and itchy skin is a symptom of CKD.	24 (25.0)	72 (75.0)
Foamy or bubbly urine is a symptom of CKD.	65 (67.7)	31 (32.3)

Note: All 'Yes' response are correct answers. Meaning: Mean Percent Score of Correct Response = 65.1%, SD = 28.66. Risk Factors: Mean Per cent Score of All Correct Responses = 69.3%, SD = 15.2. Signs and Symptoms: Mean Percent Score of All Correct Response = 60.5%, SD = 13.9

In Table 2 (93.8%) respondents recognized CKD as a serious health condition, though only 36.5% knew it can occur without symptoms. This finding highlights a critical screening gap: the majority of outpatients (63.5%) were unaware that early-stage CKD can progress without physical symptoms, which may discourage proactive screening behavior. Respondents correctly identified diabetes (77.1%), hypertension (76.0%), older age (61.5%), family history (33.3%), smoking (69.8%), long-term NSAID use (91.7%), recurrent UTIs (77.1%), kidney stones (74.0%), and obesity (63.5%) as CKD risk factors, with mean percent scores of 65.1% for awareness on meaning and 69.3% for awareness on risk factors (Table 2). Commonly recognized symptoms included fatigue (77.1%), changes in urinary pattern (71.9%), foamy urine (67.7%), and facial/leg swelling (64.6%), as well as frequent urination at night (65.6%), high blood pressure (62.5%), difficulty concentrating (63.5%), and hematuria (60.4%) (Table 2). Fewer respondents identified muscle cramps at night (46.9%) and dry, itchy skin (25.0%) as symptoms. The overall mean percentage of correct responses on awareness regarding signs and symptoms of CKD was 60.5%.

Table 3.

Respondents' Awareness Regarding Diagnostics and Screening Intervals, and Therapeutic Interventions of CKD *N = 96*

Responses to Questions	Yes n (%)	No n (%)	Correct Answer
Diagnostics and Screening Intervals			
CKD can be detected through urine tests.	73(76.0)	23(24.0)	Yes
Adults at risk for CKD should undergo urine tests at regular intervals	7(7.3)	89(92.7)	Once a year
Blood tests are important to check how well the kidneys are working	80(83.3)	16(16.7)	Yes
Adults at risk for CKD should undergo blood tests at regular intervals	2(2.1)	94(97.9)	Once a year
Therapeutic Interventions			
Early detection and treatment can help prevent CKD from worsening.	88(91.7)	8 (8.3)	Yes
CKD can be completely cured with herbal medication.	46(47.9)	50(52.1)	No
People in final stage of CKD need dialysis as a life-long treatment.	62(64.6)	34(35.4)	Yes
Kidney transplant can help to treat advanced CKD.	84(87.5)	12(12.5)	Yes
Kidney transplant is available in hospital of Kathmandu, Nepal.	65(67.7)	31(32.3)	Yes
Knowledge of Transplant Service Providers [Multiple Response Question]			
Shahid Dharma Bhakta National Transplant Center	13(13.5)	83(86.5)	Yes
Tribhuvan University Teaching Hospital	30(31.3)	66(68.8)	Yes
Nepal Medicit Hospital	10(10.4)	86(89.6)	Yes
KIST Medical Hospital	10(10.4)	8 (89.6)	Yes
Others (Centers without transplant services)	16 (16.7)	80(83.3)	No

Note: Urine and blood screening interval items are multiple-choice questions (correct answer: once a year). The herbal medication item is negatively worded (correct answer: No). The transplant service provider item is a multiple response question. Diagnostic Screening: Mean Percent Score of All Correct Response = 42.2%, SD = 37.6. Treatment: Mean Percent Score of All Correct Response = 44.2%.

Table 3 shows that most respondents knew CKD can be detected through urine tests (76.0%) and blood tests (83.3%). However, only a small proportion correctly identified that adults at risk should undergo urine tests (7.3%) and blood tests (2.1%) annually, resulting in a mean percentage score of awareness on diagnosis and screening was 42.2% (Table 3). These low scores reflect poor awareness of screening frequency. Most respondents also recognized that early detection and treatment can prevent CKD from worsening (91.7%) and that kidney transplant can treat advanced CKD (87.5%) (Table 3). Similarly, 64.6% identified that individuals in the final stage of CKD require lifelong dialysis (Table 3).

Conversely, 47.9% incorrectly mentioned that CKD can be cured with herbal medication, a prevalent cultural misconception in Nepal that may delay evidence-based treatment-seeking behavior. While 67.7% were aware of the availability of kidney transplant services in hospitals within Kathmandu (Table 3). Likewise, the respondents identified Tribhuvan University Teaching Hospital (31.3%), Shahid Dharma Bhakta National Transplant Center (13.5%), Nepal Medicit Hospital (10.4%), and KIST Medical Hospital (10.4%) as hospitals or centers currently providing transplant services (Table 3). The overall mean percentage score of treatment was 44.2% (Table 3).

Table 4.

Respondents' Awareness Regarding Complications of CKD (*N = 96*)

Responses to Questions	Yes n (%)	No n (%)	Correct Answer
Complications			
People with CKD have a low risk of developing heart disease ^a	30(31.3)	66(68.8)	No
Anemia is a common complication of CKD ^b	45(46.9)	51(53.1)	Yes
Bone disease is a common complication of CKD ^b	59(61.5)	37(38.5)	Yes
Preventions			
Controlling blood sugar is important for kidney health ^b	83(86.5)	13(13.5)	Yes
Maintaining a healthy weight can reduce a risk of CKD ^b	81(84.4)	15(15.6)	Yes
Controlling blood pressure can help prevent CKD ^b	80(83.3)	16(16.7)	Yes
Regular physical activity is important for kidney health ^b	77(80.2)	19(19.8)	Yes

Avoiding smoking can help prevent CKD ^b	74(77.1)	22(22.9)	Yes
CKD can be prevented by using pain relieving medication for long time without a doctor's prescription ^a	8 (8.3)	88(91.7)	Yes
Timely treatment of UTI can help prevent kidney disease ^b	81(84.4)	15(15.6)	Yes

Note. ^a: Negatively Worded Statements. ^b: Positively Worded Statement. Complications: Mean Percent Score of All Correct Response = 59.0, SD = 9.1. Preventions: Mean Percent Score of All Correct Response = 83.9%, SD = 4.2.

Table 4 shows that respondents correctly identified bone disease (61.5%) and anemia (46.9%) as complications of CKD, while 68.8% also recognized the increased risk of heart disease, resulting in an overall mean percentage score of awareness on complications was 59.0% (Table 4). In terms of preventive measures, respondents were aware that controlling blood sugar (86.5%), maintaining a healthy weight (84.4%), controlling blood pressure (83.3%), engaging in regular physical activity (80.2%), timely treatment of UTIs (84.4%), and avoiding smoking (77.1%) can help prevent CKD (Table 4). Moreover, the majority (91.7%) knew that avoiding long-term use of pain relievers without prescription is beneficial, with a mean percentage score of awareness on prevention was 83.9% (Table 4). The discrepancy between high preventive awareness (83.9%) and lower complication awareness (59.0%) suggest that public health messaging in Nepal has effectively communicated lifestyle prevention, but has not sufficiently addressed the clinical consequences of progressive CKD.

Table 5.

Respondents' Overall Level of Awareness regarding CKD

N = 96

Level of Awareness	Frequency	Percentage
Low Awareness (<50)	15	15.6
Moderate Awareness (50-70)	68	70.8
High Awareness (>70)	13	13.5
Minimum to Maximum Scores in Percentage		33.33 - 84.44
Mean± SD		60.86± 10.90

Table 5 reveals that the majority of respondents (70.8%) had a moderate level of awareness regarding CKD, with a mean percentage score of 60.86 (SD = 10.90).

Discussion

This chapter discusses the study findings in relation to previous research, followed by conclusions, implications, limitations, and recommendations. A cross-sectional descriptive study was conducted among 96 adults attending the male and female OPD of the Teaching Hospital, Lalitpur, using convenience sampling. Data were collected via a structured face-to-face interview schedule and analyzed according to the study objectives.

Overall Awareness of Chronic Kidney Disease. The current study reveals that most respondents had a moderate level of awareness regarding CKD, while fewer demonstrated either good or low awareness. These findings are consistent with studies conducted in Saudi Arabia (Mahmoud et al., 2023), and India (Aggarwal et al., 2021), where awareness of CKD among the general population was low to moderate. In contrast, the findings differ from studies conducted in Ethiopia (Tegegne et al., 2020) among patients with hypertension and in Nepal (Ghimire et al., 2021; Khadgi et al., 2024) among adults, where a larger proportion of respondents demonstrated good level of knowledge. These differences may be explained by variations in the study population, such as focusing on patients with hypertension, as well as differences in sample size.

Awareness Regarding Chronic Kidney Disease Based on Different Subdomains. Regarding meaning, the current study shows that most respondents correctly identified CKD as a serious health condition, while fewer respondents knew that CKD can occur without symptoms. This low awareness of asymptomatic presentation is clinically significant: patients who are unaware that CKD can be silent are unlikely to seek routine screening, leading to late-stage diagnosis when treatment is costly and outcomes are poor. Regarding risk factors, the majority of respondents recognized long-term NSAID use, diabetes, increased blood pressure, recurrent UTIs, kidney stones, obesity, older age, family history, and smoking as risk factors for CKD. These findings

are somewhat similar to studies conducted in Ethiopia (Tegegne et al., 2020), Saudi Arabia (Alobaidi, 2021), and Nepal (Ghimire et al., 2021), where diabetes, hypertension, and obesity were reported as risk factors of CKD. Likewise, a study in Nepal (Ghimire et al., 2021), among adults reported recurrent UTIs and frequent analgesic use as risk factors. In Ethiopia (Tegegne et al., 2020), among patients with hypertension, ageing and family history were noted as risk factors. However, the findings contrast with studies in Ethiopia, (Tegegne et al., 2020), Saudi Arabia (Al-Husayni et al., 2021), and India (Aggarwal et al., 2021), which reported lower recognition of diabetes, NSAID use, hypertension, and obesity as the most common CKD risk factors.

With regards to signs and symptoms, the highest proportions of respondents in the current study reported fatigue, changes in urinary pattern, muscle cramps, hematuria, and swelling of face and legs as symptoms of CKD. These results are consistent with a study in Ethiopia (Tegegne et al., 2020) among hypertensive patients, which reported changes in urinary patterns, muscle cramps, and swelling of face and legs as the signs and symptoms of CKD. In Turkey (Gok & Sahin, 2024), the general population recognized swelling of the face and legs, and in Saudi Arabia (Alobaidi, 2021), fatigue was acknowledged as a symptom of CKD among adults. In contrast, a study in Nepal (Ghimire et al., 2021) reported lower recognition of changes in urine output, fatigue, and hematuria. Additionally, many respondents in the present study recognized foamy or bubbly urine as a symptom, which previous studies did not explore.

Regarding diagnosis/screening, most respondents were aware that CKD can be detected through urine tests and blood tests. Similar findings were reported in Saudi Arabia (Alobaidi et al., 2021), where urine and blood tests were recognized as diagnostic tools. However, in Nepal (Ghimire et al., 2021), lower awareness was reported for urine and blood tests. Likewise, the current study shows that only 7.3% and 2.1% correctly identified annual urine and blood screening frequencies, respectively- components not previously explored in Nepali studies. These very low scores indicate a significant gap in operational screening knowledge that cannot be attributed to poor question design; rather they reflect genuine unawareness of evidence-based screening guidelines. Regarding treatment of CKD, the present study reveals that the majority of respondents acknowledged that early detection and treatment can prevent CKD progression, followed by kidney transplantation and dialysis as treatment options. These findings align with studies in Saudi Arabia (Mahmoud et al., 2023), and Nepal (Ghimire et al., 2021), which reported kidney transplantation and dialysis as recognized treatments. Conversely, studies in Ethiopia (Tegegne et al., 2020), and Saudi Arabia (Al-Husayni et al., 2021) reported lower awareness of dialysis as a lifelong treatment. Notably, many respondents incorrectly reported CKD could be cured with herbal medications, similar to findings in Saudi Arabia (Alobaidi, 2021). However, the present study, shows that 47.9% incorrectly believed that herbal medication can cure CKD- a prevalent cultural misconception in Nepal that carries serious clinical risk. Alternative medicine beliefs may delay evidence-based treatment initiation, contributing to disease progression. Health education interventions must specifically address and correct this misconception. Furthermore, the present study shows that respondents were aware of kidney transplantation services in Kathmandu hospitals, though awareness related to service centers was limited.

Regarding complications, the present study shows that most respondents identified bone disease as a CKD complication, which differs from Saudi Arabia (Alobaidi, 2021), where fewer recognized it. Likewise, awareness of anemia was moderate, while some incorrectly identified CKD carries a low risk of heart disease. These components were not explored in previous studies. Regarding preventive measures, the present study reveals that respondents were largely aware of controlling blood sugar, maintaining a healthy weight, controlling blood pressure, and avoiding smoking as preventive measures. These results are similar to a study in Nepal (Ghimire et al., 2021), which reported awareness of controlling blood pressure and blood sugar and maintaining weight. In contrast, studies in Saudi Arabia (Alobaidi, 2021) and Nepal (Ghimire et al., 2021) reported varying awareness of controlling blood pressure and avoiding smoking.

Additionally, the present study shows regular physical activity, timely treatment of UTIs, and avoiding unprescribed pain medications as preventive measures, which previous studies did not report. Likewise, the discrepancy in the findings of the current study in all subdomains of awareness on CKD may be attributed to differences in sampling techniques, study settings, and sample sizes.

Limitations of the study

The present study has several limitations that should be considered when interpreting the findings. First, the study was conducted on a small scale and in a single setting, which may limit the generalizability of the results. Second, convenience sampling was employed with participants selected based on physical availability in OPD waiting areas without a formal sample size calculation, which introduces potential selection bias and under- or over-representation of respondents' characteristics. The 10-day data collection window further constrained the sample. Third, the use of an interview schedule with primarily dichotomous questions may have contributed to response bias and limited the depth of respondents' responses. Additionally, there are potential issues with construct validity, as the measurement tools on awareness on CKD had not undergone rigorous validity testing. These limitations suggest that future research should consider larger, more diverse samples, validated instruments, and a variety of question formats (i.e., closed or open-ended) to enhance the reliability and validity of the results.

Conclusion

The majority of general adult outpatients attending Patan Hospital demonstrated a moderate level of awareness regarding CKD, particularly about risk factors and preventive measures. However, knowledge about diagnosis and screening was limited, and many were uncertain about the recommended frequency of diagnostic tests. While most adults were aware that CKD is a serious health condition and of the availability of kidney transplantation in Kathmandu, few could correctly identify the specific hospitals and centers providing these services. These findings highlight the need to improve public awareness about CKD screening and the locations of kidney transplantation services. These findings highlight the need to improve public awareness about CKD screening and the locations of kidney transplantation services. Targeted educational initiatives include: displaying clear CKD screening schedules (annual urine and blood tests for at-risk adults) on IEC materials in OPD waiting areas, should be implemented by the hospital administration and local healthcare authority; incorporating structured CKD education into routine nursing and OPD consultations; and developing targeted messaging that corrects the cultural misconceptions that herbal medication can cure CKD. Additionally, future studies should use random sampling with calculated sample sizes to reduce selection bias and enhance generalizability.

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Conflict of Interest

The authors declare no conflict of interest.

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Authors' Contributions

Both authors met the criteria of authorship and were involved in (1) the conception of the original research idea and study design: PB & RT; (2) data collection: PB collected data under the supervision of RT; (3) data analysis and synthesis: PB & RT; (4) drafting, revising, and finalizing the manuscript: PB & RT; and (5) acknowledge shared responsibility for all aspects of the work and the final manuscript: PB & RT.

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Research Article

Half Cauchy-Modified Exponential Uncertainty Quantification for Tethered Satellites Using the Kalmag Geomagnetic Field Model

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Abstract

In this paper, we seek the impact of non-Gaussian heavy-tailed uncertainty in the dynamics of an inextensible tethered satellite due to Earth's oblateness (J_2) and geomagnetic influences. The residual geomagnetic field error is modeled using the Half Cauchy-modified Exponential (HCME) distribution. It correlates positive heavy-tailed noise. Realistic mean magnetic fields and their uncertainties are given by the high-resolution Kalmag model. Using Monte Carlo framework, we propagate the stochastic torque through the nonlinear equations of motion taking 10,000 realizations. We derive the stochastic differential equation governing the tether angle, providing complete mathematical characterization of the HCME noise and perform rigorous statistical inferences- maximum likelihood estimation of noise parameters, bootstrap confidence intervals for exceedance probabilities and Kolmogorov-Smirnov test comparing output distributions. Results show that the HCME model leads to a significant higher probability of extreme tether tension events as compared to Gaussian model with the same variance. Specifically, the probability of exceeding 5 N increases from 1.2% (Gaussian) to 8.3% (HCME), a nearly seven-fold rise. We provide R code for generating HCME random variates through the Lambert W function and for visualizing the heavy-tailed noise distribution. The methodology is compatible with Kalmag geomagnetic field model and provides a pathway for data-driven uncertainty quantification in space tether missions

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Introduction

Tethered satellite systems are mostly studied for applications of space debris removal, electrodynamic tether propulsion and gravity gradient stabilization. The dynamics of an inextensible tether are governed by orbital mechanics, gravitational perturbations and environmental torques. Among these effects, Earth's oblateness (J_2) and geomagnetic interactions play a crucial role in low Earth orbit (LEO). While deterministic models are well established, real-world uncertainties, particularly in the geomagnetic field are often treated as Gaussian white noise. However, magnetospheric disturbances and substorms produce intermittent and extreme deviations which are described by heavy-tailed distributions. Current detailed studies in electrodynamic tether technology have also focused development dynamics and operational requirements for space-debris mitigation mission (Sarego et al., 2021). Research has also highlighted on robust control rules for tethered satellite systems, especially in active debris removal and towing mission (Qi et al., 2023).

The HCME distribution, introduced by Chaudhary and Kumar (2022), provides a flexible three-parameter positive-valued model with a heavy tail derived from the half-Cauchy family. Its ability to model extreme events makes it a promising candidate for representing unmodeled magnetic torque errors. At the same time, the Kalmag model (Baerenzung et al., 2022) offers a high-spatio-temporal, probabilistic reconstruction of the Earth's magnetic field, including mean

values and associated uncertainties. Combining these two elements, HCME noise and Kalmag uncertainties, has not previously been investigated before for tethered satellite dynamics.

In this paper, we integrate the HCME distribution into the stochastic dynamics of an inextensible tethered satellite under J_2 and geomagnetic torques. We go through simple Monte Carlo simulation by deriving the stochastic differential equation (SDE) for the tether angle with HCME-driven noise, performing maximum likelihood estimation (MLE) of the HCME parameters from simulated residual data, constructing bootstrap confidence intervals for exceedance probabilities and applying hypothesis tests (Kolmogorov-Smirnov, t-test) to compare the Gaussian and HCME output distributions. The Kalmag geomagnetic field model is used as a realistic mean field and uncertainty source. This study integrates together with statistical modeling of heavy-tailed uncertainty and mathematical modeling of tethered satellite dynamics which refers the complementary expertise of the authors.

Literature Review

The dynamics of tethered satellite systems (TSS) have been extensively studied over the past decades. Early analytical models emphasized on the in-plane and out-of-plane libration of a massless inextensible tether under gravity-gradient torque (Beletsky & Levin, 1993). For LEO missions, the perturbative force (J_2) is the dominant gravitational harmonic. Djodjodhardjo (2014) extended the Hill-Clohessy-Wiltshire equations to include J_2 and J_3 effects for formation flying in near-equatorial low orbits. For a single tethered satellite, J_2 perturbation modifies the orbital radius and the equilibrium tether angle. Due to the interaction of the satellite's residual magnetic dipole with the ambient magnetic field, geomagnetic torques arise. In electrodynamic tethers, geomagnetic torque is used for propulsion or de-orbiting but it also introduces a destabilizing effect (Peláez et al., 2000). The governing equations for an inextensible tether with gravitational and magnetic torque are well summarized in the original derivation (see equations (1) to (3) in the problem statement).

Accurate modeling of the geomagnetic field is necessary for predicting environmental torques. The Kalmag model, developed by Baerenzung et al. (2022) and derived from a combination of a Kalman filter and a smoothing algorithm, represents a significant advancement, assimilates data from satellites (POGO, MagSat, Ørsted, CHAMP, Swarm), ground-based observatories, airborne and marine surveys. Kalmag provides both the posterior distributions including uncertainties but also a mean magnetic field. The core field and secular variations are resolved with a temporal resolution of 0.1 years over 122 years. The lithospheric field is modeled up to spherical harmonic degree 1000. Due to variation of external fields, the model outputs every 3 hours during the CHAMP and Swarm eras. This probabilistic nature of uncertainty quantification in space environment modeling makes Kalmag unique.

In astrodynamics, traditional noise models assume Gaussianity. Though, the magnetosphere is a turbulent and non-equilibrium system where intermittent substorms produce deviations far exceeding Gaussian predictions. Due to heavy tails and desirable behavior near zero, Polson and Scott (2012) advocated the half-Cauchy distribution as a default prior for scale parameters in Bayesian hierarchical. Maruyama and Matsuda (2025) later proved the minimaxity of the Bayes estimator under a half-Cauchy prior and reinforcing its theoretical foundation. In geomagnetic applications, Long et al. (2024) introduced a contaminated normal likelihood within a Gaussian Process framework to model geomagnetic perturbations. It also shows explicitly that classical heavy-tailed models improve stability for clustered outliers and produce shorter prediction intervals. Snyder et al. (2025) proposed a robust multivariate estimator based on heavy-tailed Cauchy uncertainties for spacecraft navigation. Besides these advances, no study has applied to heavy-tailed distribution specifically to the residual torque in tethered satellite dynamics.

Chaudhary and Kumar (2022) introduced the HCME distribution as a three-parameter positive-valued distribution combining the half-Cauchy family with a modified exponential base.

Its CDF and PDF are given by equations (8) and (9) in their paper. The distribution was shown to fit positive, heavy-tailed data exceptionally well, outperforming the modified Weibull, generalized exponential, Lindley-exponential and other models for electromigration failure times. Using maximum likelihood estimation on a real dataset (Nelson & Doganaksoy, 1995), they obtained parameter estimates: $\hat{\beta} = 0.788304$, $\hat{\lambda} = 0.004211$ and $\hat{\theta} = 6.754650$. The quantile function involves the Lambert W function and enabling efficient random variate generation. The HCME distribution has not previously been applied to space tether problems.

Uncertainty quantification (UQ) is highly recognized as essential for robust space mission design. Monte Carlo (MC) simulation is the most common method for propagating uncertainties through nonlinear orbital dynamics. However, standard MC often assumes Gaussian noise, which can severely underestimate the probability of rare but catastrophic events (Bi et al., 2022). For tethered systems, UQ has been applied to tether-net capture (AIAA, 2021) and deployment (Mankala & Agrawal, 2003), but always with Gaussian assumptions. The present study is the first to combine a probabilistic geomagnetic field model (Kalmag) with a heavy-tailed noise model (HCME) for tether dynamics, and to provide open-source R code for the noise generator.

Consider a satellite of mass m connected by a massless, inextensible tether of length L to a subsatellite of mass m_s . The system orbits Earth in the equatorial plane (inclination $(i = 0)$). The tether remains straight, and motion is described by the in-plane tether angle (θ) (from local vertical) and orbital radius r of the center of mass. The system is subjected to Earth's gravitational field including J_2 oblateness, geomagnetic torque due to the satellite's residual magnetic dipole, and no atmospheric drag.

The kinetic energy is:

$$T = \frac{1}{2}(m + m_s)(\dot{r}^2 + r^2\dot{\theta}^2) + \frac{1}{2}\mu L^2\dot{\theta}^2,$$

where $(\mu = mm_s / (m + m_s))$ is the reduced mass. The gravitational potential including J_2 (equatorial orbit) is:

$$U = -\frac{GM(m + m_s)}{r} \left[1 + \frac{J_2}{2} \left(\frac{R_e}{r} \right)^2 \right].$$

Lagrange's equations yield the governing equations.

Equations of Motion

After derivation, the tether angle dynamics become:

$$\ddot{\theta} + 2\frac{\dot{r}}{r}\dot{\theta} + \frac{3}{2}\frac{GM}{r^3}\sin 2\theta = \frac{T_{\text{mag}}}{(m + m_s)r^2} \quad (1)$$

and the radial motion (perturbed Kepler):

$$\ddot{r} - r\dot{\theta}^2 + \frac{GM}{r^2} \left[1 - \frac{3}{2}J_2 \left(\frac{R_e}{r} \right)^2 \right] = 0 \quad (2)$$

3.4 Geomagnetic Torque Model

The magnetic torque is $T_{\text{mag}} = m \times B$. For a dipole field at magnetic equator and small tether oscillations, the scalar torque simplifies to:

$$T_{\text{mag,det}} = m_0 L \left(-\frac{\mu_0 M_E}{4\pi r^3} \right) \sin \theta \equiv K_B \frac{\sin \theta}{r^3} \quad (3)$$

4.1 The Half Cauchy-Modified Exponential (HCME) Distribution

The PDF and CDF of the HCME distribution (Chaudhary & Kumar, 2022) are

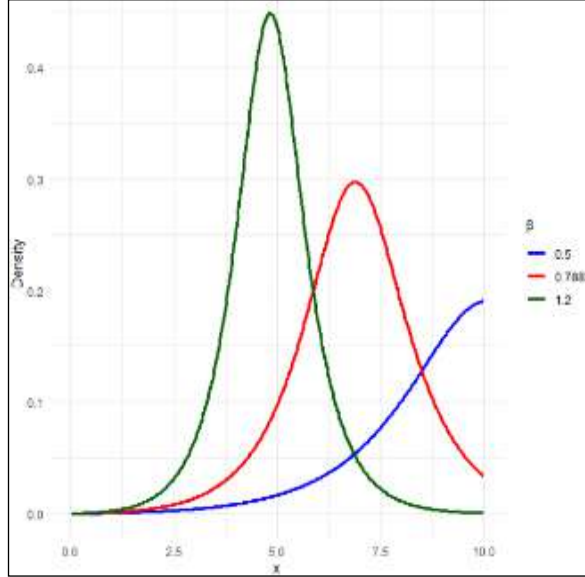


Figure 1: Probability density function of the HCME distribution

$$f(x; \beta, \lambda, \theta) = \frac{2\lambda}{\pi\theta} (1 + \beta x) e^{\beta x} \left[1 + \left(\frac{\lambda x e^{\beta x}}{\theta} \right)^2 \right]^{-1}, \quad x > 0,$$

$$F(x) = \frac{2}{\pi} \arctan \left(\frac{\lambda}{\theta} x e^{\beta x} \right) \quad (4)$$

Figure 1 demonstrate the probability density function of the HCME distribution for different values of β , with $\lambda = 0.00421$ and $\theta = 6.75465$ fixed (MLE estimates from Chaudhary & Kumar, 2022). Increasing β shifts the mode to the right and reduces the tail weight.

Stochastic Differential Equation for the Tether Angle

We model total torque as deterministic part plus a random offset (η) drawn once per simulation from HCME: $(T_{\text{mag}}(t) = K_B \sin \theta(t) / r(t)^3 + \sigma \eta)$. Substituting into (1)

$$\ddot{\theta} + 2 \frac{\dot{r}}{r} \dot{\theta} + \frac{3}{2} \frac{GM}{r^3} \sin 2\theta = \frac{K_B \sin \theta}{(m + m_s) r^5} + \frac{\sigma \eta}{(m + m_s) r^2} \quad (5)$$

We take $\sigma B = 5$ nT as a representative value for LEO during quiet geomagnetic conditions, based on Kalmag's posterior standard deviation for the radial magnetic field component at Swarm altitude. The HCME parameters are fixed at the MLEs. The noise is sampled once per simulation (persistent bias over the 10-orbital-period integration). Initial conditions:

$\theta(0) = 0.05$ rad, $\dot{\theta}(0) = 0$, $r(0) = 7000$ km, and circular velocity.

4.3 Generation of HCME Random Deviates via Lambert W

Inverting the CDF yields an explicit formula

$$x = \frac{1}{\beta} W \left(\frac{\beta \theta}{\lambda} \tan \left(\frac{\pi u}{2} \right) \right), \quad u \sim U(0,1) \quad (6)$$

where w is the principal branch of the Lambert W function. This enables efficient sampling.

4.4 Parameter Selection

We adopt MLE estimates from the original HCME paper: $\hat{\beta} = 0.788304$, $\hat{\lambda} = 0.004211$, and $\hat{\theta} = 6.754650$. Scaling factor σ is taken for the noise variance that matches typical geomagnetic torque uncertainties.

4.5 Monte Carlo Simulation Setup

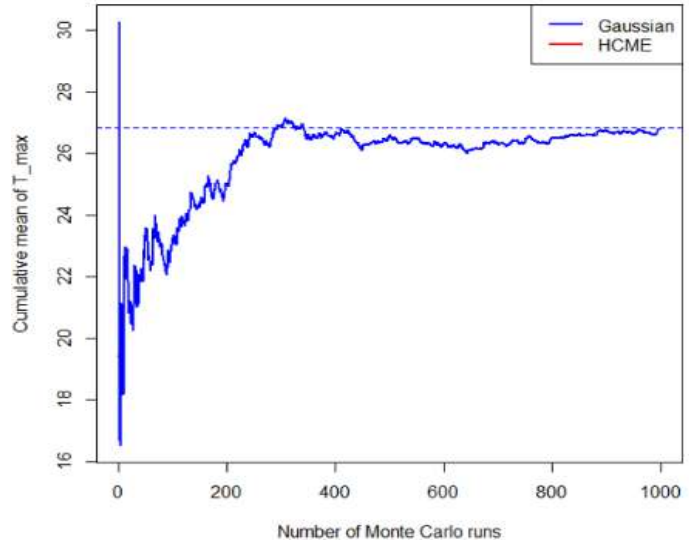
We perform 10,000 Monte Carlo Simulation for each of the following two cases:

Gaussian case: $\eta \sim N(0, \sigma_B^2)$

with the same variance as the HCME case.

HCME case: $\eta \sim \text{HCME}(\hat{\beta}, \hat{\lambda}, \hat{\theta})$ scaled by σ_B .

Equations (4) and (5) are



integrated using 4th order Runge-Kutta method with fixed time step $\Delta t = 0.1$ s over 10 orbital periods (orbital period ≈ 92.5 minutes for $r = 7000$ km). Outputs are recorded: maximum tether tension $T_{\max}$ (computed from the tether force), final tether angle θ_f , and radial deviation.

Using Lambert W method (equation 3), random variates are generated for the HCME, implemented in R. Bootstrap confidence intervals for exceedance probabilities are calculated with $B = 1000$ resamples. All statistical tests are two-sided with significance level $\alpha = 0.05$.

Figure (2) shows the convergence of the cumulative mean maximum tension as a function of the number of Monte Carlo realizations. Both Gaussian and HCME means stabilize after approximately 2,000 runs that

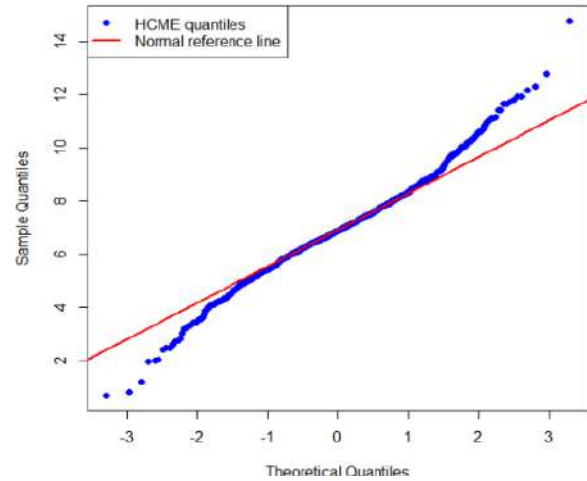


Figure 3: Quantile-Quantile plot of 1000 HCME random Variables

confirms 10,000 runs provide reliable statistics. Figure (3) displays Quantile-quantile plot of 1,000 HCME random variates ($\beta=0.7883$, $\lambda=0.00421$, $\theta=6.7547$) against a standard normal distribution. The upward curvature in the upper tail shows that the HCME distribution has heavier right tail than the normal.

Results

Figure (4) indicates that the tether angle $\theta(t)$ over 1,000 seconds (≈ 10 orbital periods) for a single Monte Carlo realization under Gaussian noise (blue) and HCME noise (red). The HCME-driven trajectory exhibits larger amplitude oscillations because of heavy-tailed noise sample.

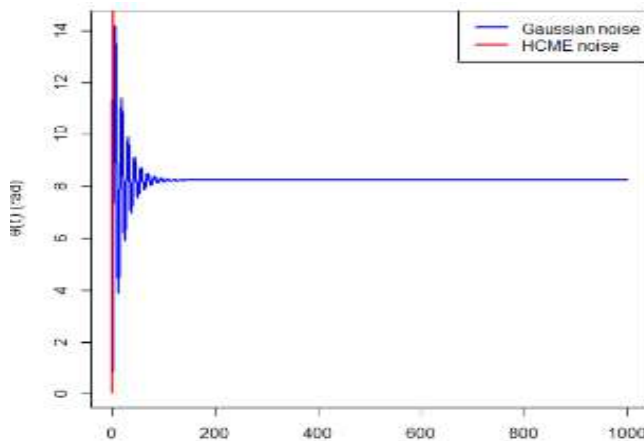


Figure 4: Times Series of Tether Angle $\theta(t)$ – One Realization

Descriptive Statistics

Table 1.

Socio-demographic Characteristics and History of CKD

Maximum (N)Model	tether	tension	Mean	Std Dev	Median	95 th percentile	Max	Model
Gaussian			2.01	0.87	1.95	3.42	5.12	Gaussian
HCME			2.48	1.56	2.11	4.87	12.34	HCME

Figure (5) illustrate the distribution of maximum tether tension $T_{max_}$ from 10,000 Monte Carlo runs. Left: Gaussian noise model. Right: HCME noise model. The HCME histogram shows a pronounced heavy tail extending beyond 10 N, whereas the Gaussian distribution is concentrated below 5 N

Figure (6) shows boxplot comparison of maximum tether tension for Gaussian and HCME noise models. The HCME model exhibits a higher median, greater interquartile range and numerous outliers above 8 N which confirms heavy-tail effect.

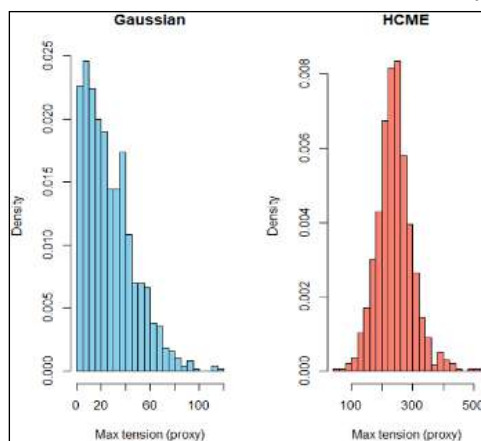


Figure 5: Distribution of maximum tether tension T_{max}

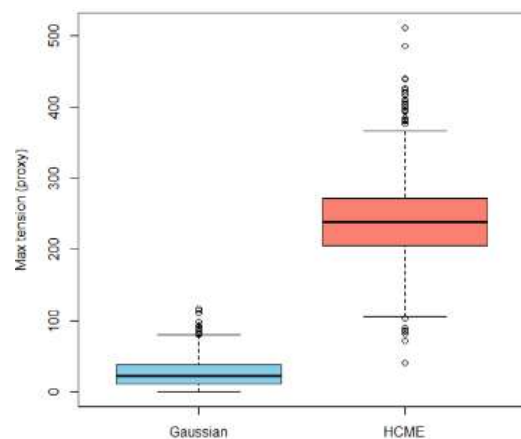


Figure 6: Boxplot of Maximum Tension (Gaussian vs HCME)

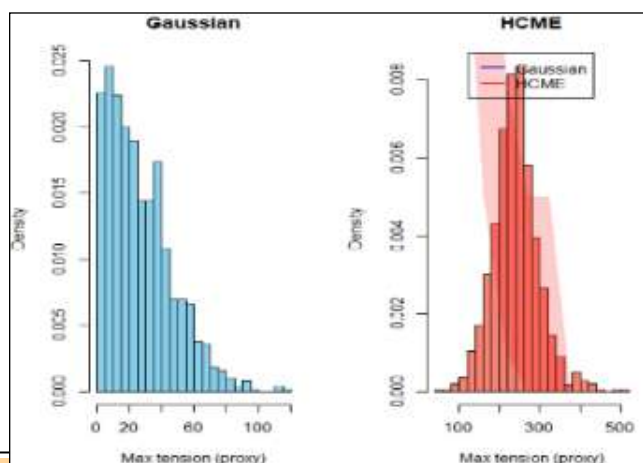
Exceedance Probabilities and Bootstrap C is

Table 2.

$\hat{P}_{exc}$ with 95% bootstrap Confidence Interval.

Threshold T_c (N)	Gaussian (95% CI)	HCME (95% CI)	Threshold T_c (N)
3.0	0.045 (0.041, 0.049)	0.147 (0.139, 0.155)	3.0
4.0	0.023 (0.020, 0.026)	0.104 (0.097, 0.111)	4.0
5.0	0.012 (0.010, 0.014)	0.083 (0.076, 0.090)	5.0
6.0	0.005 (0.004, 0.006)	0.061 (0.055, 0.067)	6.0

Figure 7 displays the Exceedance probability $P(T_{max} > T_c)$ as a function of threshold T_c for Gaussian (blue) and HCME (red) noise models. Shaded bands represent 95% bootstrap confidence intervals ($B = 1000$ resamples). At all thresholds above 2 N, the HCME probabilities are significantly higher, with non-overlapping intervals beyond 4 N



Hypothesis Test Results

Figure 7: Exceedance Probability vs. Threshold with Bootstrap Confidence

- **Kolmogorov-Smirnov test:**
 $D = 0.187$, $p\text{-value} < 2.2 \times 10^{-16} \rightarrow$ distributions are significantly different.
- **Welch's t-test:** $t = 24.8$, $df \approx 15200$, $p\text{-value} < 10^{-10} \rightarrow$ mean tensions differ significantly.
- **Bootstrap Percentile Difference**
 The 95% CI for the difference in 95th percentiles $((Q_{95}^{\text{HCME}} - Q_{95}^{\text{Gauss}}))$ is $[1.21, 1.68]$ N, not containing zero

Discussion

Obviously, the results show that using a heavy-tailed HCME noise model, by Kalmag's uncertainty estimates, leads to a substantially higher risk of extreme tether tension as compared to Gaussian model with identical variance. At the 5 N threshold, the exceedance probability increases by a factor of nearly seven. This finding is used for tethered satellite mission design: safety margins and tether strength requirements, derived under Gaussian assumptions may be dangerously optimistic.

The visual proof from our figures reinforces the statistical findings. Figures (5) and (6) show that the HCME-driven maximum tension distribution is not only shifted to a higher mean but also possesses a heavy right tail with numerous extreme values (exceeding 10 N), whereas the Gaussian distribution is confined below 5 N. This difference is quantified in figure (7): the exceedance probability for a 5 N threshold is nearly seven times larger under HCME and the bootstrap confidence intervals do not overlap for thresholds above 4 N which confirms statistical significance. The Q-Q plot (Figure 3) confirms that HCME noise itself is non-Gaussian with a heavier upper tail and the convergence plot (Figure 2) assures that 10,000 Monte Carlo runs are sufficient. Together, these figures show that ignoring heavy-tailed uncertainty would severely underestimate tether failure risk which has direct implications for mission design

Limitations of the present study

- I. We assumed the HCME bias is persistent over the entire integration window. In reality, geomagnetic residuals evolve on timescales (minutes to hours). Future work should implement a time-varying HCME process, e.g., drawing a new noise sample at each integration step or using a stochastic differential equation driven by HCME increments.
- II. We used a constant Kalmag standard deviation of 5 nT. A more accurate approach would interpolate the time-dependent $\sigma_B(t)$ from the Kalmag posterior covariance at each time step.
- III. We assumed only planar motion and an inextensible massless tether. Extensions to three-dimensional libration and tether elasticity are desirable.
- IV. The MLEs were obtained from an electromigration dataset, not from actual geomagnetic residuals. Future work should estimate HCME parameters directly from Kalmag residual time series.
- V. While we focused on HCME, other models such as the student-t, Pareto or log-normal could be compared. The HCME's advantage is its explicit closed-form quantile function (via Lambert W) which simplifies random variate generation.
- VI. The bootstrap confidence intervals for exceedance probabilities provide a rigorous basis for risk assessment. For a threshold of 5 N, the 95% CI for HCME is $[0.076, 0.090]$, meaning there is a 7.6–9.0% chance of exceeding that tension. Mission designers can use such intervals to set tether safety factors.

Conclusion

We have successfully integrated the HCME distribution with the Kalmag geomagnetic field model to quantify uncertainty in tethered satellite dynamics under J_2 and magnetic torques. The HCME distribution's heavy tail captures rare but large geomagnetic disturbances which leads to a nearly seven-fold increase in the probability of exceeding 5 N tether tension compared to a Gaussian model with identical variance. Statistical tests (Kolmogorov-Smirnov and Welch's t-test) confirm that the two output distributions are significantly different. The provided R code enables efficient generation of HCME random variates and visualization of the heavy-tailed noise facilitates further stochastic simulations. For mission designers, this means that safety margins based on Gaussian assumptions may be dangerously optimistic; heavy-tailed uncertainty must be accounted for. We encourage researchers to use Kalmag's uncertainty products (freely available at

<https://ionocovar.agnld.uni-potsdam.de/Kalmag/>) together with the HCME distribution for realistic risk assessment. Future work will incorporate time-varying HCME noise, direct assimilation of Kalmag residual data, and three-dimensional tether dynamics.

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Conflict of Interest

The authors declare no conflict of interest.

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Research Article

Landscape of the Vocational Project for Self-Employment and Entrepreneurship Promotion in Ramechhap

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Abstract

Many youths worldwide face challenges securing decent jobs because they lack the essential skills and qualifications. In this context, skill and vocational training are crucial milestones for promoting the development of self-employment and entrepreneurship. Therefore, this study examines the landscape of vocational project, promoting self-employment and entrepreneurship in Ramechhap district. Altogether 752 trainees were included in the study, obtained from the Vocational and Agricultural Training Project, covering the period of January 2023 to December 2024. Similarly, the researcher self-conducted Key Informant Interviews (KII) with two projects management staff. As a result, 56.9 percent of trainees were engaged in the earning sector through their own entrepreneurship and businesses, and the remaining trainees had an unknown status during the reporting period. Also, bivariate results showed significant relationship between vocational & skill training and gender of trainees. Similarly, KII results show that most trainees face low wages, low job priority for fresher hires, a limited job market for human resources training, social misconceptions about female trainees, and a lack of financial investment. Based on the findings, skill and vocational training are not the ultimate solution for obtaining a decent job or achieving self-employment, and further study is needed to explain why a smaller percentage of those with vocational and skills training are employed and self-employed. Additionally, it set the myth that training a skilled workforce will enable them to secure a job and run their own business quickly. Therefore, planners, policymakers, and decision-makers can refer to these findings to inform further planning and policy development in employment generation through technical and vocational training in the local area

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Introduction

Self-entrepreneurship and employment contribute to economic growth, reduce unemployment, and enhance community resilience in rural areas (ILO, 2019). These elements are critical in alleviating global poverty (World Bank Group, 2020). Nevertheless, substantial transformation frequently requires external catalysts (Van der Berg, 2008). Vocational training serves as one such catalyst by providing individuals with essential skills for entrepreneurial success (ILO, 2025). Through the development of capacity, skills, and knowledge among young people from disadvantaged backgrounds, vocational training links them to market opportunities and increases employment ability. Furthermore, it empowers marginalized and economically disadvantaged individuals with entrepreneurial competencies, promoting self-reliance and economic sustainability (Tam et al., 2021).

In industrial areas of China, emphasis is placed on skills rather than ability, knowledge, and attitude for job sustainability. They measured 11 different factors, but reliability is one of the key options for getting a quality job in the industrial sector, as per market demand. However, they retained the top-level requirement for job seekers' skills (Abbas & Sagsan, 2020). It means that skill is necessary to secure a decent job and achieve long-term job-market reliability. Besides, every vacancy announcement has focused on skills rather than the minimum or higher education required of job seekers. Additionally, a significant proportion of job opportunities are held by

skilled individuals rather than those with minimal education in the job market (Rios et al., 2020). It enhances the value of skills rather than those with higher academic education for a job.

A job enables an employee to be compensated for their labor, skills, and abilities. However, it depends on push and pull factors, such as the push towards paid employment and the transition to self-employment. On the other hand, psychologically, it motivates self-employment, and people often terminate their jobs to start their businesses and become entrepreneurs, driven by a desire to overcome a painful employment experience (Tran et al., 2021). Nevertheless, skill is crucial in sustaining enterprises and catalyzing entrepreneurship (McDaren, 2021).

Similarly, poor education leads to poverty because individuals without adequate education are often unable to secure higher-level jobs and opportunities. Vocational training enhances the skills and knowledge of underprivileged individuals, who are usually excluded from mainstream education (Van der Berg, 2008). In Hong Kong, vocational training is promoted to develop skills and entrepreneurial expertise among young people without a higher education background. Similarly, they enhance the employable capabilities of youth and the reliability of their enterprises (Tam et al., 2021). Self-entrepreneurship development or establishment is crucial because it is unlikely to succeed without long-term learning and self-readiness to accept the constraints of entrepreneurship rather than employment (Alieksieieva et al., 2021). Therefore, vocational and skill training face challenges in having a tangible impact on the practical process of creating self-employment and entrepreneurship. However, nothing is more catalytic than training to motivate and prepare. Furthermore, the training curriculum should incorporate practical knowledge and skills that foster strong relationships, thereby promoting the sustainability of entrepreneurship (Wheelahan, 2015). Therefore, vocational education training alone could not afford to develop self-entrepreneurship and employment.

The globalization of the workforce increases access to skills and knowledge, making a commitment to re-skilling and upskilling crucial for the future workforce (Li, 2024). However, the economic crisis exacerbates the underutilization of skills in practical work, leading to societal discrimination (Rafferty, 2020). Self-entrepreneurship and employment are focuses on disadvantaged groups, including migrants, people with disabilities, and marginalized communities. They depend on the policy and plan for decent job opportunities (Cieřlik & van Stel, 2024).

Globally, the employment-to-population ratio is projected to be 34.6 percent by 2025. Similarly, a 12.8 percent projected unemployment rate is anticipated for the global population in 2025. Additionally, 26.5 percent of the employment population is projected to have a 9.7 percent unemployment rate in 2025 for the South Asia region (ILO, 2024). In Nepal, 90.25 percent of households do not have small-scale businesses, out of 6,660,841 households. Similarly, households in Bagmati Province (90.06 percent), Ramechhap (Manthali Municipality, 91.91 percent), Khandadevi Rural Municipality (95.66 percent), and Sunapati Rural Municipality (91.44 percent) are without small-scale businesses (NSO, 2021).

In Nepal, agriculture is a significant contributor to economic development; therefore, there is a need to diversify livelihood opportunities based on agricultural activities (NSO, 2021). Among the 77 districts, Ramechhap, located in the Bagmati Province, has the highest negative annual population growth rate at -1.67 percent. In addition, the region experiences significant socio-economic challenges, including limited access to formal employment, inadequate industrial development, and high rates of outmigration for foreign employment (MoLESS, 2022). To address these challenges, a systematic approach to vocational training and self-employment initiatives is a need to empower individuals to establish sustainable businesses within their communities.

In particular, in the Ramechhap district, the vocational project for self-employment and entrepreneurship promotion aims to provide local individuals with technical skills, business knowledge, and financial literacy to promote entrepreneurship. In addition, TEVT provides free training opportunities in the local area, a milestone for inclusion and justice that benefits socially

excluded groups and communities (Ghising, 2025). Similarly, vocational training and market-oriented strategies improve employment ability and support regional economic growth (World Bank, 2021). Besides, establishing an entrepreneurial environment requires collaboration among government agencies, non-governmental organizations (NGO), and private-sector stakeholders (Chittaranjan, 2024). At the same time, existing research underscores the important role of vocational training in enhancing employment ability and entrepreneurial competencies in rural areas (Pandit, 2025). All these initiatives align with Nepal's national goal to reduce poverty and unemployment, as articulated in the country's strategic development framework (National Planning Commission, 2020). Therefore, skills and vocational training are essential for youth employment, as they address the gap between education and labor market requirements and equip to young people with the practical skills needed for decent jobs and entrepreneurial opportunities.

Therefore, the study research questions focused on the landscape of the vocational project promoting self-employment and entrepreneurship in Ramechhap. Particularly, it tries to explore the answer of the following research questions, which are, what is the employment status of the graduated trainees of vocational training in Ramechhap district? To what extent does the vocational training promote self-employment and entrepreneurship development among the trainees in Ramechhap? What challenges do graduates of vocational training when seeking employment or establishing their own business face? Similarly, based on this research questions, the study aims to analyze the role of vocational training in promoting self-employment and entrepreneurship in Ramechhap. Besides, the specific objectives are to analyze the status of vocational training in the Ramechhap district and explore its effectiveness in fostering self-employment and entrepreneurship. To assess the major challenges experienced by graduates of vocational training in securing sustainable employment or establishing their own business

Method and Materials

Study area

According to the administrative document of Nepal, Ramechhap district is aligned in the Himalayan region, and it comprises 47.5 percent males and 52.5 percent females out of a total population of 170302. Additionally, its annual population growth rate is -1.67 percent, the highest among districts with a negative yearly population growth rate. It has eight local units, including two municipalities (NSO, 2021).

Research Design

The study employed a mixed methods approach with a sequential exploratory design, and both qualitative and quantitative data were analyzed. Thus, the study was analyzed using a pragmatic lens and a post-positivist perspective (Creswell, 2009). Furthermore, in mixed methods, an objective reality cannot fully represent the actual situation of the study; it is evaluated together with subjective reality to better validate the data and results of the study. Similarly, as a sequential exploratory design, the study first analyzed the quantitative data and based on the preliminary findings, pursued to answer questions from the qualitative data.

Source and Nature of Data

The quantitative data were collected from a secondary source: the Progress Report on Vocational and Agricultural Training for the end of 2024 for the Promote Employment and Entrepreneurship Project, Community Development Society, Manthali, Ramechhap. On the researcher's side, a written request letter was submitted to the office with clear objectives for how the data would be used; and permission was granted, and a data sheet was provided by the organization. The project data were from January 2023 to December 2024. The qualitative data were gathered after analyzing the preliminary quantitative data using Key Informant Interviews (KII) with project staff directly involved in the decision-making process and who manage the overall project. Therefore, both primary and secondary data have been used equally in this study.

Study Population and Sample Size

The study population consisted of enrolled and graduated trainees from the three-month vocational training program in quantitative data analysis, totaling 752. Similarly, qualitative data were collected from the project staff, which included two male respondents at the project management level. As sequential exploratory approach, produced a preliminary quantitative finding and based on that purposively selected to KII respondents for interview. The KII was conducted with two management-level staff members from the vocational project, who participated in the day-to-day execution of the project. Also, except both respondents, there was not another staff to participate in the interview perspective on justifying the quantitative findings so KII limited on those two participants. As study objective there were only two management level staffs available and appropriate for the interview and to verify the preliminary findings of quantitative data. Because those two management level staffs involved in the day-to-day execution of the project from the beginning of project they were able to explain soundly to real situation.

Data Collection Process

Quantitative data included responses from 752 trainees, while qualitative data were obtained through KII with two project staff members involved in training execution. Initially, consent and approval were obtained for the project data for further analysis and presentation in the paper. All updated data sheets up to December 2024 have been collected and cleaned under the study objectives. The data have been imported into SPSS, and preliminary findings have been produced. Based on the preliminary findings, a checklist was developed for the KII. According to the checklist, the design questionnaire was outlined and shared with respondents for their input. Also, the KII information was transcribed and translated from Nepali into English.

Data Analysis

The application was used to analyze quantitative data, and thematic analysis was used to analyze qualitative responses. Mainly, univariate results were presented as percentages and observed counts, such as gender, Age, education level, status of the skill test by the national skill test board, employment status, and training items conducted in the respective area and received by trainees. Also, analysed the results of cross-tabulation between the gender of trainees and training items.

Similarly, qualitative data have been transcribed from the audio and translated into English from Nepali language. Those qualitative results incorporated with the end of the quantitative results section.

Results

Distribution of Demographic Characteristics and Status of Vocational Trainees

Figure 1 shows the gender-wise demographic distribution of graduate trainees in vocational education and skill training. As noted in the data sheet and recorded, the following report was generated and distributed.

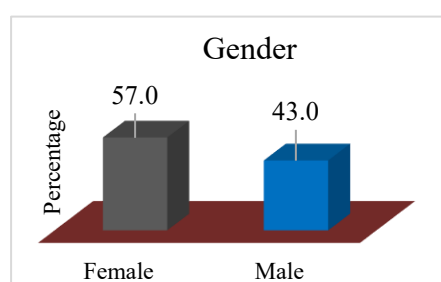


Figure 1: Gender Wise Distribution of Trainees

Figure 1 illustrates the gender distribution among vocational trainees: 57 percent are female, and 43 percent are male. Equal gender participation was prioritized, but no seats were explicitly reserved for women. However, more male trainees participated in vocational training in local areas than females. Besides, KII respondents explained, there was not gender bias

and any privilege for male and female, however female trainees experienced more difficult to participate in internship program after graduation from skill training due to restriction by household head for staying out of self-house.

Figure 2 shows the age distribution of trainees of the vocational education and skill-training project of Ramechhap district. The project has defined an age group for the vocational training, focusing on youth aged 16-40 years and agricultural-related skills training for local farmers, with age flexibility considered.

Figure 2 shows that trainees aged 16 to 65 participated in vocational training, with particular emphasis on the 16- to 40-year-old age group for technical skills. Based on the database report, they also trained trainees above 40 years of Age, which needs to be explored further, precisely why they participated or were included in the training. However, 11.8 percent of trainees belong to the 17-age group, the largest age group of participants. Similarly, the above 41-year age group accounted for less than 1 percent of trainees participating in the vocational training. The KII result justified to the participation of age above 40 in the vocational training, where less number of target youth people extend to priority to age above 40 and

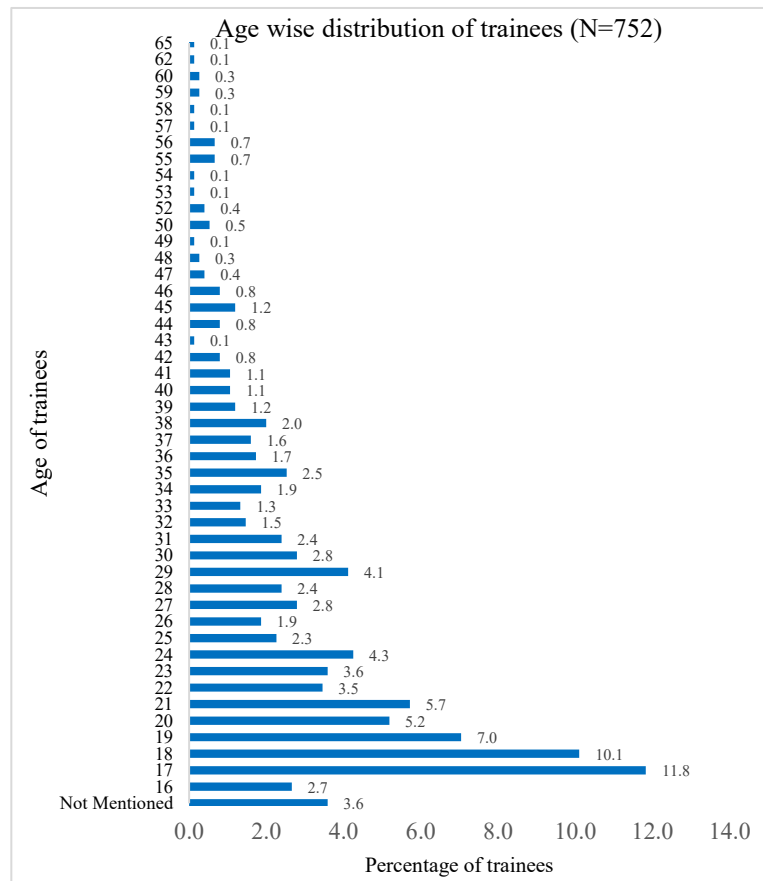


Figure 2: Age Wise Distribution of Trainees

included in the agriculture related training rather than more technical skill training.

Figure 3 shows the distribution of trainees' education levels in vocational education and skill training based on the project's recorded data sheet. Education is the most influential factor, playing a vital role in training and further developing skills.

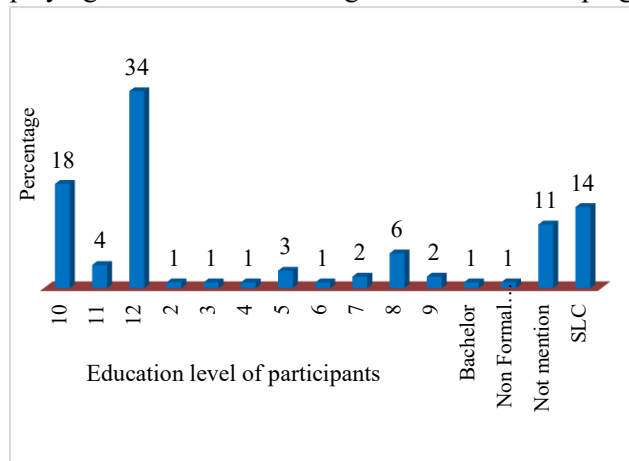


Figure 3: Distribution of Trainees based on education Level training.

Figure 3 illustrates the educational level of vocational training trainees. The largest number of trainees came from the group with education at the +12 level, accounting for 34 percent. Class 10 trainees, at 18 percent, held the second position, and SLC-passed-out trainees, at 14 percent, held the third position. Additionally, 11 percent of trainees failed to update their educational level during training. In the training, participants have a non-formal to bachelor's-level education and have received vocational

Figure 4 shows the distribution of skill certification from the authentic board of graduates' trainees in vocational training.

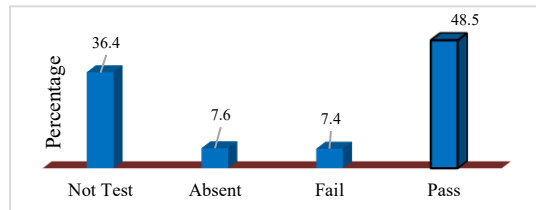


Figure 4: Status of skill test in the National Skill Test Board (NSTB)

absent, and 36.4 percent remained to be tested.

Figure 5 shows the distribution of the employment status of graduate trainees of the vocational education and skill-training project in the Ramechhap district.

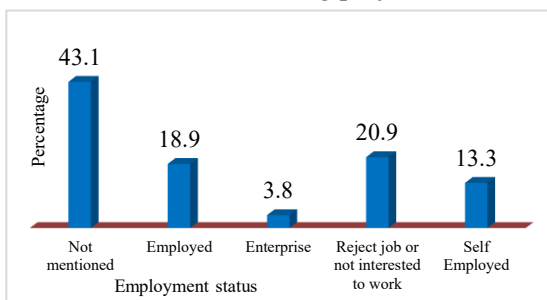


Figure 5: Employment status of trainees

trainees did not report their employment status in the database, accounting for 63.0 percent. This indicates that only one-third of trainees successfully apply their skills and knowledge in the workplace. Most of the trainees have graduated from the training and are now exploring opportunities in self-employment and entrepreneurship within their local communities. It presents a significant challenge for self-employment entrepreneurship among newly trained job seekers in the job market, as two-thirds struggle to find suitable employment or entrepreneurial opportunities. Its effect factors have not been measured, but there are further researchable areas as to why trained human resources struggle to find jobs in the market.

Based on KIIs findings, most newly graduated trainees faced similar issue during their internships and after graduation their job. They received low wages as fresher, making it difficult to afford daily expenses. Another issue is a reduced willingness to hire new people; it affects settlement and sustainability in skill-related job. As quantitative results show, only 13.3 percent of trainees are self-employed because they have faced financial problems, as financial institutions do not prioritize providing loans based on their skill and business. So, they could not run the own enterprises and business as well. Similarly, 43.1 percent of trainees have not reported any status after graduating from technical skill training. As KII results showed, trainees faced low wages and lower priority in hiring, and fewer opportunities for decent jobs as fresher, so they did not update their status during the organization's status updates. KII respondent said that these groups could be employees in the future, run enterprises themselves and have a high chance of escaping the mainstreaming of training as well, due to hurdles in identifying decent job, constraints in financial support, and a focus on job opportunities abroad. KII respondent B explained regarding the non-reporting of their status during the update. "After graduation from the training, we facilitate exploring the job market and try to connect them for hiring. So, we continue to monitor them and update their employment status. If they did not get any opportunities, trainees do not want to update their status. Therefore, the data sheet does not mention the status of trainees. We do not' limit them here. We frequently counsel them to run the skill-based enterprises at the local level and to facilitate coordination and networking as well."

Figure 6 shows that items of vocational and skills training have been tailored to individual needs at the local level in response to demand. Fifteen (15) training items have been conducted and delivered to local people.

Figure 6 shows that the training sessions were tailored to participants' needs. The highest percentage of Tailoring Level 1

training participants was 15.3 percent, while the lowest rate

was in the Dhaka weaving (1.9%). The training has been organized based on the training participants' demand; therefore, it does not have equal distribution, but it can reflect the interests of trainees, as requested.

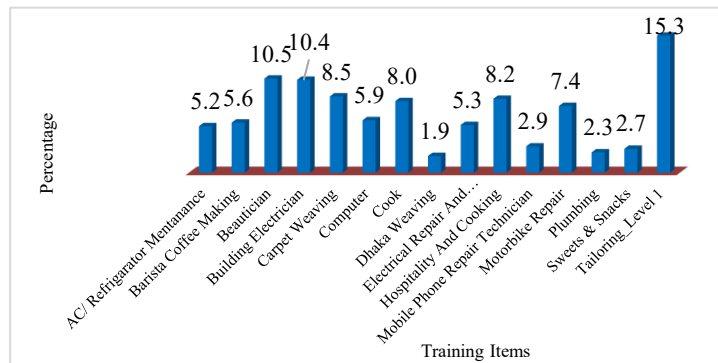


Figure 6: Distribution of Trainees based on Training Item

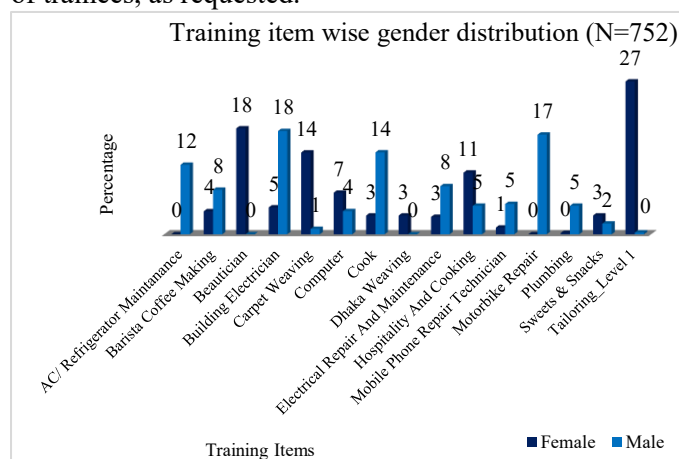


Figure 7: Training items wise gender distribution

Figure 7 shows the results of cross-tabulation analysis of trainees' gender and training items. The variable gender is major in nominal scale such as male-1, female-2.

Figure 7 shows the cross-tabulation of trainees' gender and training items. The result revealed a strong association between gender and training items, with a p-value of <0.001 and 14 degrees of freedom.

Similarly, there were no female participants, except for those in specific training programs, such as Beautician, Tailoring, and Dhaka weaving. Similar to AC refrigerator maintenance, Motorbike repair, and Plumbing training, these fields also have zero female trainees. On the other hand, the Beautician, Dhaka Weaving, and Tailoring training have zero male trainees. It indicates that training items are also related to gender-specific professions. However, overall, 57 percent of female trainees participated, compared to males.

Discussion

The discussion section deals with significant trends and challenges in participation, certification via skill tests, and employment outcomes among vocational trainees in the project area. The discussion part is thematically managed and synthesized into the overall findings.

Gender Perspectives in Vocational and Skill Training

According to the demographic information, the data show a relatively balanced distribution of trainees, with 57 percent female and 43 percent male. A cross-tabulation result analysis reveals gendered patterns in training preferences. Most female participants selected traditionally feminine skill areas, including tailoring, beautician, and Dhaka weaving. Conversely, male trainees predominantly chose technical skill areas such as motorcycle repair, air conditioning maintenance, and plumbing. Another empirical study also shows that improving gender balance in training; however, females face bias in the types of jobs they are offered and in their involvement in traditional occupations. Such a practice is a serious issue in equal participation in job opportunities for female participants (Bagale, 2016). On the other hand, gender disparities in education are also reduced through human resource development, which supports technical

education and training for females. Similarly, such technical training assists in job opportunities in the context of least developed countries (Dahal, 2011). In addition, vocational and technical training plays a vital role in empowering women and fostering their confidence to make decisions and build capabilities (Gautam, 2023). However, training equips people with skills that create job opportunities for all. In Nepal, such skill training is most important for achieving gender balance and ending gender disparities in society.

Background of trainees' perspectives on Age and education

In vocational training, age is a significant factor influencing participation. In this study, the primary age group participating in the training was 16-40 years old, with the highest representation among 17-year-olds. However, older age groups (>41 years) were underrepresented due to age-based limitations in the vocational training, which has prioritized youth below 40 years. At the same time, this demographic pattern warrants further investigation to adapt training programs for older individuals, particularly those seeking reskilling or livelihood transitions. Similarly, older employers are less likely to participate in training than their younger counterparts, which may present additional opportunities for skill enhancement among this group (Taylor & Urwin, 2011). The age distribution, concentrated in the 16-40 range, is consistent with global trends, in which vocational programs predominantly target economically active populations (ILO, 2022).

In rural communities, educational attainment is a significant factor in the preference for vocational and skill training. The study showed that vocational and skill training trainees had completed 12-level education (+2 level), with 34 percent, followed by 10-class level, with 18 percent of the 752 total graduates. The trainees have diverse educational backgrounds, ranging from non-formal education to the bachelor's level. The result indicates that the vocational and skills training sought by both highly educated and less educated people aims to upgrade skills in the competitive labor market. Such training is equally important for individuals with non-educational and higher levels of educational attainment to enter the job market and secure decent jobs or opportunities.

Skill test for certification and Employment Outcomes

The vocational education and skills training assisted in obtaining certification from the respected, authentic certification body, which is the National Skill Testing Board (NSTB). As a result, 48.5 percent passed the skill test, and 36.4 percent were untested vocational education and skill training trainees. At the same time, 13.3 percent of trainees started self-employment, 18.9 percent were employed after graduating from the training, and an interesting finding is that 20.9 percent refused a job and were unwilling to work after participating in the training. However, the majority of trainees have not reported their employment status in the project's database record. It emphasized a substantial gap in post-training follow-up and potential underutilization of acquired skills. All these outcomes are consistent with findings from comparable contexts, where vocational graduates face challenges in labor-market absorption due to limited job opportunities, skill mismatches, and inadequate enterprise support mechanisms (ILO, 2020).

Barriers to Job placement after graduation for trainees

The study collected qualitative data, which revealed structural and socio-cultural barriers in the key informant interviews. These factors affect the transition to productive employment after graduation from vocational education and skill training. Low wages for skilled manpower significantly affect their profession and influence skilled labor migration (Adhikari & Hobley, 2015). Specifically, in the hill region, there is no industrial area and limited job opportunities; however, individuals have highly specialized skills. Besides, trainees lack financial access, but they need integrated financial support alongside vocational programs (Asian Development Bank, 2014).

As a social norm, female trainees often faced socio-cultural restrictions on mobility related to job opportunities and career choices. Gender-based constraints have affected female trainees' more than male trainees. Females faced greater workplace safety and security concerns and paid

less attention to these issues. Such barriers are also encountered in other South Asian contexts during women's participation in the labor market (World Bank Group, 2018). Therefore, females limited to grab job opportunities and participate in On-the-Job Training (OJT) and employment for female graduates.

Vocational education and skill training do not ensure sustainable employment or help the graduate trainees run enterprises. According to key informants' recommendations, a holistic development approach should focus on skill development, financial access, facilitation, and assistance with soft loans or grants; career guidance, mentorship, and networking with line agencies and stakeholders for resource sharing and opportunity exploration. Similarly, evidence from the successful vocational initiatives demonstrates that such integrated models significantly improve employment outcomes and self-reliance among trainees (ILO, 2020; OECD, 2021). In addition, certain provisions should be managed in the project or program to reduce occupational segregation and expand job opportunities for both males and females. As a highlight of this study, vocational education and skill training in rural Nepal play a vital role in extending the contribution of economic growth beyond the delivery of skills and education to individuals.

Conclusion

The results of this study show that there has been significant acceptance of vocational and skills development training programs by the local communities, with more females than males participating. The high participation of women in training courses such as tailoring, beautician, and Dhaka weaving shows the significance of vocational training in improving women's access to skills development and economic opportunities. Male participants, on the other hand, were clustered in technical trades such as AC/Refrigerator repair, motorbike repair, and plumbing, indicating the continued gender-based occupational specialization in vocational training.

The training programs were able to reach a wide range of beneficiaries, aged 16 to 65 years, with the highest participation being among youth aged 17 years, reflecting the keen interest of young people in learning employable skills. The participants had diverse educational backgrounds ranging from illiterate to bachelor's degree holders, with the majority being Grade 12 and Grade 10/SLC. This indicates that vocational training is an important alternative route for skill acquisition and employment for secondary and higher secondary school graduates.

The study also shows positive results in terms of skill certification and employment. Almost half of the graduates were able to pass the skill test conducted by the National Skill Testing Board at level-1 and a significant percentage were waiting for the skill test. In addition, approximately one-third of the graduates were employed in skill-related jobs, suggesting the potential of vocational training in employment creation and livelihood enhancement. Of the 15 training trades delivered, tailoring, beautician and building electrician had the highest enrolment while Dhaka weaving had the lowest enrolment.

The statistically significant relationship between gender and training items validates that training decisions are highly gendered and influenced by gender norms and occupational preferences. Hence, future vocational training interventions should aim at gender inclusivity in all trades, improve training to certification linkages, and improve employment and entrepreneurship support for trainees. Such efforts can further improve the effectiveness of vocational training programs in fostering local employment, economic empowerment, and sustainable community development.

For further vocational and technical training achievements, the following concerns may be more helpful in revising and executing the program in the future.

Strengthen Market Linkages

The project area has a limited job market, so trained human resources professionals have limited job opportunities. Therefore, connecting trainees with industry professionals and

employers beyond the project area may be beneficial, as it can play a vital role in strengthening the market linkages.

Enhance Financial Accessibility

Financial investment is crucial for establishing a business and enhancing financial access, including investment schemes, particularly for new entrepreneurs without collateral. In particular, close cooperation with local financial institutions may assist to establish new entrepreneurship at local area for the graduated trainees.

Develop an Entrepreneurship Environment

Establishing a business is crucial because it significantly influences new entrepreneurs who are not ready for self-entrepreneurship, both psychologically, financially, and technically. Therefore, incubators and mentorship programs are essential for fostering an entrepreneurial environment from the project side and local government as well.

Further Research

The study has limited with project based secondary data and information including KII. Therefore, remains to explore from the wider beneficiaries and community level regarding the vocational and skill training.

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Conflict of Interest

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Research Article

Breadwinner Men in Patriarchal Society: Privilege or Burden?

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Abstract

Conformation toward masculinity in patriarchal society is less privileged, but most of the time, brings chaos in the lives of men. Finally, it creates a burden on men's lives. Men have the privilege of economic control and decision-making in the household. However, this privilege transforms into a responsibility to fulfill all the financial needs of the family. To conform to masculinity and become the primary provider of the family, men have to face physical and mental health issues. The research contributes to the knowledge of how patriarchy is not working only against women but also against men, who come under its evaluation at the same time. Patriarchy works as a villain in the relationship between men and women. However, the study's limited sample size, respondents' segregation, and a definite geographical region suggest the need for further research across diverse regions and diverse populations to gain more comprehensive insights.

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Introduction

Traditionally, patriarchy is a kind of power and privilege that complements men as the greatest creation of God. At the same time, women are considered to be second-class creations (Beauvior, 2015) and come under the subordination of men and manhood. "Patriarchy is the manifestation and institutionalization of male dominance over women and children in the family and the extension of male dominance over women in society in general (Lerner, 1986). It is responsible for assigning men and women roles and status in society (Walby, 1989). It mainly distinguishes which types of work should be assigned to women and which should be reserved for men (Oakley, 1972). Men always remain at the center of society, and all culture, norms, and traditions try to complement the existence of men (Connell & Messerschmidt, 2005). Traditionally, all power, privilege, economic control, and authority come to men's side while women are dependent on men for food, shelter, clothes, and emotions (Beauvior, 2015).

The conventional understanding of patriarchy is partial towards men and their existence in patriarchal society (MenEngage Alliance, 2015). However, patriarchy is not a synonym of men. Men also come under the evaluation of patriarchal norms and values (Johnson, 2005). Patriarchy is a kind of social condition that acts as a villain in the relationship between men and women. It does not work against women, but it works against humanity. According to Bhasin (2000), Women face discrimination and violence, while men are pressured to adapt to the rigidity of masculinity, such as being physically and emotionally strong and always fulfilling the needs of the family. The orthodox understanding of patriarchy interprets the word "breadwinner" as the male member of a family who is involved in economic activities and is responsible for earning a living for the maintenance of the family (Thomas, 2026).

The male gender role is the specific set of social norms and values that men are expected to follow. Some men fulfill the standards and expectations of society, while others fail to meet the standards. The stress caused by the gap between the actual behavior of men and the socially and culturally expected standard of men's role is called male gender role discrepancy stress (Pleck, 1995). When men are unable to follow the standards, it usually affects their self-esteem and psychological well-being because they may receive negative responses from society and internalize negative self-judgement (Pleck, 1995). When males feel inferior to females and are

unable to express their feelings, problems, and lack in their personality and intellect, this leads them to stressful conditions (Eisler & Skidmore, 1987). The psychological and public health research on masculinity reveals that the conventional and orthodox masculine norms that prohibit men from showing emotion and seeking help affect the mental health of men (Mokhwelepa & Sumbane, 2025). Human beings cannot flourish when males are pressured to adopt hyper-masculinity, repressing the feminine one, and females are pressured to adopt all female traits, repressing the masculine one (Becker, 1999).

The existing studies on men and patriarchy examined how patriarchy has created segregation of rights and duties between men and women. The men are considered to be the main providers of the family, and they are encultured with the concept that men are strong, brave, aggressive, and breadwinners (Kimmel, 2005). However, some studies come up with results that habitual suppression of emotion can lead to mental health issues in men (Wong et al., 2017); the existing study failed to analyze what men feel and how they act to become the primary provider of the family. Many of the studies discuss the male breadwinner in patriarchal society theoretically; however, there are limited empirical studies based on how men experience power and pressure as providers in the household, especially in the context of Nepalese society.

The study was conducted to find whether the breadwinning role of men in patriarchal society provides them strength or creates chaos in their lives by affecting them physically and emotionally. The core objective of this study was to uncover the consequences of traditionally rooted patriarchal norms and values in men's lives as the primary breadwinners of the family in Janakpur Sub-Metropolitan City.

Method and Materials

In order to investigate the lived experience of the male breadwinner in the family, the researcher used a qualitative research design, which is phenomenological in nature. Phenomenological research is used to understand the subjective meaning of lived experiences from the individual's perspective (McLeod, 2024). The researcher used in-depth semi-structured interviews for data collection to get the perception of married employed men. In-depth semi-structured interviews help to investigate the opinions, feelings, and emotions of participants on a particular topic through closed-ended and open-ended questions (DeJonckheere & Vaughn, 2019). The study involved twenty-two male respondents from the Janakpur Sub-metropolitan City of Nepal. The respondents were married, employed, and basically the main providers of their families. They were from diverse socio-economic backgrounds. The researcher used a purposive sampling method to select respondents whose attributes matched the needs of the research topic. This research method is effective in digging into the conventional role of men in patriarchal society and its implications. All the respondents experienced the consequences of patriarchy and its expectations towards men as breadwinners. The interviews were guided by the thematic framework to explore the experiences of married employed men as the primary providers for their families. As the topic was subjective in nature and required personal information from respondents, the interview commenced with rapport-building questions. The in-depth interviews from all participants were audio-recorded with their consent for further data analysis to highlight the diverse experiences related to the primary provider. The study adhered to the ethical principles of respect for persons, beneficence, justice, and responsible research conduct, consistent with the ethical guidelines promoted by the Nepal Health Research Council (NHRC) (Adhikari et al., 2023).

Results

In this study, twenty-two men between the ages of 23 and 52 shared their diverse experiences as primary providers to their families in a patriarchal society. Most of them started working in their 20s. Sixteen of them started earning before marriage, while six of them started

earning shortly after marriage. Spouses of six men are earning, while others are housewives. Most men think that for the smooth functioning of the household, both the husband and the wife should earn. But a 36 years old engineer whose wife is school teacher stated, "earning is the main work of men, and men are responsible for fulfilling the financial needs of the family. Indeed, women are also working nowadays, but their contribution is secondary to the family. Women's involvement in economic activities is not obligatory if she has a spouse who earns a living."

Altogether, there was consensus among the respondents on the point that breadwinning should not be a gender symbol, and providing for the family should not be celebrated. To fulfil the basic needs like food, clothes, and shelter, everyone should earn, whether they are male or female. But respondents experienced and learnt that fulfilling the needs of family members is the responsibility of male members of the family, which is stereotypical thinking in a traditional patriarchal society. A 38 years old married man working in dental clinic on the post of dental hygienist clearly presented his opinion, "as I am the head of the family, I fulfill all basic needs of the family without taking care of my health and spend most of my time calculating income, expenses, and saving."

The finding showed that in the contemporary world, the needs of people have diversified. To fulfill the needs of the family, the male member really experiences gender role strain. They feel pressure to fulfill all the stuff that their children and wife need. It is not only about need, but there is a scenario of comparing with others in the neighborhood. Men feel stressed and have shortcomings when they are unable to meet the demands of family members. A 44 years old sweeper whose wife also does cleaning job and has 5 children stated, "I feel pressure when extra expenses come, which are out of my budget. I always try to give a better life to my children by balancing my income and expenses. It is always a stressful job for me to balance my income and expenditure."

The respondents believed society expects them to show their positive masculine abilities, like strength, aggression, and protection, while suppressing their negative traits, like fear, tears, and pain. They have no idea when they learnt all the attributes that define them as "man". At a very early stage, they got to know that they would be responsible for creating their family of procreation and have to take care of them as every father does. Despite these responsibilities, they believe that economic control does not give them more authority and power in decision-making in the family. A 51 years old reputed doctor whose wife is housewife and has two children expressed "Although my approval is needed for any new changes, I never impose any kind of decision on my family member."

There was a divided opinion among the respondents about the support of wives in the financial discussion and decision-making. Some of them agreed that their wives are unaware of their total income, investment, and plans. Reasons were diverse, as some say their wives are not literate enough to know all these things, while others say their wives aren't interested in financial discussions. However, nearly half of the men agreed that their financial decisions are always mutual and they always involve their family, especially their wife, in the financial decision-making. A 43 years old banker whose wife is also a banker said "I have never done any investment without my wife's approval because she knows better than me". A 51 years old government officer living in joint family and is only provider of family after his father's retirement, who was a teacher in primary school shared a different and really complex experience; he stated, "I often welcome my family's involvement in decision-making, sometimes they participate, while other times they leave it to me for final decision. But the burden for the success of those decisions always makes me anxious."

Finally, the findings seem tilted toward the pressure side because almost every man feels that their role as a breadwinner is creating pressure and stress in his life. A 39 years old assistant lecturer in private college shared "I never feel privileged, only because I am a provider to my family. Providing for family is not a privilege, but it is a responsibility. The responsibility that creates a burden sometimes." A 26 years old shopkeeper who started his business when he was

21 said, “Women may feel that being a breadwinner man is a privilege, but I never find it so easy. Gender role stereotype of patriarchy is hurting both men and women, so it should be up to the couple to divide their roles in the household.”

Discussion

The major findings of the research are somewhere closer towards the pressure side of the privilege-pressure continuum. The respondents had mixed views on the topic whether they experience privilege or pressure. Overall, their responses were clearly explaining their emotions and experiences. Most of them had never thought that something like privilege or pressure is the situation in their life. However, after deep interview with them their responses seem tilted towards pressure side.

The finding revealed that there is a myth that women are only victims of patriarchy, while men are equally victims of the patriarchal norms and values. Because traditional patriarchal norms had made some boundaries for men as well, these boundaries never allow men to express their love and concern for their children, nor are they allowed to share their difficulties and problems with them. In patriarchy, women have to deal with domination, dependence on men, subordination, oppression, lack of personal choice, and lack of liberation, but men get all the opportunities to impose power on women; they have the right to make decisions, they are the primary people to earn bread for their family members, and can show aggression and behave violently (Bhasin, 1993). These are the attributes that patriarchal society expects from men.

While findings revealed that the conformation towards masculinity hurts men, and these rigid rules of society affect them psychologically and physically. Men are judged based on a gender-appropriate role. If they are unable to meet these expectations, their existence is called into question. So, men always try to conform to attributes of the dominant form of masculinity such as risk-taking, aggressiveness, competitiveness, focusing on work, and having power over women (Mahalik et al., 2003).

The findings of the present study support the earlier research that men go through gender role strain when they fail to satisfy the economic needs of their loved ones. Men are socialized from the very beginning to act in such a way that conforms to their masculinity (Connell, 1995). Being the provider to a family gives prestige to men. It is the responsibility of men to feed their families. Men are socialized, not born to become providers. As a result, men face extreme gender role strain as breadwinners, house heads, and decision makers in the family (Adil et al., 2017).

The findings supported the earlier studies, as men are treated as robots who have an obligation to earn for the smooth functioning of the family without taking care of their own health. Even they try to perform at the optimum level to show their masculine behavior as well. Beauvoir (2015) writes, “one is not born, but rather becomes a woman.” This statement also applies to men. Men also are not born the way they are; in fact, the expectations of society transform them to act in a manly way. Society expects men not to show their pain to others, and crying is almost a sin for men (Krishnan et al., 2020). Some facets of masculinity are associated with health protective factors, whereas others are associated with health risk factors (Levant et al., 2011). Men tend to suppress their emotions, such as sadness, fear, and anxiety, more than women (Flynn et al., 2010). Men who suppress emotions had more problems avoiding stress. In such a condition, when people start living in a reserved way, these accumulated emotions may manifest as health risks.

Women’s oppression is structural inequality (Bhasin, 1993), while men’s pressure to conform to masculinity is a functional burden in the social system of patriarchy. Men who support traditional masculine gender norms are less likely to engage in several health protective behaviors like annual physical checkups, seeking psychological help, exercising, consuming a healthy diet, etc (Levant & Wimer, 2014).

The discoveries of the study linked to the earlier study, as men go through psychological distress when their original attributes fail to confront the ideal patriarchal masculine attributes, that teach them to stay strong and become protector of family till their last breath. Men are always under the surveillance of patriarchal norms and values. The roles and statuses that are ascribed to men not provide them only strength but also create chaos in their lives. The harshness of role strain can cause adverse effects on the physical and mental well-being of men (Griffith et al., 2011).

The study has used a qualitative approach with a small sample size, which may not fully capture the diversity of experiences and individual opinions across areas and communities, which can seem a limitation for the study. At the same time, the respondent felt shy, nervous, and uncomfortable answering all the questions that seemed personal to them. The focus of the study is just one sub-metropolitan city, which might have restricted the generalizability of the findings.

Conclusion

The study concludes that men are victims of patriarchal norms and values, too. Firstly, men have to strictly conform to the gender role, especially in earning and providing for the family. Secondly, men are not pleased enough with the privileges they are ascribed as men because these privileges come with twice the burden. Finally, men have to face physical health issues by ignoring their basic needs of the body, like a balanced diet, sleep, and recreation, and mental health issues after suppressing emotions for a long time.

To address the consequences of patriarchy, both man and women, first need to drop the blame game who suffers more in patriarchy. The traditional patriarchal family should transform to egalitarian family. The breadwinning responsibility should be flexible enough that it should not be governed by traditional gender roles. Economic contribution of both man and women should be appreciated based on abilities and circumstances. The process of male socialization should be transformed. Boys, from their very young age shouldn't be raised with expectation that men must conform all the masculine attribute and solely fulfill the economic needs of the family. All the family members must understand the difficulties faced by men while fulfilling the needs of family without taking care of his health. The family should function as a place where a man can feel mentally peace and physically comfortable rather than feeling alienated in his own home. Therefore, there must be a mutual cooperation between men and women to tackle the deeply rooted patriarchal norms in society.

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Conflict of Interest

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Research Article

Prevalence of Stress, Anxiety and Depression Among Home-Isolation COVID-19 Patients in Kathmandu Valley, Nepal

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Abstract

COVID-19 resulted in a dedication to both physical and mental health, with infected people experiencing home isolation as the main impact. The coronavirus outbreaks, together with COVID-19 pandemic research, show that people who experience isolation while they fear disease spread and face uncertainty with misinformation face increased stress, anxiety, and depression symptoms. The study measured stress, anxiety and depression symptoms among home-isolated COVID-19 patients in Kathmandu Valley. The research used a cross-sectional study design to examine 425 COVID-19 patients who were in home isolation throughout Kathmandu Valley. The researchers collected data through telephone interviews between 30 April and 21 May 2021 using the Nepali version of the Depression Anxiety Stress Scales-21 (DASS-21). The researchers used descriptive statistics to identify stress, anxiety and depression, and Pearson Product Moment Correlation was used to examine relationships between psychological variables (i.e., stress, anxiety and depression) and multiple linear regression analysis to find demographic factors that predict psychological outcomes. The participants had stress (66.8%), anxiety symptoms (57.2%), and depression symptoms (33.2%). Participants showed severe or extremely severe symptoms for stress at a rate of 14.8% and for anxiety at 10.0% and for depression at 6.0%. The researchers found a positive correlation between stress, anxiety, and depression, while the strongest relationship existed between anxiety and depression, which resulted in a correlation coefficient of $r = 0.805$ and a statistical significance of $p < 0.01$. The researchers found that age and education level were supporting factors for stress levels, while age, gender, income level and education level predicted anxiety and depression levels. The psychological distress level among home-isolated COVID-19 patients in Kathmandu Valley reached a significant level. Home-isolation and pandemic response strategies need to include mental health screening together with telephone counselling and accurate risk communication and targeted psychosocial support.

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Introduction

In late 2019, clusters of pneumonia were reported in Wuhan, China, leading to a global pandemic. Coronavirus disease 2019 (COVID-19) was identified as the cause of the pandemic and was determined to be severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (She et al., 2020; Seeliger & Pessaux, 2021). Whereas the primary effects of COVID-19 are respiratory problems, it also affects other aspects of the human body and poses significant psychological burdens to affected individuals, families, and communities.

During outbreaks associated with severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS), several mental problems were noted, including anxiety, depression, insomnia, post-traumatic stress disorder (PTSD), fear, and suicidal ideation (Singh et al., 2021). The COVID-19 outbreak furthered these impacts due to the sudden rise in cases, uncertainty about the level of seriousness, fear of infection within households, disruption of

people's daily activities, strain on health care systems, and increased stress and anxiety levels amongst the infected patients. In addition, misinformation and over-exposure to information on social media sites led to fear, confusion, stress, anxiety, and depression (Verma et al., 2023).

The policy of isolation was commonly used for patients suffering from mild to moderate symptoms of the disease. Although the practice reduced pressure on hospitals and other medical facilities, it also brought additional psychological burdens for the isolated individuals. This included lack of access to medical professionals, reduced interactions, fear of getting sicker, uncertainty regarding recovery, and fear of contracting other diseases (Verma et al., 2023). In Nepal, especially in urban areas like the Kathmandu Valley, the practice could have been exacerbated by the crowdedness, financial pressures, and social stigma.

Despite the awareness of the psychological burden associated with pandemics, there has been limited study focused on home-isolated patients in Nepal. Understanding the burden associated with stress, anxiety, and depression in such individuals would help create a supportive psychosocial system in the case of future infectious disease outbreaks. Therefore, this research was designed to identify stress, anxiety, and depression among patients with COVID-19 in home isolation in Kathmandu Valley, Nepal.

Method and Materials

Study design and setting

A descriptive cross-sectional study was conducted among COVID-19 patients staying in home isolation in Kathmandu Valley, Nepal. Patients who contracted COVID-19 were studied and treated their condition at home instead of receiving institutional isolation or hospital treatment.

Sample size and sampling procedure

The sample size was calculated using Cochran's formula at a confidence interval of 95%, 50% expected prevalence, and 5% acceptable error and adding a 10% non-response rate to the calculated sample size. The sample size obtained was 425 respondents. Convenience sampling was used. The selected respondents were approached for an interview via telephone.

Study participants

The study also consisted of people infected with the COVID-19 virus and under self-isolation at home in the Kathmandu Valley. Individuals who provided consent to participate in the interview conducted via phone calls only participated in the study.

Data collection tool

Depression, anxiety, and stress were assessed using the Nepali version of the Depression Anxiety Stress Scale-21 (DASS-21). The DASS-21 is a 21-item self-report instrument developed by Lovibond and Lovibond (1995) to measure three emotional states: depression, anxiety, and stress. The scale includes three subscales, with seven items in each domain. Each item is rated on a four-point Likert scale from 0 to 3, where 0 indicates "did not apply to me at all" and 3 indicates "applied to me very much or most of the time." The raw score for each subscale ranges from 0 to 21 and is multiplied by two for interpretation, giving a final score range of 0 to 42 for each subscale. Higher scores indicate greater severity of depression, anxiety, and stress symptoms. The Nepali version of the DASS-21 has been used and validated among Nepali-speaking populations, showing acceptable psychometric properties (Tonsing, 2014; Thapa et al., 2022).

Data collection procedure and ethical considerations

Data were collected through telephone interviews from 30 April to 21 May 2021 after departmental approval of the proposal. The study adhered to the ethical principles of respect for persons, beneficence, justice, and responsible research conduct, consistent with the ethical guidelines promoted by the Nepal Health Research Council (NHRC) (Adhikari et al., 2023). COVID-19-positive patients in home isolation were identified from records obtained through the

National Communicable Disease Center, Teku, and the Kathmandu Metropolitan Office. Eligible participants were contacted by phone, and their identity was verified by confirming basic information such as name, age, residence, and home isolation status.

Before the interview, participants were informed about the study objectives, voluntary participation, confidentiality, possible risks and benefits, and their right to withdraw at any time. Verbally informed consent was obtained. Interviews were conducted by the researcher using the Nepali version of the DASS-21. Participants were asked to stay in a private and comfortable place; if privacy or network quality was poor, the interview was rescheduled. In case of emotional discomfort, the interview was paused or stopped, and participants were encouraged to seek support from family members or available health services.

Data management and analysis

Frequency and percentage descriptive statistics were employed in presenting socio-demographic information, as well as the occurrence rate of stress, anxiety, and depression among the participants. Pearson's correlation analysis was done to examine the relationship among stress, anxiety and depression. Multiple linear Regression analysis was used to examine the association between some socio-demographic variables and the psychological variables. Before regression analysis, assumptions of linearity, normality of residuals, homoscedasticity, independence of errors, and multicollinearity were checked using scatterplots, normal P-P plot, Durbin-Watson statistic, tolerance, and VIF values.

Results

Table 1.

Socio-demographic characteristics of participants (n = 425)

Variable	Category	Number	Percentage
Age (years)	18-29	111	26
	30-40	212	50
	40-64	77	18
	65 and above	25	6
Gender	Male	329	77
	Female	96	23
Residence	Urban	401	94
	Rural	24	6
Religion	Hindu	387	91
	Others	38	9
	Illiterate	28	7
Educational status	Primary education	69	16
	Secondary education	196	46
	Higher education	132	31
Monthly income (NPR)	<10,000	56	13
	10,000-20,000	122	29
	>20,000	247	58

The Table-1 shows that Participants whose ages were between 30 to 40 years accounted for 50%, while participants who were above 65 years old constituted 6%. Majority of participants were males (77%), were urban dwellers (94%), and Hindus (91%). Secondary level was the most common educational attainment among participants, constituting 46%. More than half of them had an income above NPR 20,000 per month.

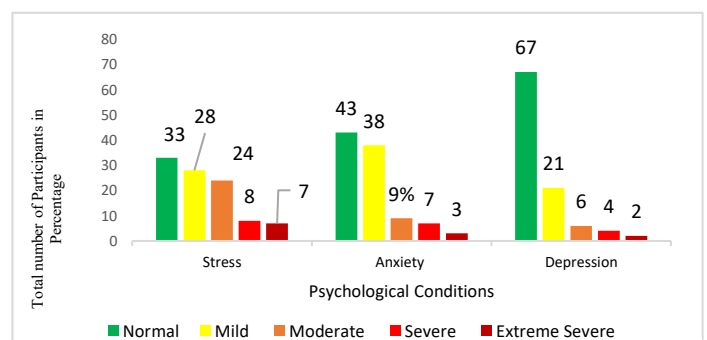


Figure 1 Prevalence of Stress, Anxiety and depression

Figure 1 shows that, in total, 66.8% experienced some form of stress, 57.2% felt anxious, and 33.2% felt depressed. Stress was the

most common symptom among all psychological conditions. The percentage of participants with severe and very severe cases included 14.8%, 10.0%, and 6.0% for stress, anxiety, and depression, respectively.

Table 2.

Correlation analysis of stress, anxiety, and depression

	Stress	Anxiety	Depression
Stress	-		
Anxiety	0.704**	-	
Depression	0.610**	0.805**	-

Note. ** Correlation is significant at the 0.01 level (2-tailed).

Table 2 shows that stress, anxiety, and depression were found to have significant positive correlations. There was a strong positive correlation between stress and anxiety ($r = 0.704$, $p < 0.01$) as well as a moderate to strong positive correlation between stress and depression ($r = 0.610$, $p < 0.01$). A very high correlation was recorded between anxiety and depression ($r = 0.805$, $p < 0.01$).

Table 3.

Regression analysis of demographic predictors of stress, anxiety, and depression

Outcome	Variable	B	S.E.	95% CI		t-value	P-value	R ²
				LL	UL			
Stress	Age	0.060	0.016	0.028	0.092	3.386	0.001**	0.051
	Gender	0.373	0.480	-0.570	1.316	0.777	0.438	
	Income	0.259	0.257	-0.246	0.764	1.009	0.314	
	Education	0.792	0.234	0.331	1.252	3.380	0.001**	
Anxiety	Age	0.070	0.009	0.051	0.088	7.376	0.001**	0.176
	Gender	-1.187	0.278	-1.734	-0.640	-4.268	0.001**	
	Income	0.328	0.149	0.035	0.620	2.202	0.028*	
	Education	0.386	0.136	0.120	0.653	2.846	0.005**	
Depression	Age	0.96	0.014	0.070	0.123	7.133	0.001**	0.178
	Gender	-1.275	0.398	-2.057	-0.493	-3.205	0.001**	
	Income	0.857	0.213	0.438	1.275	4.023	0.001**	
	Education	0.458	0.194	0.077	0.840	2.360	0.019*	

Note. B = unstandardized beta coefficient; S.E. = standard error; CI = confidence interval; LL = lower limit; UL = upper limit. *: p-value significant at < 0.05 . **: p-value significant at < 0.01 .

The table no.3 shows that education and age were predictors of stress; however, gender and income level did not have an effect on stress levels. In terms of anxiety, gender, income level, age, and education emerged as statistically significant factors of anxiety. This regression model could account for 17.6% of the variance in anxiety with age, gender, income and education. Likewise, gender, income level, age, and education were also significant predictors for depression, which had a model accounting for 17.8% of the variance in depression.

Discussion

The current study investigated psychological factors like stress, anxiety, and depression among home-isolated COVID-19 patients in Kathmandu Valley. According to the results, psychological distress was prevalent among home-isolated patients in Kathmandu Valley with stress being the most common problem, followed by anxiety and depression. The findings affirm the claim that COVID-19 is not merely an infectious disease but a psychosocial stressor. Previous studies indicated that epidemics of infectious diseases including Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and COVID-19 could lead to anxiety, depression, stress, insomnia, post-traumatic symptoms, and other psychological issues among those infected with the virus and the general public (She et al., 2020; Singh et al., 2021). Fear of progression, doubts about getting well soon, stigma, fear of infecting others, uncertainty about the severity of symptoms, and other factors could contribute to psychological distress among participants.

Stress, anxiety, and depression reveal that a significant portion of patients with active COVID-19 infections was emotionally distressed while undergoing home isolation treatment.

While home isolation decreases the number of patients in the hospital, it might exacerbate emotional problems among patients. It is possible that home-isolated patients did not undergo systematic psychological assessment, and their needs remained unattended without active screening and monitoring measures (Khanal et al., 2022; Mohamed & Yousef, 2021).

Positive correlations among stress, anxiety, and depression suggest that patients with any psychological symptoms usually suffer from other conditions. The strongest correlation occurred between anxiety and depression, implying that patients with elevated anxiety levels were likely to exhibit depressive symptoms too. Psychological disorders in times of crises tend to coincide rather than manifest separately. Thus, mental healthcare providers should conduct holistic assessments and treatments when addressing the psychological effects of COVID-19 (Mazza et al., 2020; Salari et al., 2020; Vindegaard & Benros, 2020).

The factor of age turned out to be important in predicting the results for stress, anxiety, and depression. Older participants felt more stress, anxiety, and depression. It could be explained by greater perceived vulnerability to severe consequences of COVID-19 infection, increased fear of possible complications, and concerns regarding family obligations (Han et al., 2021; Koçak et al., 2021). Education turned out to be significant for stress, anxiety, and depression as well. Such results might be associated with increased awareness of disease-related risks, exposure to information related to the pandemic, and job or family-related pressures experienced by educated individuals (Ebrahim et al., 2020; Kuang et al., 2020; van Lissa et al., 2021). Income proved to be associated with anxiety and depression, but not with stress (Salari et al., 2020; Wang et al., 2020; Vindegaard & Benros, 2020).

The results of this study are helpful for the development of preventive actions in the area of public health. Namely, when designing a protocol for the people who suffered from COVID-19 and in home isolation, authorities need to account for potential negative psychological effects. The protocol might require conducting mental health screening, implementing psychological first aid over the phone, arranging follow-ups and referrals for those experiencing acute distress, and providing adequate follow-up assistance for vulnerable populations. Also, risk communication will be essential because misinformation spread via media and social networks might exacerbate anxiety and stress experienced during health emergencies (Verma et al., 2023).

Limitations of this study

Firstly, its cross-sectional nature prevents establishing a causal relationship between variables. Secondly, the use of the convenience sampling procedure makes it difficult to generalize findings to other populations. Thirdly, interviews conducted by telephone might have led to biased reporting of results. Fourthly, the DASS-21 scale is designed for detecting psychological symptoms' severity, but not for clinical psychiatric diagnosis (Lovibond & Lovibond, 1995). Nevertheless, this study contributes valuable information concerning the psychological experience of home-isolated patients with COVID-19 in Kathmandu Valley. Mental health screening should become a part of home-isolation monitoring systems for patients with COVID-19 and other infectious diseases. Psychological first aid, telephone counselling, and communication strategies might help in identifying and reducing stress, anxiety, and depression in these patients. Those suffering from severe or extremely severe psychological conditions should be immediately transferred to mental health professionals. Authorities should consider reducing misinformation, fear, stigma, and uncertainty associated with the outbreak.

Conclusion

Significant levels of stress, anxiety, and depression were identified among COVID-19 patients who have been isolated at their homes in the Kathmandu Valley region. Stress had a higher occurrence rate than the other two psychological issues, anxiety came second, and depression had the lowest level of occurrences. High correlations between these three variables

indicate that there are a connection and interaction between psychological problems occurring during the home isolation process. Demographic characteristics such as age, education, income, and gender affected the psychological impacts differently.

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Conflict of Interest

No conflict of interest

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Research Article

Nutritional Status and Body Image Dissatisfaction Among Adolescent Girls of Barahathwa Municipality, Sarlahi District

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Abstract

Adolescence is a crucial stage in which physical and psychological development takes place. The importance of body image in the adolescent age group cannot be neglected. Dissatisfaction with body image occurs due to differences between an individual's ideal thinking and actual body shape, which can affect dietary practices. In this context, the present study attempts to find out the association between nutritional status and body dissatisfaction among adolescent girls residing in Barahathwa Municipality of Sarlahi district in Nepal. A descriptive cross-sectional study design involving a sample size of 384 adolescent girls was conducted. The present study used a structured questionnaire. Findings of the study showed that 53.9 % of the respondents had a normal Body Mass Index. However, the prevalence rate of body dissatisfaction among adolescents was 26.3 %, mainly due to fears of stunting (44.5%) and being overweight (33.7%). There is a positive correlation between nutritional knowledge and practices of adolescents. Although 51.6% had good knowledge and 49.6% followed good nutritional practices, 94% of adolescents preferred to eat junk food. Even though 73.7 % of adolescents were satisfied with their body frame, body dissatisfaction among underweight adolescents was still prevalent. These results emphasised the importance of implementing nutrition and body image-specific programs that would help prevent body image distortions and improve dietary behaviours. Despite the high levels of nutrition knowledge among participants, their ability to make healthy food choices did not tend to be applied. Hence, the implementation of appropriate actions should be based on helping adolescent girls connecting theoretical knowledge with practical application through educational measures and behaviour patterns

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Introduction

The phrase “body image” refers to the way an individual feels, thinks, and views himself or herself in terms of physical appearance. This term does not refer to how an individual perceives his appearance but the way he or she thinks he or she appear in front of the other people. This discrepancy between the ideal body image and real body image creates body image dissatisfaction. This dissatisfaction is characterized by several negative feelings and actions. The most common negative emotions associated with this problem include self-esteem problems, stress, and anxiety, while the common negative behavior is binge eating, starvation, and overeating. This phenomenon occurs frequently among adolescents, who experience rapid change both emotionally and physically. Body image dissatisfaction is prevalent among young teenage girls, as revealed through previous research studies such as in Kathmandu, where more than half of the teen females have normal Body Mass Index (BMI); 75.2% of them have body image problems (Malla et al., 2021).

Alongside nutritional issues, body image dissatisfaction has become an important concern for adolescents that goes beyond the one's perceptions, beliefs, and attitudes towards

their physical appearance (Yadav, 2024). Nutrition, which is often measured in terms of BMI, is an essential aspect of an adolescent's well-being and development. Nevertheless, the association between nutrition and body image is complicated. Normal-weight adolescents may consider themselves overweight, whereas underweight adolescents could seek to lose additional weight (Dhungal & Bhattarai, 2020). As a result, this negative perception upon a body structure causes abnormal eating habits such as restrictive or excessive eating practices that easily affects the nutritional status of a person. For example, a survey conducted in Romania showed that 22.6% of normal-weight students were misperceiving their body weight as overweight, with higher levels of misperception being recorded among females (Ursoniu et al., 2011). This shows that the female students had a higher tendency of engaging in unhealthy behaviors for controlling their weights, such as fasting and using a diet pill that helps to shape their body. Also, another study showed that 11.6 % of normal-weight adolescents had an overestimation of their weight, and this erroneous perception increased their poor food consumption and sedentary life style (Dues et al., 2020). As we know, adolescence is a critical stage in the human life cycle. It is characterized by substantial development that calls for proper nourishment to facilitate healthy development. Poor nutrition in this age may lead to malnutrition and weak immune system with potential implications on the well-being of such individuals. In the research carried out in Malangwa Municipality of Sarlahi, it was established that 40.1 % of adolescents were malnourished (Dhobi et al., 2021). The high prevalence rate of body image dissatisfaction among adolescent girls stands at 75.2 % (Malla et al., 2021) showed by another study in Nepal. Notwithstanding these worrisome statistics, information on the impact of nutrition and body dissatisfaction amongst the teenage girls living in Barahathwa Municipality, Sarlahi, Nepal Is revealing the absence of such information limits the formulation of effective strategies that would address the issues of unhealthy body image and poor nutrition amongst this specific demographic group. Hence, the present study was conducted to determine the association between nutritional status and body frame dissatisfaction among adolescent girls of school of Barahathwa Municipality, Sarlahi.

Method and Materials

A descriptive cross-sectional study was employed with 384 adolescent girls aged 15 to 16 years old, from various schools of Barahathwa Municipality. The Cochran (1977) formula was used to calculate the sample size, which is $n = z^2 p(1 - p) / d^2$. In this calculation, $z=95\%$ confidence, $p=50\%$ prevalence of IGD, and $d= 0.05$. Respondents were selected through simple random sampling technique. Data were collected through structured questionnaires on demographics, nutrition knowledge, eating behavior, and perceptions of body image by self. BMI measurements were also conducted to assess the nutritional status of participants. BMI was calculated by dividing a person's weight in kilograms by their height in meters squared (Khanna et al., 2022). The questionnaire featured multiple-choice questions, allowing for objective scoring, and minimizing respondent bias. The knowledge assessment consisted of 10 items, each scored as correct or incorrect. Respondents' total scores were sum and categorized as poor (1-4), good (5-7), or very good (8-10). This aligns with the methods employed in the development of the validated nutrition knowledge questionnaires by (2011), with Cranach's alpha of 0.73. This was also true for the practice level, which comprised 7 questions marked as correct or wrong. The marks obtained by the participants were added and then categorized as low (1-3), high (4-5) or very high (6-7). In such reliable tools, participants' knowledge and practice are measured using structured questions whose answers can be objectively scored, usually right or wrong. This method improves reliability and ensures consistency in assessing participants' answers. After that permission was granted from the administration department, agreement from the guardian of the respective students and assent from the participant, in order to follow the ethical aspects for the research purpose. The study adhered to the ethical principles of respect for persons, beneficence,

justice, and responsible research conduct, consistent with the ethical guidelines promoted by the Nepal Health Research Council (NHRC) (Adhikari et al., 2023).

Results

Demographic and socioeconomic characteristics of respondents (or study population)

Table 1.

Demographic and Socio-economic Information

Characteristics	Frequency (N)	Percent (%)
Age (Years)		
13-14	28	7.3
15-16	227	59.1
17-18	123	32
19-20	6	1.632
Ethnicity		
Brahmin	15	3.9
Terai Janjati	66	17.2
Pahad Janjati	33	8.6
Dalit	47	12.2
Mahato	136	35.4
Yadav	48	12.5
Pahad Chhetri	36	9.4
Muslim	3	0.8
Religion		
Hindu	362	94.3
Muslim	3	0.8
Christian	19	4.9
Residence		
Own House	373	97.1
Rental House	11	2.9
Family Type		
Nuclear	271	70.6
joint	113	29.4
Education of Parents		
Illiteracy	91	23.7
Primary Level	49	12.8
Lower secondary	84	21.9
Secondary	126	32.8
Higher secondary and above	34	8.9
Major Occupation of Parents		
Government Job	12	3.1
NGO/Private Job	12	3.1
Agriculture	232	60.4
Business	74	19.3
Foreign Employee	32	8.3
Daily Labor	22	5.7
Earning Member		
One	257	66.9
Two	85	22.1
More than two	42	10.9
Monthly Income		
Up to Rs. 2,000	80	20.8
Rs. 2001-5,000	72	18.8
Rs. 5001-10,000	87	22.6
More Than Rs. 10,000	145	37.8

Most respondents were 15-16 years of age (59.1%), which implies that most respondents belonged to the mid-adolescent age group. As per the ethnic composition, most of the respondents belonged to the Mahato community (35.4%), followed by Yadav (12.5%) and Dalit (12.2%). The religious faith of almost all the respondents was Hinduism (94.3 %). It indicates that the religion prevailing in the locality is predominantly Hinduism. Most respondents resided in their respective houses (97.1%). The number of nuclear families (70.6 %) exceeded joint families (29.4 %) in the survey. Secondary level of education prevailed in the highest percentage (32.8 %), whereas the percentage of literacy among some respondents remained nil (23.7 %). Occupation-wise, agriculture was the major occupation of the respondents (60.4 %), followed by business and foreign employment. The major sources of income for the households comprised only one family member (66.9 %). Even though a considerable number of households earn Rs. 10,000 or more per month

(37.8 %), the rest of the respondents belonged to a lower socio-economic class category.

Table 2.
Knowledge on Nutrition

Characteristics	Frequency	Percent
Knows about nutrition diet		
Yes	373	97.1
No	11	2.9
If yes, name of nutritional food (n=373)		
Pulses, Cereal	15	4
Vegetables, Fruits	60	16.1
All	290	77.8
Animal Derived	8	2.1
Knows about food with less nutrition		
Yes	348	90.6
No	36	9.4
If yes, name of less nutritious food (n=348)		
Balance Diet	2	0.5
Junk Food	340	97.8
Snacks	6	1.7
Knowledge on necessity for having nutrient diet		
For Adequate Physical Growth	15	3.9
For Adequate Mental Growth	3	0.8
For immunity Power	19	4.9
All	347	90.4
Large amount nutrient		
Carbohydrate, Protein, Fats	198	51.6
Vitamins, Minerals	45	11.7
All	141	36.7
Small amount nutrient		
Carbohydrate, Protein, Fats	74	19.3
Vitamins, Minerals	272	70.8
Other	4	1
All	34	8.9
Knowledge about food intake times a day		
One -Two times	99	25.8
Two- Three Times	226	58.9
Three- Four Times	59	15.4
Main source of carbohydrate		
Rice	360	93.8
Fruits	4	1
Vegetables	3	0.8
All	17	4.4
Main source of protein	330	85.9
Egg, Fish, Meat	27	7
Bean, Peas	16	4.2
Seafood	11	2.9
Main source of vitamins		
Meat, Poultry, Fish	32	8.3
Bean, Peas	46	12
Whole, Grains, Soybeans	16	4.2
Nuts, Seeds, Vegetables Oils	16	4.2
All	274	71.4
Main source of iron		
Red Meats	38	9.9
Nuts, Seeds, Vegetables Oils	30	7.8
Chicken Liver	49	12.8
Breakfast Cereals	45	11.7
All	222	57.8

The present study results showed that the great majority of respondents (97.1 %) were aware of a nutritious diet, implying good general awareness of the concept amongst the participants. Of those respondents who were aware of the nutritious diet, the majority (77.8 %) were aware of its correct constituents, including pulses, cereals, vegetables, fruits, and products of animal origin, while very few had partial information. Likewise, the majority of respondents (90.6 %) were aware of the less nutritious diet and almost all of them (97.8 %) correctly perceived the junk food to be less nutritious. This implies that adolescents have adequate conceptual knowledge about less nutritious foods. In terms of the significance of nutritious foods, most participants (90.4%) possessed comprehensive knowledge in realising the importance of a nutritious diet for physical and intellectual growth and building up immunity in an individual. Therefore, the participants had adequate conceptual knowledge regarding this topic. Regarding the nutrient knowledge, slightly more than half of respondents (51.6%) recognized carbohydrates, proteins, and fats as the nutrients which are

consumed in large quantities (macro-nutrients). Moreover, the majority (70.8%) had knowledge regarding the micro-nutrients, such as vitamins and minerals. While there was generally a high level of knowledge among the participants however, certain areas remain to be further improved in terms of distinguishing the different classes of nutrients.

On the other hand, as regards meal practices, it can be seen that almost half (58.9 %) of the respondents agreed that having two to three meals a day is acceptable. The identification of sources of different nutrients showed high levels of knowledge on certain types of nutrient sources. For instance, there was general knowledge on the source of carbohydrates, where 93.8 % identified rice as the main source of carbohydrates based on their dietary practice. Knowledge of iron sources was also adequate, with 57.8 % correctly identifying multiple appropriate food sources.

Table 3.

Practice on Nutritious food in daily Life

Characteristics	Frequency	Percent
Frequency of meal in a day		
One times	24	6.3
Two times	214	55.7
Three times	146	38.0
Vegetarian or non -vegetarian		
Vegetarian	140	36.5
Non- Vegetarian	244	63.5
Non-Vegetarian food meal in a week (N=244)		
One times	93	38.1
Two times	134	54.9
Three times	17	7
Consume junk food (N=384)		
Yes	361	94.0
No	23	6.0
If yes then (N=361)		
Always	39	11.2
Sometime	322	89.2
Consume iodized salt		
Yes	382	99.5
No	2	.5
Consume balance diet		
Yes	343	89.3
No	41	10.7
Consume iron-rich food		
Yes	298	77.6
No	86	22.4
Source of iron-rich food (N=298)		
Red Meat	43	14.4
Nuts	81	27.1
Chicken liver	36	12.1
Breakfast Cereals	18	6.1
All	120	40.3

The majority of respondents consumed two meals daily (55.7%), identified as non-vegetarian (63.5%), and reported consuming junk food (94%), primarily on an occasional basis (89.2%). Additionally, a significant proportion (99.5 %) used iodized salt, and 89.3percentage believed they maintained a balanced diet. Furthermore, 77.6% consumed iron-rich foods, with nuts (27.1%) and red meat (14.4%) being common sources.

Table 4.

Level of Knowledge and Practice on Nutrition

Level of Knowledge and Practice on Nutrition				
Knowledge Level	Range	Frequency	Percent	Mean
Poor	1-4	38	11	4.5
Good	5-7	168	49	
Very good	8-10	137	40	
Practice Level				
Poor	1-3	6	2.1	2.4
Good	4-5	141	50.4	
Very good	6-7	133	47.5	

The results show that the respondents have a satisfactory level of nutrition knowledge. Most of the respondents (49.9%) have a good level of knowledge about nutrition, while 40.0 %of

respondents have a very good level of nutrition knowledge. However, 11.0% respondents had poor nutrition knowledge. The mean score for knowledge is 4.5, which means that respondents have an acceptable level of knowledge about basic nutrition concepts.

When it comes to the practices of the respondent's concerning nutrition, it was also satisfactory. More than half of the respondents 50.4 % had good nutrition practices while 47.5% respondents had very good practices. Only 21 % (N=6) respondents had poor nutrition practices. The mean score for nutrition practices is 2.4 which means that respondents have good practices in their lives.

Table 5.

Body Frame satisfaction and dissatisfaction of the participants

Characteristics	Frequency	Percent
Satisfied with own body frame		
Yes	283	73.7
No	101	26.3
Changes want with own body frame (n=101)		
Body weight increase	22	21.8
Body Weight Decrease	32	31.7
Increase Height	47	46.5
Reason of not satisfied with own body frame (n=101)		
Under weight	19	18.8
Stunting	45	44.5
Wasting	3	3
Overweight	34	33.7
Reason of satisfied with own body frame (n=283)		
Body Fitness	187	66.1
Appropriate Height	59	20.8
Appropriate Weight	37	13.1
Maintain own diet for body frame Satisfaction		
Yes	318	82.8
No	66	17.2
Which Diet like to maintain (n=318)		
Vegetarian	93	29.2
Non-Vegetarian	145	45.6
Fruitarian	80	25.2

The majority (73.7%) of participants were satisfied with their body frame, primarily due to body fitness (66.1%). Among the 26.3% who were dissatisfied, the most common concern was stunting (44.5%), followed by being overweight (33.7%). Nearly 83% actively maintained a diet, with non-vegetarian (45.6%) being the most preferred choice.

Table 6.

Cross Tabulation Between Nutrition Knowledge and practice in Daily life

Knowledge Level	Practice Level			Total (%)
	Poor (%)	Good (%)	Very Good (%)	
Poor	0(0.0)	21(8.3)	7(2.8)	28(11.0)
Good	6(2.4)	59(23.2)	66(26.0)	131(51.6)
Very Good	0(0.0)	42 (16.0)	53(20.9)	95(37.4)
Total	6(2.4)	122(48.0)	126(49.6)	254(100)

The majority (51.6 %) had a good level of knowledge, with most of them (26.0 %) practicing very good nutrition. Among those with very good knowledge (37.4%), the majority (20.9%) also had very good nutrition practices. Only a small percentage (11.0 %) had poor knowledge, and none of them exhibit poor nutritional practices

Table 7.

Cross Tabulation Between Satisfaction and Dissatisfaction own body based on BMI

BMI	Satisfaction with own body frame	Yes (%)	No (%)	Total (%)
<18.5	Number (% of Total)	132 (34.4)	38 (9.9)	170 (44.3)
18.5-24.9	Number (% of Total)	148 (38.5)	59 (15.4)	207 (53.9)
25-29.9	Number (% of Total)	3 (0.8)	4 (1)	7 (1.8)
Total	Number (% of Total)	283 (73.7)	101 (26.3)	384 (100)

The majority of participants (53.9 %) fall within the normal BMI range (18.5–24.9), with most of them (38.5 %) being satisfied with their body frame. Among those underweight (BMI

<18.5), 44.3% of participants were present, with 34.4% satisfied and 9.9% dissatisfied. Only a small percentage (1.8 %) were overweight (BMI 25–29.9), with nearly equal satisfaction and dissatisfaction. In general, the satisfaction levels were very high for those with normal BMI, whereas the dissatisfied people have low BMI

Discussion

The results of the current study on body image dissatisfaction of adolescent girls living in a municipality of Barahathwa Municipality showed that the prevalence of body dissatisfaction was very high, with 75.2 % being dissatisfied with their body image. This rate of body dissatisfaction in the current study resembles other studies carried out in Nepal. In particular, Sangam et al., (2015) found body dissatisfaction in 80.9% of adolescents Malla et al., (2021) identified body dissatisfaction in 80% of adolescent girls. This slight difference in prevalence between the different studies could be attributable to the difference in study settings, sample characteristics, age distribution, sociocultural factors. However, the consistently high rates across the similar studies imply that body dissatisfaction is a common concern among Nepalese adolescents, especially among the girls. This may be the cause of increased exposure to sociocultural pressures, media influences and changing standards of beauty that affect body evaluations among young girls. On the other hand, studies from other cultural contexts show mixed results. For instance, a study with Brazilian adolescents indicated that underweight and overweight/obese students reported higher levels of body dissatisfaction (Moehlecke et al., 2020). In the same vein, another study conducted in Iran reported that underweight, normal weight and overweight participants all chose the thinnest figure as their ideal body image (Alipour et al., 2015). These differences reflect the impact of cultural norms and societal pressures on body image perception across regions.

Most of the respondents in the present study had two meals a day (55.7 %), were non-vegetarian (63.5 %) and consumed junk food (94 %) mainly occasionally (89.2 %). This showed that although unhealthy food consumption was common among adolescents, it was not frequent enough to be a regular dietary dependence. However, it could be if sustained, and may have long term health risks among the participants. In addition, the present study showed that 99.5% of the participants used iodized salt and 89.3% perceived that they had a balanced diet. Moreover, 77.6% of the participants consumed iron-rich foods, with nuts (27.1%) and red meat (14.4%) as common sources. These findings aligned with previous studies indicating that while many adolescents are aware of healthy dietary practices, actual adherence varies. For example, in Pokhara, Nepal, 63.1 % of the study participants were found not to be eating enough calories, 27.4% were underweight, and 8% were overweight (Subedi & Yadav, 2018). Likewise, research in Nepal has shown that cultural norms and gender stereotypes are important factors in determining food practices among adolescent girls, often limiting their access to adequate nutrition (Cunningham et al., 2020). These findings indicate a mismatch between dietary intake and nutritional requirements among the participants. The results obtained by the present study demonstrates the complexity of relations between knowledge, cultural environment, and real behavior associated with nutritional problems in adolescents

Conclusion

This present study emphasizes the complicated relation between nutritional status and body image satisfaction among teenage girls in Barahathwa Municipality, Sarlahi. Although subjects exhibited a normal body mass index, they were dissatisfied with their bodies, especially those girls who perceived themselves as either underweight or overweight. Therefore, body perception seems to be based not only on objective parameters but also on subjective factors and social influences. Despite the established correlation between nutritional knowledge and health behaviors, excessive intake of junk food indicates that awareness is still not sufficient among the

participants. Consequently, it is necessary to undertake awareness initiatives that encourage positive body image, together with the knowledge to maintain balance and nutritional diet to ensure adolescents' body positivity and nutrition knowledge

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Conflict of Interest

No conflict of interest

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Research Article

Analyzing Contribution of Remittance on Socioeconomic Transformation

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Abstract

Remittances have become a vital pillar of Nepal's economy, yet their micro-level effects on rural households and local development remain unevenly understood. This study examines the contribution of remittance receipts to household socioeconomic conditions and analyzes remittance inflow trends and their impact on local development in ward number 5 of Nagarain Municipality, Dhanusa District. A descriptive design with purposive sampling of 42 remittance receiving households was employed, using structured questionnaires and key informant interviews. Findings reveal that all migrant workers are male, predominantly married and employed in Gulf-countries, with formal channels (IME and banks) facilitating largely bi-annual transfers controlled by fathers and wives. Remittances are primarily allocated to housing construction, daily consumption and loan repayment, resulting in a dramatic shift from temporary to permanent dwellings, increased private school enrolment, and greater reliance on hospitals and clinics over basic health posts. Household incomes rose substantially; no recipient household remained in the lowest income bracket after migration, confirming direct poverty- reduction effects. Bank account ownership and insurance uptake also grew. However, productive investment in agriculture or business remains minimal. While remittances significantly upgrade living standards, housing and human capital, their transformative potential for self-sustaining local economic development is constrained without supportive policies that channel funds into productive sectors. The study underscores the need for financial literacy, entrepreneurship training, and accessible credit to convert short-term welfare gains into long-term resilience.

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Introduction

The remittance refers to the transfer of foreign exchange from various countries of the world to their home countries. Over the past two/three decades, it has become a major pillar of Nepal's socioeconomic structure. It is one of the most important sources of revenue in Nepal. This reflects the country's heavy reliance on labour migration as a development strategy. Beyond merely supplementing household income, these remittances actively work to reduce poverty, narrow economic inequalities, and raises living standards across both urban and rural communities (Kunar,2021; Regmi,2016). At the macroeconomic level, remittance constitutes an important source of foreign exchange earnings, providing the economy with the economic stability that its comparatively lower export base alone cannot sustain. This makes Nepal particularly fragile to any oscillation in global migration patterns or host country policies. At the household level, a significant proportion of remittance income is deliberately distributed towards education, healthcare, and nutrition. Spending that goes beyond immediate consumption and instead represents strategic human capital investment (Pant,2020; Pison,2003) over time, strengthens quality of labour force, improves the health situations, and extends access to opportunity. In addition, it creates collective foundation on which the long-term and sustainable economic development of Nepal is established. Spending on education and health produces greater socioeconomic benefits and greater returns compared to domestic employment. If a large share of remittances is spent on education and health, investment, business or agriculture decrease (Rai,2021; Solimano,2003), as a results, these sectors cannot create jobs and produce their potentials.

Determinants such as pandemic, oil price fluctuations, and economic slowdown negatively affect remittance inflow, which impacts on household well-being and national economic stability (Acharya,2017; Khadka,2020). In addition, remittance also affects micro and macroeconomic conditions as it contributes to GNP and supports the livelihood of millions (Gaudel,2007). Despite the great significance felt by the people, the optimal uses and objectives are not fully achieved. In this context, this paper depicts how remittance contributes to household income, expenditure, and overall social and economic transformation in Nepal.

Remittance has both positive and negative impacts. It is seen that it has gradual negative impact on socio-cultural and religious values and traditions that have been ingrained in Nepali society for centuries. But it has positive impact on housing, consumption, and dynamic lifestyles of citizens (Khadka,2022). Governments can further improve remittance benefits by establishing plans and policies that assist productive use and sustainable development (Gaudel,2007). Remittances alone do not automatically translate into productive investment; rather, institutional support in the form of targeted training and accessible financial products is the critical catalyst (Sharma and Adhikari,2025). Remittances provide as a base for improving living standards, increasing household earnings, and easing investment, all of which can have a fruitful impact on both family well-being and the country's overall development (Ranga,2003). However, depending heavily on remittances may impair a household's ability to handle with economic disruption, and migration can lead to a loss of capable individuals, thereby reducing the number of skilled man powers remaining in the country (Mathema,2010). The practice of worker migration did not start in the twentieth century. Throughout history, people have left their native counties for employment in foreign countries where they could receive wage slips for their labour. The only difference today is that the number of migrant workers is drastically higher than ever before. At present, millions of people live and work in foreign, whether to support themselves or to find job. Migrant workers encounter many types of discrimination in the job market. This research studies the socio-economic effects of remittance in Nepal. Even though Nepal is foremost recipient of remittances, there is still few research on how these funds are used and what effects they produce. The aim of this study is to understand how remittances affect household earnings, spending patterns, social development, and economic stability, thereby addressing gaps in current knowledge. This paper also analyzes the trends of remittance inflow in the particular study area and how they influence the social and economic conditions of the households

Research Gap

There are so many researches which have been conducted. Most of the available researches try to focus on the things like household expenditure, reducing poverty, or macroeconomic measures. Sufficient attention hasn't been given to whether remittances lead to change livelihoods or motivate people to invest money in productive ways. This study tries to fill that gap by examining how remittance affect social and economic progress in Nepal. Also, it pays attention to the ways that the households use the money they receive and what it important for rural livelihoods.

Objectives

The objectives or aims of the study are to examine the contribution of remittance receipts on the socioeconomic conditions of households, and analyse the trend of remittance inflow and evaluate its impact on local socioeconomic development.

Literature Review

Due to unavailability of jobs and opportunity in country, many people go abroad and the money sent back is the greatest source of socio and economic development of the country. Nepal has been the face where remittance has been the source for the survival and living of various families and the economic development of the country. This part shows different parts of the world and the surrounding region, along with research done specially in Nepal in order to better understand the contribution of remittance to socio and economic growth.

Theoretical Views on Remittances and Development

In the 1960s and 1970s, people had a positive view on migration and remittances. There was a decline in the poverty line when people started to send money, skill and knowledge to the home country (Abdullah, 2014). They get to know that remittances as a proper way to make up for the loss of workers and to ease shortages of money in the least developed nations.

After that many mentalist and structuralist thinkers have started to go against this rosy view. They keep up their point that more dependency on remittance can be a bad sign for the country's own local productions, socio-development and increase the gap of global inequality. Looking from their eyes, it was clearly seen that remittance can be an approach for short term economic growth for the families but it will be a hurdle in the long-term economic transformations of the country.

Currently many researches are conducted on the middle ground approach. Study shows that it will help to elevate the people's lifestyle and livelihood but it will limit the sustainable development relying on how the policies are setup and how the money gets invested. In the countries like Spain, Italy and Ireland remittance was very common since 1800-1900 to support the family living-hood, support economies. (Adams,2006).

Remittances and Nepal's Socio-Economic Situation

Nepal's economy has been deeply influenced by the huge number of people going abroad for employment. Poverty has scattered to different parts of Nepal especially in rural areas with not any adequate solutions, and the economy has a certain built in limitations, these problems are due to not having enough liable jobs available. In starting 1900s, it came in concern when various Nepali's started to migrate after the Anglo-Nepali war to contribute in the Foreign Military units as an employment and seasonally to India also. Remittance has started helping the economy after people started to send money back home after migrating to Dubai, Malaysia, Qatar etc. At the time of political unrest and economical trouble, remittance has been a resilient source to keep Nepal's economy steady. Study says that foreign currency reserve has been prevented from falling down and people can have their bread and butter due to the incoming funds (Ratha, 20216). Overall, quality of life has been improved as you see when money sent from foreign lands leads to have better living conditions, afford schooling and proper medical care.

How Households Make a Living and Use Remittances?

The way of life, what they eat as a proper food and nourish themselves and how the standard of living is raised is all described as household's living is concerned with remittance income in Nepal with rural areas being one of the affected parts of economic crisis. So, these incomes readily support cover every day payslip and overcome financial burden. Research from various studies across various families compared paints a mixed picture. When it comes to income generating activities, the people who receive remittance and who don't have any difference in rural areas (Thakur,2014). This study shows that due to not having proper plans the money came back from remittance has not been utilized for more useful investments. Money has been utilized to enhance the household living but the main part is that it failed to improve the local economy of the rural areas (Dhungana,2020). These are due to weak guidance and proper investing opportunities

Method and Materials

Descriptive research design was adopted to systematically examine the contribution of remittances and evaluate their impact on household socio-economic conditions, without manipulating variables. The study was conducted in Nagarain Municipality's ward number 5, Dhanusha District, Nepal -a site purposively due to its high concentration of out-migration workers. The primary unit of analysis was the remittance receiving household. Out of 310 households in the ward, 105 were identified as receiving remittance, forming the target population. From these, a sample of 42 households was drawn using purposive, non-random

sampling, based on respondents' willingness to participate, availability, and the presence of active migrant workers. This approach was necessary because a complete sampling frame was unavailable and the study required detailed, context-rich data from directly affected families.

Data collection employed both quantitative and qualitative tools. A structured questionnaire was administered face to face, capturing household demographics, migrant characteristics, remittance amount, transfer channels, dispatch frequency and detailed pre- and post-migration information on housing types, children's school enrollment, health facility uses, household income and expenditure brackets, as well as the primary purpose of remittances use. Qualitative insights were gathered through semi-structured interviews with local social workers and the Municipal Secretary, supplemented by field observations. Secondary data were sourced from published journal articles, government reports, census documents, and municipal records to contextualize primary findings.

To directly address the research objectives, specific variables were operationalized. To "examine the contribution," variables included remittance amount, expenditure allocation (staple goods, housing, loan repayment, education, healthcare, weddings, asset purchase), housing type health institutions visited, income and spending. To "analyze the trend of remittance inflow," variables comprised country of employment, monthly earnings, transfer mechanism, and remittance sending frequency. To "evaluate impact," before and after comparisons of all welfare indicators were performed.

Data analysis relied on descriptive statistics. Quantitative data were coded, entered into Microsoft Excel, and analyzed using frequencies, percentages, and before-and-after comparison tables. Qualitative responses were organized thematically to explain numerical patterns. Results were presented as frequency distribution tables with absolute numbers and percentages, and interpretation focused on the magnitude and direction of change, supported by qualitative context. Thus, integrated design, deliberate variable selection, and purposive sampling were essential to capture the multifaceted role of remittances in a setting where experimental controls were impossible, ensuring that the verbs "examine," "analyze," and "evaluate" were fully addressed within the study's scope and available resources.

Results

Respondents' Attributes

This part presents the social, demographic, and economic characteristics of both the households that receive remittances and the migrant workers themselves. It covers up things like family size, age, gender, marital status, education levels, where migrants go for work, what skills they have, and why they choose to work abroad. These details help set the platform for understanding the broader context of migration and how remittance money gets used.

The total number of people living in the surveyed households came to 155. Out of these, 81 were female (about 52.26 percent) and 74 were male (47.74 percent). The higher share of women is largely because many men have left for jobs overseas, leaving behind women, children, and older family members. This kind of population pattern is common in communities that send many migrants abroad, and it has a big influence on who does what in the household and how much dependency there is on remittances.

Looking at the ages of migrant workers, foreign employment tends to draw younger adults the most. The biggest group 19 percent falls between 24 and 30 years old. Next comes the 18 to 20 age brackets, which makes up 16 percent. Smaller shares were seen in the 30–36 range (5 percent), 36–40 (2 percent). This shows that younger, working-age people are the ones most likely to go abroad for jobs, probably because they have more physical energy and greater financial pressures. The fact that the 24–30 group stands out the most suggests that migration is closely tied to starting a family and needing a steady income.

When it comes to gender, the breakdown of migrant workers is very one-sided. Men make up cent percent of all migrants of the survey participants. Women are null. This imbalance

is largely due to traditional social expectations, gender roles, and how the labour market is structured in Nepal. There are limited job opportunities abroad for women, plus family obligations at home, along with legal and cultural barriers that all restrict female participation in international labour markets particularly in study area.

Marital status also plays a role in shaping migration patterns. The majority of migrant workers 71.43 percent are married, while 28.57 percent are unmarried. Those who are married tend to send money back more regularly to cover household costs, pay for their children's schooling, and afford medical care. This points to a strong link between being married and how consistently remittances are sent.

When it comes to education, migrant workers show a range of achievement levels, though most have moderate amounts of schooling. About 40.78 percent have finished the Secondary Education Examination (SEE), 16.67 percent have completed 10+2, 30.95 percent have education below the SEE level, and only 11.90 percent hold a bachelor's degree or higher. The relatively small share of highly educated migrants highlights the lack of good job opportunities at home, which pushes even educated people to take low-skilled or semi-skilled positions overseas.

Country-wise Migrant Workers

Migrant workers choose to travel various countries for employment and the data shows that nearly half- 47.62 % are employed in Gulf Countries, next come to those who are working in Malaysia, the United States, Europe and Australia, which holds together for only 4.76 percentage. And, also 4.76 % people flew to India. Gulf being the larger share of percentage due to being high demand of low and semi-skilled workers and easy migration process compared to other destinations (Source:2026, Field Survey).

Training of Migrant Workers

Depending upon the work they do, the skills of the migrant workers vary. Unskilled workers make up the highest percentage at 47.52 percent. And general semi-skilled share up 33.71 percent. Driving training accounted for 9.19 percent, while computer training with 5.68 percent. This suggests that most migrant workers have unskilled suited for hardworking in industry and highly skilled, while far fewer have training and highly skilled (3.09%) for office-based or technical roles (Source: 2026, Field Survey).

Drivers of Foreign Employment

Various push factors such as limited access to basic requirements, lack of jobs and social-conflicts and being in debt causes the people of Nepal especially in remote areas to migrate and work abroad. A lack of facilities was cited by 38.10 percent of respondents as their main reason for leaving. Unemployment came next at 21.42 percent, followed by family conflicts at 14.29 percent, social conflicts at 9.52 percent, and indebtedness at 16.67 percent. These studies indicate that lack in basic facilities and living conditions are major forces driving migration within the study area.

Impact of Remittance

Foreign employment has significantly increased the living standards of people in the study area. The inflow of remittances has allowed families to obtain modern amenities –such as motorcycles, televisions, smartphones, gas stoves –which have greatly elevated their quality of life. These financial endowments have led to many social benefits as discussed below.

Improvements in Housing

Housing is a basic social need and a key measure of an individual's quality of life and status within a society. Addressing housing needs is essential for securing proper living conditions for all. The following data emphasizes the different categories of house structures in the study area.

Table-1.*Improvement in Housing*

Types of Houses	Before		After	
	Number	Percent	Number	Percent
Pakki	06	14.29	30	71.43
Ardha-pakki	10	23.81	07	16.67
Kachhi	26	61.90	05	11.90
Total	42	100.00	42	100.00

The above table shows a significant change in housing quality following remittance. Initial data depicted that 61.90% of houses were “Kacchi” and only 14.29% were “Pakki”. However, after foreign

employment, the percentage of Kacchi houses declined to 11.90 %, while Pakki houses increased to 71.43%. This changes in figures advocates that higher remittance income enables families to invest in more durable and improved accommodation structure.

Improvement in Education

Education acts as a transformative tool for individual enablement and the upgrading living conditions. Training people with the required skills and knowledge enables them to connect with and benefit from developmental initiatives. Furthermore, education improves personal viewpoints and lifestyles, which are necessary for impactful involvement in economic, social, and political realms. The associated data details how participants’ educational preferences changed following the receipt of remittances.

Table-2.*Improvement in Educational standards*

Institution	Before		After	
	Number	Percent	Number	Percent
Government School	35	83.33	29	69.05
Private School	07	16.67	13	30.95
Total	42	100.00	42	100.00

Remittances from foreign employment have led to a significant shift in the educational choices of households in the study area.

Initially, the government schools were primary choices before receiving remittance i.e., 83.33% respondents enrolled their children in government school and only 16.67% in private school. However, after foreign employment the enrollment in government school dropped to 69.05 %, while private school preference rose to 30.95%. This data suggests that inflow of remittances has directly affected families’ decisions to seek different educational opportunities.

Improvement in Health Care Facilities

Healthcare facilities are important for promoting welfare of the society. Regular health checkup is vital to every stage of human life from unborn stage to till death. However, low income, lack of awareness, and lack of health care facilities compel people not to get health checkup regularly. The following data highlights that the respondents have changed their health checkup habit to the better medical institution.

Table-3.*Improvement in Health Care Facilities*

Health Institution	Before		After	
	Number	Percent	Number	Percent
Health Post	22	52.39	16	38.10
Hospital	15	35.71	17	40.48
Clinic	05	11.90	09	21.42
Total	42	100.00	42	100.00

The above data highlights the distribution of the respondents based on changes in their health status. Prior to receiving remittances, 52.39% of the surveyed respondent used health

post for health care, while 35.71% went to hospitals followed by 11.90% to private clinics. However, after receiving remittances, healthcare choices shifted that the use of health post dropped to 38.10% but the visit of hospital and clinic rose to 40.48% and 21.42% respectively.

Improvement in Socioeconomic Status

Social status of respondents also improved as remittance earnings increased. Higher incomes directly boosted people’s capacity to afford better accommodation, healthcare, education and luxury products. Furthermore, respondents also experienced a better capacity to

help financially to others in society. This makes individuals better social standing within the community.

Remittance also acts as a vital role as foundation for both local and national economies. Remittances directly enhance cash inflow, making a noticeable difference in the economic health of an individual households and the country as a whole. Since money is the basis of economic power, these received funds from abroad play a vital role in maintaining financial stability.

These remittances inflow can play role as a safety net, helping to decline investor's worry during periods of increasing foreign debt or low foreign exchange reserves. Nepal has a low export bases, hence remittance becomes a major source of foreign currency. Therefore, remittance is not only effective factor for better economic condition of households, but also it is crucial for the national economy.

Economic Changes at the Household Level

An empirical analysis of household economic indicators depicts a positive association between the receipt of remittances and the collection of financial assets. Although non-liquid assets specifically land and furniture remain unchanged, a significant expansion was observed in institutional savings. After foreign employment, the substantial number of households operating bank balance rapidly increased from 12 to 30, showing shift towards financial inclusion. Furthermore, 12 households stated that they took out an insurance after going abroad, which is new to these households. Thus, the changes reflect total improvement in the economic situation of households which receives remittance.

Impact on Household Income and Expenditure

Labour migration caused a huge upward shift in household incomes, entirely removing lowest income segment. Before foreign employment, largest households' group (55.41%) earned below NPR 15000. This was followed by 31.18% earning NPR 15 to 25 thousand, and 19.26% of 25 to 35 thousand. Only small fraction of 6.05% earned between NPR 35 to 45 thousand, and very few percentages of 3.28 earned above NPR 45 thousands. After migration, financial capacity spiked. An overwhelming 42.37% of households shifted into moderate income bracket of NPR 25 to 35 thousand. Another significant household 36.15% earned between NPR 35 to 45 thousand, and 21.48% of households earning more than 45 thousand. No household falls under income group below NPR 25 thousand, proving that remittance inflows play as a powerful way for poverty reduction (Field Surrey, 2026).

Household spending also massively rose after receiving remittances. Before migration, over half of households (55.41%) spent below NPR 15 thousand monthly, and 29.32% spent between NPR 15 to 25 thousand. Post-migration, the share of low spending households i.e., under 15 thousand, declined sharply to 21.31%. Households spending NPR 15000 to 25000 increased to 40.56 percent and those spending NPR 25000 to 35000 grew to 25.42 percent. A very few households (3.14 percent) reported spending above NPR 45000. The increased disposable income is largely directed to food, basic non-food products, and education, representing a tactical investment in household welfare, and contributing to raising the living standards.

Patterns in Remittance Flows Over Time

Remittance helps to sustain both household finances and the widen national economy. At the household level, remittances lead to better living conditions and help alleviate people out of poverty. Looking at the country as a whole, they raise foreign currency reserves, improve the balance of payments, and support job creation. Remittances still play a role in enhancing social and economic development, even though only a small fraction gets put into productive investments.

Earnings of Workers Abroad

How much a household earns is a major factor for migration. Especially in farming where low wage is present and options are limited and where work is often seasonal pushes

people to look for employment in a foreign country. The current earnings of migrant workers show that moving abroad provides higher and more dependable income, which in turn improves family well-being and raises their overall social and economic standing.

Monthly Earnings of Migrant Workers

Looking at how much money migrant workers make per month, none of the respondents said they earn below NPR 15,000. Around 11.90 percent make between NPR 15,000 and 25,000, while 23.82 percent earn between NPR 25,000 and 35,000. A larger share of 52.38 percent reported monthly earnings in the NPR 35,000 to 45,000 range. And, 11.90 percent send home more than NPR 45,000 per month. These figures show that the majority of migrant workers earn relatively high incomes, which boost their ability to send money back to their families

How Remittances Are Sent?

Migrant workers use different media to send money home. The most common channel is International Money Exchange (IME), used by 47.62% of respondents. Banks come in second at 35.71%. A smaller portion relies on relatives to carry money (11.91 %), while only 4.76% use informal options like hundi. These results suggest that formal transfer methods dominate, though informal channels are still used by a few, especially among those who have limited access to banking services.

Remittance Dispatch Frequencies

The frequency of remittance transfer, most of the migrant workers send money home bi-annual, representing largest share of 45.23%. Annually transfers are the second most common, accounting for 38.10% of the total. Meanwhile, 16.675 of workers make irregular payments. The findings depict that most of the migrant workers send money to the home once or twice a year rather than monthly.

Reimbursement for family

Reimbursement refers to the funds that sent home by expatriate workers working foreign countries. These workers go abroad for better financial opportunities. Abroad, workers earn competitive salaries that attract international employees. This remittance substantially amplifies local, regional, and national economies in home countries.

Table-4.

Reimbursement for Family

S.N.	Amount of Money (in NPR)	No. of Respondents	Percent
01	Below 15000	-	-
02	15000-25000	05	11.90
03	25000-35000	10	23.82
04	35000-45000	22	52.38
05	Above 45000	05	11.90
	Total	42	100.00

The above table highlights the monthly transfer of remittance by migrant workers. About 11.90% of the employees send between NPR.15000 and 25000 monthly and also above 45 thousand. Meanwhile, 23.82%

transfer rupees between NPR 25000 and 35000. A largest group of 52.38% sends between the NPR 35 and 45 thousand.

Recipient Family

Human migration is deeply linked with remittances that serve as a vital source for economic development of country. In fragile nations, people are often pushed to go abroad due to wars, political oppressions, or financial crisis. Particularly, for the People of the least developed countries (LDCs), migration become necessity for survival rather than voluntary choice. Although migrants left their home country, they support their country's economy by sending money back to their families. In Nepal, usually close relatives of the migrants get benefited from the funds. The following table overview the remittance recipients.

Table-5.

Remittance Recipients

Remittance Recipients	Number	Percent
Father	16	38.10
Wife	13	30.95
Mother	07	16.67
Brother/Sister	04	9.52
Relatives	02	4.76
Total	42	100.00

The data of the study reveals that fathers (38.10%), wife (30.95%) and mother (16.67%) are the most frequent recipients. Siblings and relatives receive a few shares. In Nepal, generally father remains the boss of the households and maintains

control the remittance that how it spent.

Purpose and Utilization of Remittances

The academic perspective on how these funds influence development has changed over time. Early research suggested that remittances were not productive because they were spent on primary daily consumption rather than being invested in business, farming or trade and business. However, modern research argues that the demarcation line between consumption and investment is deemed. The use of remittance for health services, education, and skills development is now recognized as a significant investment in human capital that accelerates long term economic growth. When linked with physical assets, these funds can really outpace local employment returns. Ultimately, direct business investment is significant, using funds to improve household wellbeing and access to services equally vital for sustainable development.

Table-6.

Use of Remittance

Purpose	No. of Respondents	Percent
Staple Goods	10	23.82
Building Houses	13	30.95
Loan Repayment	09	21.43
Wedding	05	11.90
Assets	03	07.14
Health Care	01	02.38
Education	01	02.38
Total	42	100.00

As the above table shows, the utilization of remittances by recipient varies among different household needs. The majority of recipients (30.95%) use funds towards building houses. The daily living commodity account for 23.82% while 21.43 percent respondent repays loans. Furthermore, 11.90 % uses for

wedding and 07.14% of recipients utilize funds for assets. Similarly, 02.38% uses for health care and education facilities each.

Discussion

The findings of this study shows that remittances significantly improve household living standards in Ward No. 5 of Nagrain Municipality, consistent with prior research in Nepal (Kunwar, 2021; Regmi, 2016). The dramatic shift from Kacchi to Pakki housing (from 14.29% to 71.43%), increased private school enrollment (from 16.67% to 30.95%), and greater utilization of hospitals and clinics over basic health posts confirm that remittance income directly enhances physical infrastructure, human capital investment, and healthcare access. These improvements align with theoretical perspectives that recognize remittances as strategic investments in household welfare and human capital development (Pant, 2020; Pison, 2003).

However, the study reveals a critical constraint: remittance utilization remains heavily skewed toward immediate consumption (23.82%), housing construction (30.95%), and loan repayment (21.43%), with minimal allocation to productive sectors such as agriculture, business, or enterprise development. This pattern supports concern raised by structuralist schools that remittance dependency may hinder long-term economic transformation despite short-term welfare gains. The absence of productive investment is particularly notable given that 71.43% of migrant workers are married and 47.62% are employed in Gulf countries, suggesting that household financial priorities remain focused on stability rather than entrepreneurial risk-taking.

The study's finding that 100% of migrants are male reflects persistent gender disparities in international labour migration, consistent with Mathema's (2010) observations. Remittance control predominantly rests with fathers (38.10%) and wives (30.95%), with bi-annual transfers (45.23%) through formal channels dominating. While increased bank account ownership (from 12 to 30 households) and insurance uptake indicate growing financial inclusion, lump-sum transfer patterns limit effective financial planning and investment opportunities.

Ultimately, this research confirms that while remittances powerfully reduce poverty and elevate living standards, their transformative potential for self-sustaining local economic development remains underexploited without targeted policy interventions. As Sharma and Adhicari (2025) argue, institutional support through financial literacy programs, entrepreneurship training, and accessible credit is essential to channel remittance inflows toward productive sectors, converting short-term welfare gains into long-term economic resilience and sustainable community development.

Conclusion

The study examined the contribution of remittances to household socioeconomic conditions and analyzed the trend of remittance inflow along with its impact on local development. Regarding the first objective, remittances were found to substantially improve household welfare. Expenditure was directed primarily towards house construction, daily consumption, and loan repayment, leading to a sharp increase in permanent housing, greater private school enrollment, and a shift from health posts to hospitals and clinics. Household income and monthly spending both rose markedly, with no family remaining in the lowest income bracket after migration, confirming remittances' direct role in poverty reduction and enhanced living standards.

Concerning the second objective, remittance inflow trends revealed that nearly half of migrant workers are employed in Gulf countries, with formal transfer channels –IME and banks- dominating. Transfers arrive mainly bi-annually or annually, and fathers and wives act as a primary recipient. These inflows have generated visible local impacts: improved physical infrastructure through better housing, deeper financial inclusion evidenced by increased bank accounts and insurance uptake and upgraded human capital through education and healthcare investments. However, productive investment in agriculture or enterprise remains minimal. Overall, while remittances have significantly elevated household wellbeing and contributed to local socioeconomic development, their potential for self-sustaining economic transformation remains underexploited without targeted policy support.

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Conflict of Interest

The authors declare no conflict of interest.

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Research Article

Exploration on Soil Corrosivity towards Buried Metallic Structures in Tansen Municipality Roadway Areas

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Abstract

The corrosivity of soil towards the buried structures depends upon physicochemical parameters of soil. An empirical corrosion rating model is done for six soil corrosivity parameters such as physical parameters (colour, smell, general texture and types of soil) and chemical parameters (moisture content, pH, resistivity, chloride and sulphate ions) for collected 45 soil samples from three different depths of 0.4 m, 0.8 m and 1.2 m below the ground level of Batasedanda – Tansen Buspark - Parvas roadway areas of Tansen Municipality for their corrosive nature towards the buried structures. The values of moisture content, pH, resistivity, chloride content and sulphate content ranged from 5.27 % to 21.83 %, 6.91 to 9.46, 6,958.54 Ohm.cm to 28,691.58 Ohm.cm, 28.942 ppm to 104.86 ppm and 72 ppm to 284 ppm respectively in this research work. The experimental results indicated that the soils could be rated as mildly corrosive to less-corrosive groups to the buried structures according to American Standards of Testing and Methods (ASTM). Based on the findings of the present studies, it is best to bury metallic pipelines in between 0.4 m to 0.8 m but it can be done at 0.4 m if the soil is undisturbed. A polyethylene-sheet encasement around the galvanized-steel and cast-iron water pipelines or the use of non-conducting materials of gravel/ sand around the burying ground could be sufficient for the extension of their life up to 50 years or more. Present findings would be insightful and suggestive in making the corrosive land maps of the selected studied areas which would be helpful for the potable water pipeline works in municipal water supply system in Palpa, Nepal

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Introduction

Corrosion is a pervasive and inevitable natural phenomenon, present in air, water, soil, and virtually every environment. The concept is as old as the Earth itself, though recognized by different names over time. Technically, corrosion refers to the deterioration of metals through chemical or electrochemical reactions with their surroundings (Revie & Uhlig, 2008). While plastics may crack, wood may decay, granite may erode, and cement may leach, the term “corrosion” in this context is restricted to the chemical degradation of metals. Actually, corrosion of iron is rusting but non-ferrous are corroded instead of rusting (Poudel et al., 2020). Corrosion manifests in various forms, including uniform corrosion, pitting, galvanic corrosion, selective leaching, intergranular corrosion, environmental cracking, crevice corrosion, and erosion corrosion (Gupta & Gupta, 1979). Generally aqueous corrosion, atmospheric corrosion, concrete corrosion and soil corrosion are four types of corrosion based on corrosive environment (Bhattarai, 2013).

Economics, safety, and resource conservation are three aspects of corrosion. Engineers are targeted to reduce metal degradation that are utilized in water supply pipelines, reinforced concrete infrastructures, ships etc. (Denison & Romanoff, 1957). Corrosion induced failures may causes accidents and hence safety perspectives should be considered (Gautam & Aryal, 2021). Further, conservation of resources like metal, energy, water etc. has significant role of corrosion (Norin & Vinka, 2003). Corrosion of buried metallic structures in soil is one of the geotechnical

consequences due to various soil parameters that results cracking or pitting causing failures of underground pipelines (Levlin, 1992). Such failures of buried metallic materials lead to global environmental and economic consequences for water, gas, and/ or petroleum supply system (Dhakal et al., 2013). Corrosion of underground metallic structures is severe in case of disturbed soils than undisturbed soils (Gautam & Bhattarai, 2014). Oxidation reduction potential, moisture and aggressive ions content, pH, conductivity, etc. of soil parameters leads to soil corrosion (Wasim et al., 2018). But exact determination of corrosion rate due to these soil corrosivity parameters is difficult and relative corrosion risks can be predicted (Robinson, 1993; Regmi et al., 2015).

Soil corrosion becomes urgent since utilization of metallic pipelines for supply system of water, gas, petroleum etc. is increased day by day (Knauf & Howard, 2008; Rajani & Makar, 2000). In case of our country, buried metallic pipelines are predominant for the municipal water supply system. Water supply system of Tansen municipality is primarily with buried cast iron pipelines from reservoirs to terminals of distribution (Gautam & Aryal, 2022). Also, failures of such pipelines cause disturbances in supply system that leads to economic burdens and environmental consequences. Therefore, this research work is aimed to investigate six soil corrosivity parameters around municipality roadway areas by estimating corrosion risk conditions in accordance with ASTM protocol. Also, relationship between soil corrosivity and depths is analyzed. These findings will help to develop corrosivity maps and serve as guidelines for authorities for designing better service life of buried water supply metallic pipelines around municipal roadways

Method and Materials

A total of forty-five soil samples were collected in airtight polyvinyl bags from three depths (0.4 m, 0.8 m, and 1.2 m below ground level) across five sampling sites located along the Batasedanda, Tansen Buspark, and Parvas roadway areas of Tansen Municipality, Palpa, during January–February 2020. The selected sites included areas near TMC Campus, Palpa Jail, Banbatika Hotel and Restaurant, and Lumbini Medical College. The spacing between adjacent sampling sites was approximately 500 meters as described elsewhere (Dahal *et al.*, 2021). Samples were primarily obtained from roadside locations (Fig. 1) where galvanized steel and cast-iron or metallic pipelines were installed or planned for installation to supply drinking water to different parts of the municipality.

The physical characteristics of soils; such as color, odor, texture, and type were evaluated at

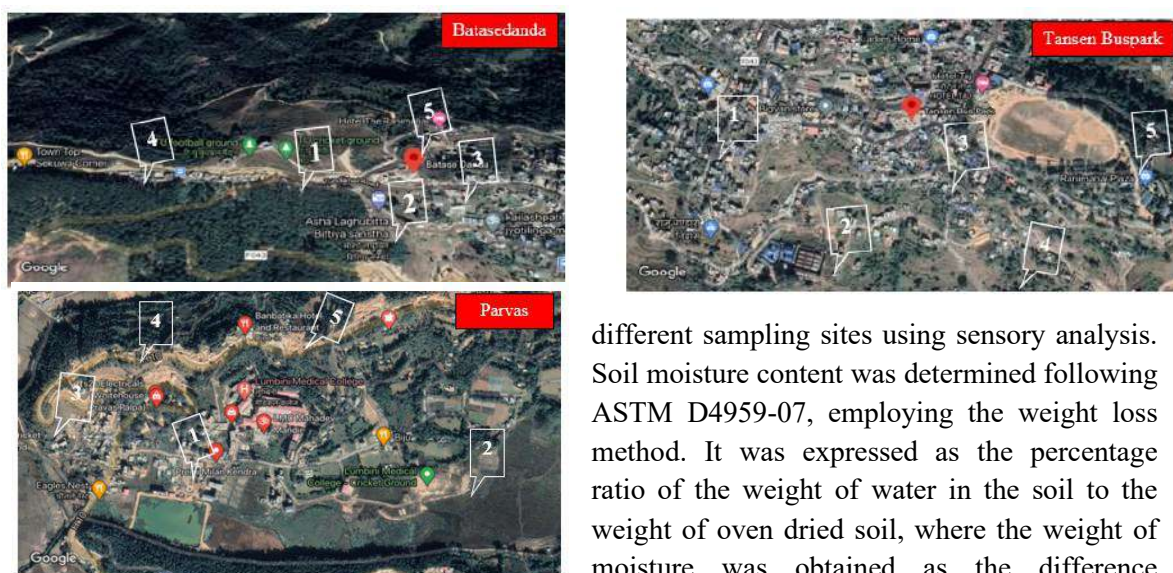


Figure 1 Satellite map of the soil sampling sites of -1. Batasedanda, 2. Tansen Buspark and 3. Parvas roadways area of Tansen Municipality, Palpa (Google earth, 2024).

different sampling sites using sensory analysis. Soil moisture content was determined following ASTM D4959-07, employing the weight loss method. It was expressed as the percentage ratio of the weight of water in the soil to the weight of oven dried soil, where the weight of moisture was obtained as the difference between the wet and dry soil samples. The pH of each soil sample, collected from the Batasedanda–Tansen Buspark–Parvas roadway area of Tansen

Municipality, was measured using a digital pH meter in a 1:2 soil–water extract according to ASTM G51-95. Also, ASTM G187-05 was utilized for measuring conductivity of the same soil extract. AASHTO T291-91 protocol of argentometric titration method is obeyed for estimating chloride content and potassium chromate solution as indicator is used. Gravimetric method in accordance with AASHTO T290-95 followed for estimating sulfate ion content.

Results

Study of corrosion risk of underground pipelines is challenging since corrosion of underground metallic structures in soils complex and random phenomena. The major six soil corrosivity parameters are estimated for collected soil samples from three different depths around the selected municipal roadways. Three types of soils- sandy, loam and clay- were found and show different corrosion risks, as displayed in Fig. 2(a-c). Mildly corrosive soils were found at about 47% of the investigated depths of 0.4 m from the surface, but about 53% of the soil samples, of which 40% were sandy and 13% were loam, were investigated at that depth, representing non-corrosive or slight corrosiveness. Similarly, 80% soils at 0.8 m depths slight or non-corrosive since 67% sandy soils and 13 % are loam soils and 20% are clay soils at those depths. But, 33% of soils at 1.2 m depth clay (mildly to moderately corrosive), while 40% sandy and 27% are loam, meaning that approximately 67% of soils at this depth less or non-corrosive to buried structural materials. Thus, sandy soils were predominant overall; however, at 0.4 m depth, a higher proportion of clay (47%) and loam (13%) was observed, likely due to soil disturbance. Consequently, between 67% and 80% of soils in the 0.4–0.8 m depth range can be considered less or non-corrosive toward buried structures. No peat or muck soils were identified. Previous studies have reported that sandy soils exhibit high resistivity and are among the least corrosive, while peat soils, characterized by low resistivity, are highly corrosive (Gautam et al., 2025).

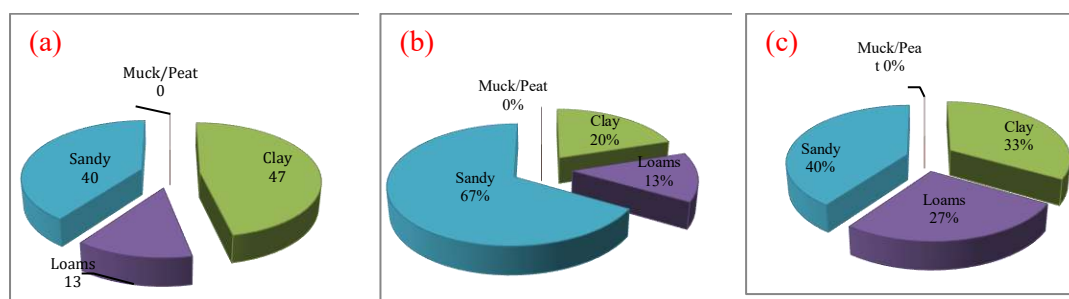


Figure 2: Pie charts illustrating the distribution of soil types collected at three depths-(a) 0.4 m, (b) 0.8 m, and (c) 1.2 m-below ground level along the Batasedanda–Tansen Buspark–Parvas roadway area of Tansen Municipality

The moisture content of the forty-five soil samples collected from the Batasedanda-Tansen Buspark- Parvas roadway areas ranged between 5.27% and 21.83%, as presented in Fig. 3. With the exception of one sample from Parvas roadway near Banbatika Hotel and Restaurant

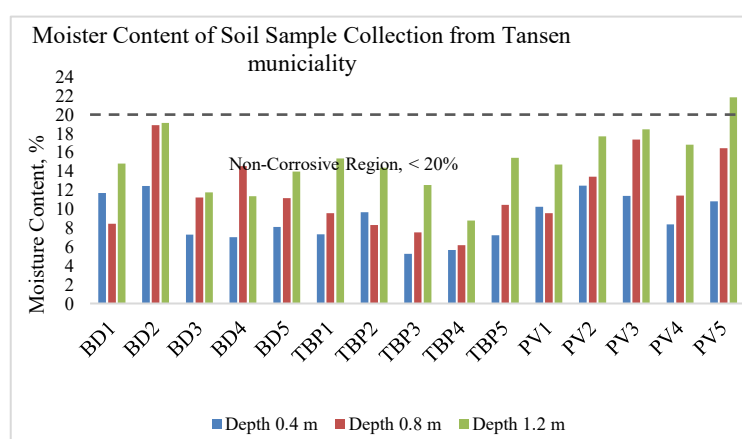


Figure 3: Moisture content in each soil samples collected from Batasedanda-Tansen Buspark- Parvas Roadways area.

(PV-5) at a depth of 1.2 m, most samples exhibited moisture content below 20%. According to established ASTM criteria, soils with 20–40% moisture content are classified as mildly corrosive, while those with less than 20% are generally regarded pburied metallic pipelines. On this basis, the majority of soils from the study area can

be categorized as less or non-corrosive.

More specifically, the moisture content was 5.27–12.48% at 0.4 m depth, 6.18–18.8% at 0.8 m depth, and 8.80–21.83% at 1.2 m depth. These findings suggest that burying metallic pipelines at depths of 0.4 m or 0.8 m is preferable, since soils at these levels typically contain less than 20% moisture. As illustrated in Fig. 3, moisture content increased progressively with depth at 11 sampling sites (BD-2, BD-3, BD-5, TBP-1, TBP-3, TBP-4, TBP-5, PV-2, PV-3, PV-4, and PV-5). This depth-dependent increase is most likely attributed to the influence of the groundwater level.

The pH values of all forty-five soil samples ranged from neutral to basic (6.91–9.46), placing them within the less corrosive to mildly corrosive range for buried galvanized steel and cast-iron pipelines, as shown in Fig. 5. Two samples: TBP-3 (near Hotel Diamond) and PV-5 (Lumbini Medical College cricket ground) at 0.4 m depth-recorded pH values above 9, classifying them as corrosive to buried metallic pipelines. Nineteen samples exhibited pH values between 6.6 and 7.5, indicating low or negligible corrosivity, while twenty-four samples had pH values in the range of 7.6–9.0, corresponding to mild to moderate corrosivity.

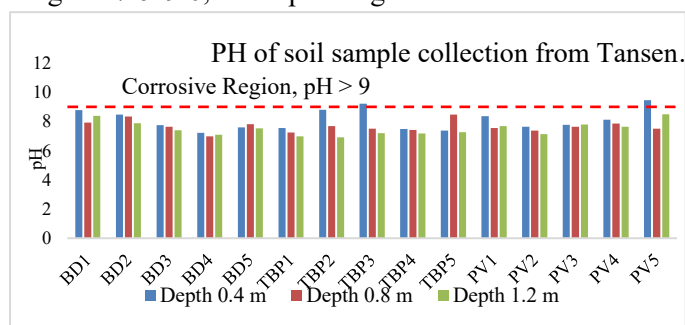


Figure 4: Soil pH in each soil samples collected from Batasedanda - Tansen Buspark - Parvas roadways area

observed, a decrease in pH with increasing depth was recorded at eight sampling sites (BD-2, BD-3, TBP-1, TBP-2, TBP-3, TBP-4, PV-2, and PV-4).

Soil resistivity is a key parameter in determining the corrosivity of buried metallic materials. As shown in Fig. 6, the resistivity of the forty-five soil samples collected from the Batasedanda–Tansen

Buspark–Parvas roadway area of Tansen Municipality ranged between 6,958.94 and 28,691.58 Ω .cm.

At 0.4 m depth, one sample from the Karagar area (TBP-4) exhibited resistivity above 20,000 Ω .cm, classifying it as essentially

non-corrosive, while the remaining fourteen samples at this depth were mildly to moderately corrosive. At 0.8 m depth, three samples—BD-1 (near TMC ground), TBP-4 (Karagar), and PV-1 (Parvas Lake)—also recorded resistivity values exceeding 20,000 Ω .cm, placing them in the non-corrosive category, while the other thirteen samples were mildly or moderately corrosive. By contrast, all fifteen samples at 1.2 m depth fell within the mildly to moderately corrosive range.

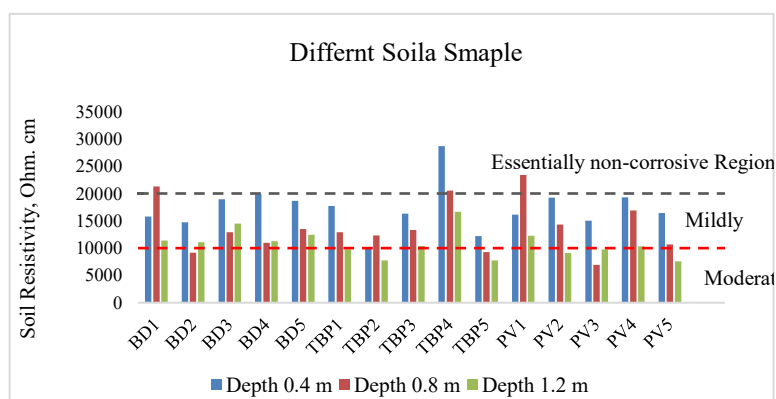


Figure 5: Resistivity of Soil in each soil samples collected from Batasedanda - Tansen Buspark - Parvas roadways area.

Overall, four samples were classified as essentially non-corrosive, thirty-one as mildly corrosive, and ten as moderately corrosive.

More specifically, resistivity values at different depths were 9,846.41–28,691.58 $\Omega\cdot\text{cm}$ at 0.4 m, 6,958.94–23,340.71 $\Omega\cdot\text{cm}$ at 0.8 m, and 7,561.67–16,666.66 $\Omega\cdot\text{cm}$ at 1.2 m. These findings suggest that metallic pipelines are better buried at depths of 0.4 m or 0.8 m rather than at 1.2 m, where soils tend to be more corrosive. No consistent correlation was observed between resistivity and sampling depth, although decreasing resistivity with depth was noted at eight sites. This indicates that soil corrosivity toward buried pipelines is not governed solely by depth, but rather by the combined influence of other factors such as moisture content and ionic composition (Gautam *et al.*, 2025).

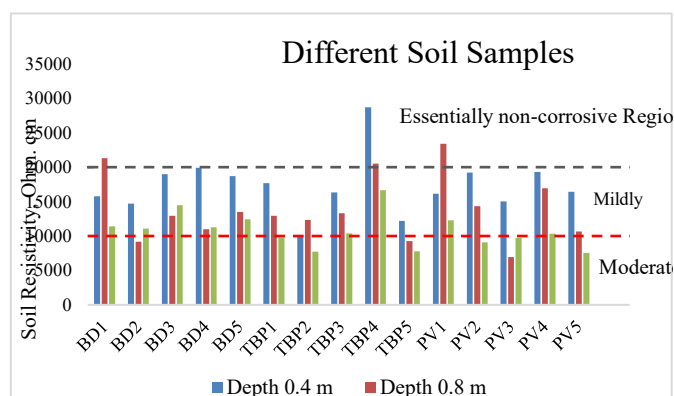


Figure 6 Chloride content in each soil samples collected from Batasedanda - Tansen Buspark – Parvas roadways area.

(PV-5 at 1.2 m) exceeded 100 ppm (104.86 ppm). Overall, these concentrations classify the soils as less to mildly corrosive for buried galvanized steel and cast-iron pipelines (Fig. 7). Depth-wise, chloride contents ranged from 28.94–57.85 ppm at 0.4 m, 32.54–65.09 ppm at 0.8 m, and 43.39–104.86 ppm at 1.2 m. Although chloride levels tended to increase with depth at several sites, no consistent relationship with burial depth was evident, suggesting that chloride distribution is influenced more by local soil or environmental conditions than by depth alone.

The sulphate content of the forty-five soil samples collected from Batasedanda–Tansen

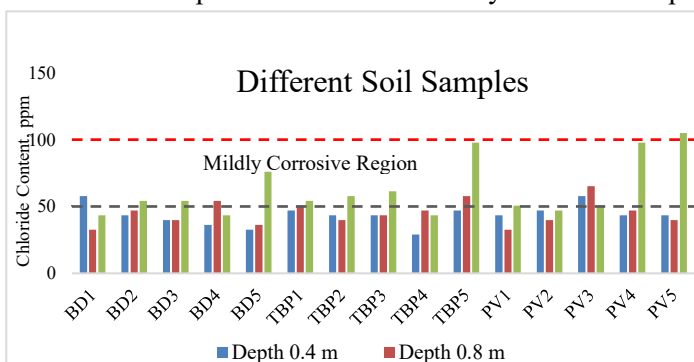


Figure 7 Sulphate ion content in each soil samples collected from Batasedanda - Tansen Buspark – Parvas roadways area.

Buspark–Parvas Roadway area ranged between 72 and 284 ppm (Fig. 8). Of these, six samples contained less than 100 ppm, thirty-three samples were within 100–200 ppm, and six samples ranged between 200–300 ppm, suggesting less to mild corrosiveness of soils to buried metals. Also, 70–137 ppm sulphate content was determined at 0.4 m depths and was found increased to 72–186 ppm at 0.8 m depths and to 147–284 ppm at 1.2 m depths, indicating decreased corrosion risks with depths of burying and suitable for installing pipelines at depths as consistently demonstrated in 12 sampling sites in Fig.8.

Conclusion

Soil samples collected from three different depths (0.4 m, 0.8 m, and 1.2 m) are mostly sandy soils that are low or negligibly corrosive towards buried metallic water supply pipelines. Moisture content was below 20% in 44 out of 45 samples (97.11%), except for one sample from Parvas Roadways near Banbatika Hotel and Restaurant (PV-5) at 1.2 m depth, suggesting minimal corrosive potential, although moisture generally increased with depth. Soil pH values of 41 samples (91.11%) fell within 6.6–8.5, indicating mildly to essentially non-corrosive conditions for galvanized-steel and cast-iron pipes. Similarly, 35 samples (77.77%) exhibited high soil resistivity ($>10,000 \Omega\cdot\text{cm}$), corresponding to mildly corrosive to non-corrosive behavior, supporting the recommendation to install metallic pipelines at 0.4–0.8 m depth, where approximately 80% of soils were mildly to essentially non-corrosive. Chloride and sulfate contents were below 100 ppm and 200 ppm, respectively, in the majority of samples (97.77% and 86.66%), further confirming that the soils were predominantly mildly corrosive to essentially non-corrosive. Overall, the site conditions indicate that buried metallic pipelines can be safely installed with minimal risk of corrosion, especially at intermediate depths.

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Conflict of Interest

No conflict of interest

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Authors' Contributions

Experiments: sample collection, data analysis etc. are designed by JK, and SS. JK performed experiments to get results according to documented methods under supervision of MG. The first draft of the manuscript was written by JK, and SS, and revised final version by MG. All authors read and approved the final manuscript.

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Research Article**Practical Measures of Benefits of Education: An Analysis of Systematic Review**

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<https://orcid.org/0000-0009-0000-3177-4365>, Email: minrajpaudel94@gmail.com**Abstract**

Education is a service that provides both economic and non-economic benefits to individuals, society, and the state. However, especially in developing countries like Nepal, the measurement of economic benefits of education is very low, while the measurement of non-economic benefits is almost non-existent. Additionally, in Nepal, there is a lack of study materials and knowledge of standardized methods. In this context, the study aims to identify, analyze, and compare practical methods and techniques used internationally to measure both economic and non-economic benefits of education. For this, research articles, books, policy reports, and PhD dissertations were reviewed based on a systematic literature review design. A total of 136 study materials were collected, and 48 materials met the selection criteria. The findings of the study reveal that many methods are available to measure the economic benefits, and those are also easy to understand and use. Methods, namely, years of experience, discounting, normality testing, mean, marginal, age-education-earnings profile, etc., can be used to measure the economic benefits of education. In addition, methods such as Cronbach's alpha, Pearson's correlation, average weighted mean value, etc., are used to measure the non-economic benefits of education. However, for measuring non-economic benefits, there is a complex measurement process, no uniform approach, and difficulty in understanding the methods. Finally, this study will provide practical avenues for researchers in the economics of education, especially in countries like Nepal, where there are limitations in the study materials and research in this area.

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Introduction

In today's world, education is essential for a person not only to perform all the tasks but also to survive. It means education yields significant benefits to the individuals, society as well as state. It is a factor that has a positive impact on all aspects of human and social development. Benefits of education can be measured in terms of both monetary and non-monetary values for private and social sectors. The monetary benefits represents the economic benefits is also called the direct benefits, and non-monetary benefits refers that way forwards which help individuals and society to make right decisions. The consumption benefits are non-monetary returns accruing from education to the individual throughout his or her lifespan (McMahon, 1995).

The individuals gain economic benefits due to participating in education (Institute for Higher Education Policy, 1998; Leslie & Brinkman, 1988). The private monetary benefits includes lifelong earnings of the individuals (Moroşan & Sava, 2010). A person gets lifelong earnings from education because education make people able through the different knowledge, skills and competence, and also increases the possibilities of getting a better salary job. In this regards, human capital theory advocates that education increases productivity of employees resulting they able to seek higher paid, more satisfying, and more secure jobs. In addition to this, education provides strong base to make progressive decisions, critical thinking and confidence (World Bank, 2026). These benefits can be measured in different ways. Firstly, people are more likely to participate in the labour market; secondly, individuals are likely to experience less unemployment and, thirdly, higher educated workers can earn, on average, higher wages than those with lower skills (European Commission, 2005). Education provides non-monetary benefits

to the individuals in the fields of career prospects, job security, job adequacy, better health, quality of life, social and cultural participation, personal well-being, life expectancy, sound marital life, and others (Heise & Meyer, 2004).

On the societal level, education provides significant benefits to the society but that are not captured by individual accounting. It provides both the monetary and non-monetary benefits to the society and are also called the direct and indirect, respectively. The direct social benefit of education refers to the monetary income of the government from the tax of the educational sector. The government taxes the education sector to collect revenue and also invests in the sector to provide education to people. In practice, the government receives the tax, and employees receive the disposable amount. The social benefit includes all types of monetary (financial) benefits made by education. It is specifically before-tax earnings, also called gross earnings, and not separated into tax and disposable earnings (Blaug, 1972). In addition, education provides the non-monetary benefits to the societies. Education reduces crime, and increases civic involvement (University of the People, 2021). It helps alleviating poverty and enhancing social justice by creating unlimited opportunities for social mobility. In addition, it plays an important role in establishing higher standards of health and sanitation while decreasing infant and maternal mortality rates, makes a difference in creating social cohesion, tolerance and civic responsibility by creating awareness of the democratic process, assuring free and fair elections and enhancing trust among members of society, plays an instrumental role in preventing crime and social disintegration, and helps in maintaining cultural values and traditions while encouraging innovations and social progress (UNESCO, 2026)

Education directly contributes in the economic growth of a state. If enrollment in education is increased by one percent resulting gross domestic product increases by one to three percent. In addition, if level of education is increased by one year causing per-capita output increases by three to six percent (Guo et al., 2019). On average, one additional year of schooling increases life expectancy at birth by 8.3 years, and each increased year of life expectancy increases lifetime earnings by 1.7 percent (Hoque et al., 2020).

It is clear from the evidence that education plays a significant role in the socio-economic development of individuals, societies, and the nation as a whole. But a question arises as to how to measure the benefits of education. To my knowledge, there is a lack of adequate reading materials, especially in libraries in Nepal. This means that textbooks, research-based articles, reports, worksheets, and other learning materials are not adequately available to new students in Nepal. On the one hand, there is a lack of materials, and on the other, numerous methods and techniques are required to measure the benefits of education. Additionally, no study has been conducted on measuring both the direct and indirect benefits of education in Nepal to date. This lack indicates the need to fill the gap in the method of measuring the benefits of education. Various scholars outside Nepal have estimated both direct and indirect benefits of education, but there is no uniformity in the application of methods and techniques for estimating them. In this context, the aim of the study is to collect several methods and techniques, and to analyze and compare those that are practically appropriate in developing countries like Nepal

Method and Materials

This study applies a systematic literature review design. This design allows for the collection, analysis and comparison of different methods, techniques and approaches used to measure educational benefits (Creswell & Creswell, 2018). The data required for this study taken from secondary sources, including academic articles, books, policy reports, research-based reports, institutional publications, and PhD dissertations. The data was collected systematic. The primary purpose of the systematic data collection is to gather, organize and disseminate the facts (Gothberg, 1990; Singh, 1998).

The literature review process was conducted in several stages. First, databases and e-libraries such as HINARY, JSTOR, ProQuest, Academia, NDLI, ResearchGate, ELSEVIER, Google Scholar, the World Bank Library, and search engines were accessed. Five key search terms were used in the search process. These terms are benefits of education, estimating the benefits of education, age-education-earnings profile, education-earnings function, and methods and techniques for measuring the benefits of education. The following settings were applied after clicking on the advanced search option of each database. I can access was chosen in the access type; articles, books, policy reports, research-based reports, institutional publications, and PhD dissertations were ticked in the object or educational material option; the subject area was economics of education; and the relevance was ticked in the sort by option. No restrictions were imposed on date and time. This is because all materials (old and new) were equally important for the study. Based on these selection criteria, 137 materials were collected. However, only 48 were included because they entirely fulfilled the selection criteria of the study. The collected data are presented in the equations and analyzed based on evidences and logics.

Results

Benefits of education refer to returns to education, and some benefits can be measured in terms of money, and some cannot. Benefits of education are grouped in direct and indirect, and further classified into private and social. In this study, 48 publications have been reviewed, and among them, there are 22 reference books, 17 research articles, 7 research reports, and 2 PhD dissertations. The results of study are presented under the sub-headings as follow.

Direct Benefits of Education

The direct benefits of education is classified in direct private and direct social benefits. The direct private benefits refers to the employees' monetary (financial) benefits from education. It indicates the job-related earnings such as salary, allowances, and others. It accurately represents the disposable income of employees which is measured by after-tax earnings. Income tax rate is used to estimate employees' disposable income that is set by the government (McMahon, 2004).

The direct social benefit of education refers to the monetary income of the government from the tax of the educational sector. It includes all types of monetary (financial) benefits made by education. The government taxes the education sector to collect revenue and also invests in the sector to provide education to the people. In practice, the government receives the tax, and employees receive the disposable amount. It is specifically before-tax earnings, also called gross earnings, and not separated into tax and disposable earnings. Education prepares well educated people, and they earn more than other and pay high tax than other (Galindo-Rueda & Vignoles, 2005; Holland et al., 2013; McMahon, 2009; O'dubhslainé, 2006). The sum amount of both the tax amount and the disposable amount is direct social benefits.

Computing Methods and Techniques

The direct private and social benefits can be analyzed through unadjusted and adjusted form. The unadjusted data represents all monetary earnings, assuming that education is the sole factor influencing employee earnings. However, in reality, education is not the only determinant of earnings. Other factors, such as socio-economic, educational, and job-related factors, also affect employees' annual earnings. Therefore, the adjusted data reflects only the portion of earnings attributable to education. Both unadjusted and adjusted data are further classified into social and private benefits. Before estimating annual direct benefits of education, it should be assumed that employees' total earnings are related to their jobs, and their jobs are related to their educational degrees. Therefore, it is an axiomatic fact that employees' earnings are related to their educational degrees. Due to this assumption profits, rents, interests, surplus value, lottery wining income, donation, property-sell income, and others are not considered in the calculation of earnings (Paudel, 2022).

Year of Experience Method. Graduates receive their earnings continuously from the time they join the job till retirement. But graduates' job joining times depend on the level of education. Upper-level graduates enter the job market later than lower-level graduates. Graduates' working duration directly affects the gross earnings figure. The nature, type, and other factors of the job determine employees' working duration. Therefore, before collecting and estimating earnings data, graduates' year of working experience should be fixed based on the government rules. The potential year of working experience is calculated by an equation (Tangtipongkul, 2015), which is presented in Equation 1.

$$\text{Years of Working Experience} = \text{Age reported at the time of survey} - \text{Years of schooling} \quad (1)$$

Discounting Method. The present value of earnings is the present discounted value of expected future earnings. It is generally calculated annually, but for some purposes, the annual yardstick is insufficient, such as weighing the net financial effect of colleges, estimating the economic damages in a wrongful death, quantifying the value of human capital, etc. (Trostel, 2014). Graduates receive their earnings in the future. For example, if bachelor-level graduates enter the job market at age 23, they receive earnings until retirement. The monetary value of future earnings reduces due to inflation. Therefore, graduates' earnings, collected using a snapshot technique by age, should be discounted to their current value. The private and social present value (PV) of earnings is calculated (Psacharopoulos & Woodhall, 1995) using Equation 2.

$$PV = \sum_{t=0}^n \frac{(Y_{LE})_t}{(1+r)^t} \quad (2)$$

Where, Y_{LE} represents the graduates' earnings from certain level of education. Likewise, r represents the discount rate, and $t-n$ represents the discounting time duration. The analysis process for benefits of education starts after computing present value of graduates' earnings. It means other methods and techniques can be used to analyze the benefits of education after converting the monetary value of the future earnings into present (Gilbert, 2011). The present value of future earnings reflects the worth of graduates' earnings. The discount rate is a key component that indicates the risk of graduates' earnings. In addition, it affects the final valuation of graduates' earnings. The liquidation value method, multiple approaches, stable growth techniques, etc., are used to measure the present value (Heyes, 2026).

Normality Test Method: A normal distribution of earnings data describes a statistical pattern that indicates that earnings are symmetrically distributed around a mean value. It's important to verify the normal distribution of income data because if the assumption of a normal distribution is violated, statistical results may be inaccurate or misleading (Creswell & Creswell, 2018). Researchers can use different methods to assess normality. Broadly these are visual methods and statistical methods. Histogram, quantile-quantile plot, and boxplot are visual methods. They help researchers to detect skewness and outliers. Skewness, Kurtosis, Shapiro-Wilk test, Kolmogorov-Smirnov test, etc. are statistical methods. They help researcher to know how earnings data are far from the mean value, and which group's earnings affect in normal distribution. For this, EXCEL, SPSS, STRATA, etc. software are used.

Average Method. The average method is one which provides the current scenario of monetary returns from education. This is also called the per-unit method. This can be used to know the per-employee annual earnings based on the level of education, type of education, sex, type of employment, nature of employment, security of employment, location of employment, and etc. Average earnings (AE) is obtained through the total earnings divided by unit of output (Asep et al., 2016; Bialek-Jaworska, 2015). Traditionally, it is computed simply by adding up the total annual earnings, and dividing by the number of employees (Bowen, 1981). Psacharopoulos and Woodhall (1995) have suggested the different methods to calculate of average earnings. These methods are presented in Equations 3.

$$AE = \frac{TE}{N} \quad (3)$$

Where, TE is the total annual earnings due to education, and N is the number of employees. In addition, geometric mean method, log earnings methods, and harmonic mean method can be used to estimate the average annual earnings. The mean earnings can be compared by T-test for two groups and by ANOVA for more than two groups. The direct social benefits of education are calculated before the tax amount of an individual by age earning profiles (Moroşan & Sava, 2010). These can be obtained as:

$$\text{Private Benefits (Direct)} = \text{Total Life-time Earnings of Educated Workers} - \text{Income Tax} \quad (3.1)$$

$$\text{Social Benefits (Direct)} = \text{Total Life-time Earnings of Educated Workers before Tax} \quad (4)$$

Marginal Method. Benefits of education can be obtained by the differences between average earnings of higher level of education and lower level of education, earned over their average life expectancy (Moroşan & Sava, 2010). It is estimated by computing the differences in between upper level graduates' earnings and lower level graduates' earnings (OECD, 2021). The direct private benefit (DPB) and direct social benefit (DSB) can be estimated using given equations (Moroşan & Sava, 2010) that are presented in Equation 5 and Equation 6, respectively.

$$DPB = \text{Upper Level Earnings} - \text{Lower Level Earnings} - \text{Income Tax} \quad (5)$$

$$DSB = \text{Total Life-time Earnings of Educated Workers Before Tax} \quad (6)$$

Age-education-earnings Profile Method. The age-education-earnings profile shows the age-wise earnings differential of graduates by education levels. Similarly, the profile measures how much monetary earnings people make throughout their lives because of their education. The profile has analyzed the average lifetime earnings of educated employees (Moromoke, 2025). Similarly, the profile also indicates the earnings differential, which explains how much graduates from upper levels of education earn compared to graduates from lower levels of education. Therefore, the profile has clearly explained the advantages of getting a certain level of education compared to its lower levels. The before-tax age-education-earnings profiles provide the social rate of return, and the after-tax age-education-earnings profiles provide the private rate of return, and these both have been constructed for levels of education, sex, sector of employment, job security, service sector of employment, and types of education. This profile can be prepared for both time-series and cross-section data. If there is lack of time-series data, only cross-section data has been utilized to construct the profile (Alcantar, 2006). It helps to estimate the lifetime average and marginal earnings of the graduates.

Indirect Benefits of Education

The indirect benefits of education includes the indirect private and indirect social benefits. The indirect private benefits are the non-monetary benefits like career prospects, job security, job adequacy etc. and likewise, also provides the non-material benefits like good health, quality of life, social and cultural participation, personal well-being, life expectancy, better marital life, honorary activity, etc. (Heise & Meyer, 2004). It is accrued by individuals that are not directly related to monetary benefit like consumption and quality of life benefits (Hansen & Weisbrod, 1969; Williams & Swail, 2005). Such benefits are difficult to quantify, but no less important to understanding the benefits of higher education (Hansen & Weisbrod, 1969). Similarly, better educated individuals with higher skills and productivity can get better jobs and engage in better occupations, which reduces unemployment, enhances their healthy lives and helps in better education of their children (Becker, 1975), (Herndon, 2008; Lochner & Moretti, 2004).

Computing Methods and Techniques

The economist Becker (1993) has estimated that externalities could lead to the original benefits. Other some studies have also succeeded in identifying externalities, however few have been able to quantify them. An early attempt in USA by B.A. Weisbrod in 1964, Haveman and

Wolfe in 1984 had included external benefits such as crime reduction, social cohesion, technological innovations, and intergenerational benefits (Psacharopoulos & Woodhall, 1995). An analysis for the World Bank of the relationship between education and fertility by S.H. Cochrane in 1964 and 1986 has used the fertility of female as the externality of education (Cochrane, 1986). Likewise, Chapman and Lounkaew (2015) have measured the value of externalities from higher education using the higher tax payment and technological progress as externalities of education. Similarly, McMahon has also measured the value of externalities from the higher education including several items like contributions to democracy, human rights, political stability, less crime, less poverty, environmental benefits, and use and adaptation of technology. They set the stage for each new round of development within nations (McMahon, 2004, 2009, 2010, 2017). The indirect private and social benefits can be analyzed on the basis of Equation 7 and Equation 8.

$$\begin{aligned} \text{Indirect Private Benefits} = & \text{Social Status} + \text{National Character} + \text{Personality} + \\ & \text{Satisfaction} + \text{Family Related Benefits} + \\ & \text{Employment Related Benefits, and etc} \end{aligned} \quad (7)$$

$$\begin{aligned} \text{Indirect Social Benefits} = & \text{Utilization of Voting Rights} + \text{Reduction in Theft} + \\ & \text{Given Knowledge to the Society, and etc} \end{aligned} \quad (8)$$

Cronbach's Alpha. The Cronbach's alpha is a technique that assesses the internal consistency reliability of a measurement instrument, a set of items, or a questionnaire's statements. It improves the quality of research data, establishes the credibility and validity of findings, and justifies combining multiple items into one variable. It is useful to measure the indirect benefits of education (Adeniran, 2025). These benefits of education are expressed in qualitative form. A set of items or a questionnaire having several positive statements is prepared in a Likert-scale or open-ended form. A certain number is given to these statements, such as 5 to 1 for positive statements and 1 to 5 for negative statements. The Cronbach's alpha technique is used to check the reliability of these positive items. But this technique does not tell the researcher whether a set of items is measuring the right concept or validity. Its value ranges from 0 to 1. Its value is generally accepted, $\alpha \geq 0.6$ (Taherdoost, 2016).

Pearson's Correlation. The Pearson correlation coefficient is a statistical method. It is employed to accurately measure the linear correlation between two variables (Schober et al., 2018). In addition, it measure of the strength of a linear relationship between paired data (Ikhwan et al., 2024). The Pearson correlation is used in quantitative research, especially in the analysis of benefits of education. It measures the relationship between level of education and graduates' earnings, and relationship between work experience and earnings growth. Additionally, it supports prediction and further analysis, and simplifies interpretation of data. This method has some assumptions like variables are continuous scale, relationship is linear, data are normally distributed, and there are no major outliers. Its value ranges from -1 to +1. Its value is generally accepted, $r > 0.3$ (Taherdoost, 2016). Construct validity examines whether the instrument measures the theoretical construct it is intended to measure. The Pearson's correlation ensures that the items within a questionnaire are measuring the intended constructs, such as the indirect benefits of higher education. Likewise, convergent validity ensures that items intended to measure the same construct are highly correlated.

Average Weighted Mean Value. The average weighted mean value (AWMV) helps to the researcher for meaning making of indirect benefits of education. If a set of items has five positive statement, number is given 5 to 1. For example, one statement is 'higher education improves employment opportunities', and its response options are strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1). Now, AWMV for this statement is estimated (Leon-Mantero et al., 2020) by Equation 9.

$$AWMV = \frac{\sum(f \times w)}{N} \quad (9)$$

Where, f indicates frequency/number of respondents for each option, w refers the weight assigned to each option, and N represents the total number of respondents. Suppose, AWMV is found 3.8, which is greater than neutral value 3, it suggests respondents generally agree with the statement. In the case of multiple statements, researcher should calculate average weighted mean value for each item, and then compute an overall average mean across items (Clason & Dormody, 1994). It is presented in Equation 10.

$$AWMV = \frac{\sum (AWMV1 + AWMV2 + \dots + AWMVn)}{N} \quad (10)$$

Where, AWMV1, 2, ... n represent the average weighted mean value of respective statements, and N includes the total number of statements.

Conclusion

The article concludes that education provides significant direct or monetary and indirect or non-monetary benefits to individuals, society, and the state. There are many methods to measure these benefits, and the measurement process is also complex. Likewise, different methods and techniques are used to measure the direct and indirect benefits of education. The study systematically identifies, analyzes, and compares practical methods and techniques used internationally to measure both types of educational benefits. The years of experience method, discount method, normality test method, average method, marginal method, age-education-earnings profile method, etc., are widely used to measure the direct benefits of education. The years of experience method standardizes the working period to make a fair comparison of earnings between levels of education. The discount method converts future earnings into present value, accounting for inflation and risk. It means that it determines the future monetary value of earnings of human capital in present value. The normality test method helps to prevent spurious results, verifies whether the earning data is symmetrically distributed or not, and ensures statistical accuracy. The average method plays a significant role in both obtaining the current situation and calculating per-graduate annual earnings. The marginal method isolates the returns to an additional level of education and answers the question of whether to invest in further education. The age-education-earnings profile helps to visually present lifetime earnings differences and calculate the average annual lifetime earnings.

Similarly, Cronbach's alpha, Pearson's correlation, average weighted mean value, and others are used to measure the indirect benefits of education. Cronbach's alpha method ensures the reliability of qualitative survey instruments. As a result, the research results become universally acceptable. Pearson's correlation method measures the strength of the relationship between education and earnings and between variables that affect graduates' earnings. The average weighted mean value quantifies the subjective responses related to respondents' satisfaction.

Finally, especially in developing countries like Nepal, where there is little research on measuring the benefits of education and also a lack of study materials, the analysis of these methods provides a way for researchers of the economics of education to measure both the direct (monetary) and indirect (non-monetary) benefits of education.

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Conflict of Interest

Except for producing an academically and knowledgeably written paper with a rigorous review and analysis of the available data, no one has any interest in the paper.

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Research Article

Revisiting the Aim of Education in the 21st Century: A philosophical Inquiry

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Abstract

Educational Philosophy, since ancient time, has seriously showed its concern about the aim of education. But with the advent of new technologies, the emergence of globalisation, spread of ecological crises and the socioeconomic inequalities and disparities have questioned the traditional aim of education, and thereby have necessitated a fundamental reconsideration of the purpose of education. Unlike traditional educational philosophy that emphasised the transmission of knowledge, socialisation, and personal development, the recent scholarship in education has stressed the broader objectives — sustainability, global citizenship, ethical responsibilities, lifelong learning, ecological awareness and safer future — of education. The article is a conceptual and philosophical essay that critically analyses the ideas and opinions of the influential philosophers and compare them with the contemporary philosophers' arguments. This article contends that the aim and objective of education must significantly shift to architect humans imbued with compassion and empathy, and capacitate them for addressing global challenges and contributing to a sustainable future and a better world. It is high time to reassess and review the aim of education in the 21st century that addresses human rights, global citizenship, sustainable development, human health, climate concern, war, terrorism and other challenges

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Introduction

Education has always been a powerful means of shaping and sharpening human knowledge and nature. It is an agency of societal change, molding the minds of rising generation. Notwithstanding, the aim and objective has changed significantly with the change in scholarship, and therefore, the pedagogical approaches of teaching and learning models have markedly advanced gradually over time. Classical philosophers like Plato and Aristotle defined education as a process of cultivating knowledge, virtue and social accountability. Education, for them, was a foundation for a just society. Modern thinkers like Jean- Jacques Rousseau and John Dewey gave much emphasis to individual development and democratic participation. According to Rousseau, education should prepare one to live a complete life.

Although these great educators and thinkers, and their contributions have stood the test of time, the 21st century seeks a shift in education to prepare students for the new challenges. In the contemporary world greatly influenced by globalisation, environmental crises, digital technology, socio-economic disparity, geopolitical tensions, and spiritual crisis, the aim of education covers beyond simply transmission of knowledge for employment and intellectual satisfaction. The pressing need of 21st century education is to prepare students to cope with global challenges like environmental crisis, terrorism, and war on the one hand and foster in them quality to be a responsible citizen with ethical decision-making capacity. Therefore, revisiting the aim and objective of education by embracing change and adopting suitable educational policies and process has become imperative for the stakeholders and philosophers of education.

Literature Review

Philosophical discourse on the aim and objective of education is not a recent phenomenon. Rather it dates back to ancient civilisation both in West and East. In ancient Greek, Plato was the most influential thinker who viewed education as a tool to promote rational knowledge and moral virtue imperative for a just society. According to Plato, as Barrow writes, the goal of education is "to produce adults who may successfully contribute to the happiness of the whole community, which themselves enjoying happiness within that community" (1975, p. 1). Berberabe (2021) also writes that the goal of education, as Plato etched in his famous book *The Republic* is "to drag every man as far out of the cave as possible. The aim is not putting information, experience, insight into the soul but at turning the soul toward right desires" (p. 25). In other words, the aim of education, for Plato, was to produce enlightened citizens capable enough to rule the country wisely. Expanding Plato's notion of education, Aristotle emphasised the cultivation of intellectual and moral righteousness through training and grounding. Aristotle pointed out at four basic practical purposes of education as "(1) reading and writing, (2) physical training, (3) music, and (4) drawing" (Turan, 2011, p. 34). In similar fashion, Baykent (2016) also outlines Aristotle's view on education. He notes that:

Aristotle's view of education emphasizes moralism rather than pragmatism, uniformity rather than pluralism, statism rather than individualism. The end of education is to encourage men perfected by moral values. The education aims at bringing up uniform citizens equipped with the values of good and happiness. The good for a man will bring about the good for the state. (p. 98)

In a model shift in education, there emerged modern thoughts demanding to debate, decide and introduce new dimensions to the aim of education. To begin with, Jean- Jacques Rousseau (1712-1778), a Genevan philosopher, revolutionised educational philosophy by introducing a more child-centred concept of education. He was against the education that imposed ideals and morals. In his famous book *Emile, or On Education* (1979), Rousseau wrote that "The Child has his own ways of seeing, thinking and experiencing. We should not impose our own methods on him. It will be a folly" (p.75). Summarising Rousseau's notion of education, Hung (2025) writes that:

Education is not merely the transmission of knowledge but the process of forming a holistic human being ... Rousseau argued that society corrupts the primitive human being, the "noble savage", and that education must restore that innocence by allowing children to learn through experience, exploration, and interaction with nature. (p. 2)

Clarifying further, Sel and Aveke (2025) state that:

Central to Rousseau's approach is the belief that a child's education must align with nature—meaning it should adapt to the child's needs, capacities, abilities, interests, and perspective at each stage of growth. This harmonious relationship does not emerge spontaneously; children require thoughtful adult care to thrive. For Rousseau, the primary goal of education is to nurture a child's inner abilities and competencies, allowing this development to unfold naturally. In *Émile*, he stresses that education should minimize the constraints of civilization, drawing people as close to nature as possible. (p. 95)

For John Dewey, the core aim of education is continuous growth through meaningful experiences that prepare individuals for active participation in a democratic society. Citing John Dewey, Noh et al., (2023) define education as:

the process of forming fundamental dispositions, intellectual and emotional towards nature and fellow men or in other words the basic process of creating a natural, intellectual, emotional reaction towards nature and mankind. He also further emphasises that education is the way of using knowledge to help mankind to acquire more knowledge which will ultimately lead to a more harmonious, productive, meaningful and elevated existence in the end. (pp. 1215-1216)

Dewey's philosophy of education is based on the idea that learning should be relevant to students' lives and experiences and students should be actively engaged in the learning process. Hanh (2024) remarks that "*Dewey's work Democracy and Education is considered a "summary of educational philosophy."* In it, he affirmed the philosophy of considering education as life itself, clarifying that education's nature, function, and goal are human development and contributing to a democratic society" (p. 2).

Along with the Western thinkers, Indian educationists like Rabindranath Tagore, M.K. Gandhi, Vivekanand and others have also contributed in the field of education, and their guiding principles have a lasting impact on modern day education. In his famous book *Creative Unity*, Tagore talked of the aim of education. According to him, the prime objective of education should be physical and intellectual development. He believes that education "should be a way to gain freedom and to fully develop youth potential" (Sun, 2017, p. 14). Accordingly, Gandhi believed that education should necessarily create the quality of self-dependence in man, supplying vocational efficiency. He held wide view on education and regarded it also as a means of self-realisation. Citing Gandhi, Varkey writes that "true education should contemplate the whole of human existence" (2011, p. 77). Confucius viewed education not merely as a means of acquiring knowledge but as a moral process aimed at cultivating virtue, wisdom, and social responsibility. He emphasized self-cultivation, ethical conduct, and lifelong learning, asserting that education should develop the character of the learner rather than focus solely on intellectual achievement. Muyunda and Yue (2022) write that "Confucius placed a substantial value on moral education. His education's main goal was to cultivate highly qualified and virtuous people. Confucius taught his students to pursue "truth" and "moral integrity" throughout their lives" (p.251). His educational philosophy places excessive emphasis on obedience, respect for authority, and adherence to tradition, which may discourage critical inquiry and individual creativity.

Viewed in the light of literature reviewed, it can be claimed that the guiding principles and philosophy of the great philosophers remain insufficient in isolation at present. Therefore, these classical and modern educational ideals need to be reviewed and reinterpreted critically to address the current global challenges like globalization, mass migration, terrorism, technological advancement, artificial intelligence, environmental crises, and cultural and religious conflicts. Therefore, this paper attempts to revisit, critically review, and philosophically evaluate the aims of education in the twenty-first century by synthesizing enduring educational principles with present-day realities and needs.

Objective of the Study

The primary objectives of this study are:

- *To investigate and scrutinise the traditional aims of education.*
- *To evaluate the changing socio-cultural context of the 21st century.*
- *To scan emerging educational aims in response to contemporary challenges.*
- *To recommend comprehensive philosophical framework for education in the 21st century.*

Method and Materials

This paper is a conceptual essay that surveys and analyses the thoughts and theories of dominant global thinkers of education. It chiefly relies on comparing and contrasting traditional and modern educational aims suggested by thinkers. No empirical data were collected and analysed for the paper.

Results

The analysis reveals several significant shifts in the aims of education:

- From Knowledge Transmission to Knowledge Construction: Education is increasingly seen as an interactive process where learners actively construct knowledge rather than passively receive it.
- From Vocational Training to Lifelong Learning: The focus has expanded from preparing individuals for specific jobs to equipping them with skills for continuous learning and adaptation.
- From Individual Success to Social Responsibility: There is a growing emphasis on fostering ethical values, empathy, and social justice.
- From Anthropocentrism to Ecological Awareness: Education now aims to develop environmental consciousness and sustainable practices.
- From Standardization to Personalization: Learner-centered approaches prioritize individual differences, interests, and potentials.

Discussion

Critique of Instrumental Function of Education

The instrumental function of education refers to the idea that education serves as an instrument to achieve specific goals in life and society, rather than being an end in itself. This sort of education targets at acquiring skills, knowledge, and abilities that can be used to accomplish practical purposes such as employment, social mobility, national development, and produce human capital. While this trend has significantly contributed to economic development, it has reduced education to a purely bread and butter aim of education. This function of education is widely criticised for being too narrow and materialistic. Referencing Martaha Nussbaum, Ruth O'Brien (2010) writes that:

Nussbaum undercuts the idea that education is primarily a tool of economic growth. She argues that economic growth does not invariably generate better quality of life. Neglect and scorn for the arts and humanities puts the quality of all our lives, and the health of our democracies, at risk. (p. xi)

Nussbaum remarks imply that much emphasis on economic growth sabotages the comprehensive humanistic aim of education and ignores holistic development. It thwarts the physical, mental, social, emotional, intellectual, and spiritual aspects of human life. Gert Biesta (2016) also believes that "educational processes and practices generally work in three different areas and thus can be said to serve three different kinds of purposes. I refer to these as qualification, socialization and subjectification" (p.5). This statement also asserts that education in its true sense must go beyond a tool to livelihood and it must foster moral and ethical values, democratic sensibilities, and social accountability. The Universal Declaration of Human Rights, 1948 also affirms that "Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms. It shall promote understanding, tolerance and friendship among all nations, racial or religious groups" (qtd. in Nussbaum, 2010, p. 14). In essence, education is not only the means of livelihood security and achieving academic milestone. Rather, it is about nurturing, inculcating, and empowering human beings to lead enriching lives, contribute altruistically to society, and adapt to the fast-changing world. Education must prepare individuals for a more resilient future.

Global Paradigm Shift and Call for Revisiting Educational Aims

The twenty-first century is marked by fast-paced and unprecedented changes, challenges, and opportunities in all walks of life. Groundbreaking innovation in technologies, exponential growth in the application of AI, and the digitalisation of knowledge have ushered a transformative shift in learning and sharing knowledge. Educational researchers assert that digital technologies and AI are reshaping learning environments, promoting personalised learning and interactive engagement with knowledge (Laak et al., 2024). Similarly, planetary concerns like

pandemic, climate change, systematic inequality, religious fundamentalism, and political polarisation seek to encourage learners to inquire, innovate, and invest knowledge in the real-world-context, fostering adaptability and sustainability. Therefore, the pressing need of time at present is to revisit and rethink of educational aim that urgently addresses the above raised issues. International organisations like UNESCO report that "The changes in the world today are characterized by new levels of complexity and contradiction. These changes generate tensions for which education is expected to prepare individuals and communities by giving them the capability to adapt and to respond" (2015, p. 9). Education, in the present-day situation, must find ways to resolve challenges and threats like exclusion and violence against women and children, terrorism, regionalism, religious intolerance, environmental crisis, vulnerability, and other immediate threats by taking into account divers world views and alternative solutions.

In order to embark and revisit educational aim in the 21st century, one of the most important aspects is to cultivate and reaffirm the humanistic approach of education. It means that education is not solely an academic pursuit to satisfy intellectual needs; rather it must enhance and foster human dignity, ethical responsibility, individual's capabilities, critical and critical thinking, and human values. Education must act as a stabilising force to address the present-day global crisis. Citing Saveikaite, Kleindienst (2024) writes that "Education transcends the mere acquisition of information. It serves as a pathway for students to unearth their self-identity, assimilate core values, cultivate personal accountability, and comprehend their unique disposition and identity" (p.5). Education must be aimed at nurturing moral and ethical consciousness in the students. They should be trained to develop the ability to critically analyse social structure, question all sorts of injustices, and contribute in forming and fostering all-inclusive and harmonious societies. By nurturing a sense of responsibility and civic engagement, education on human dignity encourages individuals to add to the well-being of their communities and work towards a more peaceful world (Khan et al. 2019). This aim of education well aligns with modern day's need of education as a global common good that thrives on the principle of Datta (Give), Dayadhvam (Sympathise), and Damyata (Control) derived from the *Brihadaranyaka Upanishad*. Summing up, in a world characterised by cultural diversity, intercultural cross flows, and global interconnectedness, one of the aims of education must be to foster generosity, compassion, and self-restraint.

Global citizenship and sustainability are interconnected frameworks empowering individuals to act as responsible stewards of the planet, aiming for a peaceful, just, and sustainable world. Therefore, another vital aim of education in this era is to promote and endorse global citizenship and sustainability. It is argued and asserted that the aim of education is also to train students to cope with the problems like climate change, migration, terrorism, economic disparities and poverty, and religious intolerance. Since local activities often have global impacts, it becomes imperative for us to act wisely and ethically to save the planet, and not just one nation or some specific part of the globe. Emphasising the need of education for sustainability and global citizenship, Subramaniam et al. (2025) assert that:

In a world where there are greater interconnection and interdependence, the capacity to handle challenges globally and make productive contributions to society is no longer a national concern. Global citizenship education (GCE) has become an important means of promoting empathy, cross-cultural competencies, critical thinking, and social responsibility in learners. Integrating elements of Global Citizenship Education in core subjects able to create a responsible global citizen. As global problems become increasingly noteworthy, including the climate crisis, social and economic disparities, and political division, the need and applicability of the use of GCE in the education system are more essential and urgent than ever. The main conclusion focuses on the necessity of education systems to inculcate a universal sense of identity along with the consideration of cultural diversity, with perspectives where the curriculum should help to enhance the knowledge of global issues and universal values as stated in the 2021 UNESCO report. (pp. 47-48)

To inculcate values and attitudes in learners to contribute in creating a sustainable and peaceful world should be the rallying cry of the 21st century education.

Modern education must integrate digital tools and application of digital technologies, for these technologies have shown powerful impact on education system and have significantly altered the nature and transmission of knowledge and scholarship. Accordingly, the aim of education in the present-day world is also to cultivate, promote and refine the application of digital literacy. Highlighting the need of technology in education, Haleem et al. (2022) suggest that:

Digital technologies assist in developing abilities that will require students' professional performance, such as problem-solving, thinking structure creation, and process comprehension. They are also preparing for a more unpredictable and changing future in which technology will play a critical role. Students' acquired qualities and abilities will be essential to their professional success. Educational resources and digital tools help to improve the classroom atmosphere and make the teaching-learning process more compelling. (p. 276)

Use of digital platforms, application of AI, and integration of technological developments help learners to enhance and update their skills in accordance with evolving social and technological conditions. In this context, Naharia, et al. (2024) believe that:

Digital technology plays a crucial role in enhancing learners' creativity and innovation skills today. Through the utilization of digital technology, learners can hone their creative thinking skills, improve their problem-solving skills, and expand their adaptability. There are several effective strategies in integrating digital technology into the learning process to enhance learners' creativity and innovation skills. These include creating a learning environment that supports the use of digital technology, providing training to educators regarding the utilization of such technology, and developing digital technology-based learning resources. Thus, digital technology is not just a tool, but also the main catalyst in developing learners' creative and innovative potential in the 21st century era. (p. 9652)

Digital technology unfolds and unveils great opportunities to improve education and to help learners to cope with changing scenario of meaning and application of their skills.

Finally, yet importantly, one of the most important aims of education in the 21st century is to foster holistic development of human beings. Holistic development is an integrated approach focusing on the comprehensive growth of an individual—physically, mentally, emotionally, socially, and spiritually—bridging mind, body, and spirit rather than focusing solely on cognitive or economic metrics. Chasing financial dreams and indoctrination of capitalist thought have transformed human into mere machines. Education should be to teach them the values of shared responsibility, interdependence, mutual respect and the need of compassion in a world that has been converted into a waste land. Talking about the gap between what education is and what it should be, Kachamba et al. (2025) remark:

Education in the twenty-first century stands at a pivotal crossroads—between the unprecedented expansion of knowledge and technology on one hand, and the erosion of moral, spiritual, and communal values on the other. While advancements in science, information technology, and the fragility of moral consciousness and ethical accountability in modern society. (p. 4098)

The aim of education, therefore, is not only to produce competent and capable citizens, but also to awaken them morally to be human being charged with compassion and global responsibility. Regarding the aim of education in the 21st century, he further states:

In an era defined by rapid globalization, technological innovation, and deepening ethical crises, education faces the urgent challenge of redefining its purpose beyond mere technical proficiency. The growing moral vacuum in professional, political, and economic leadership underscores the need for a more holistic approach to human formation—one that integrates intellect, ethics, spirituality, and social responsibility. (p. 4098)

The statement clearly indicates that education is meant to mould learners to grow intellectually, morally, emotionally, and socially. The most important objective of education today is to prepare learners to live life with human dignity and intellectual emancipation.

In this fast evolving and rapidly changing world, the aim and objective of education needs reexamination and revamping for maintaining a balance between knowledge and societal shift. Education must align with the pace of development and challenges of this temperamental world. Experts and stakeholders contend that education at the present time must vie with the demands of the time. Kuhl et al. (2019) maintains thus:

... education needs to be transformed in order to meet the demands of rapidly changing technologies, new skill demands in the workplace, and to foster equity, social cohesion and global citizenship. Implicit in these demands and expectations is the aim to realise every individual's potential. Twenty-first century education requires teachers, environments, technologies, educational content and pedagogical practices that can help learners attain that goal. (p.3)

Conclusion

Revisiting and revamping the aim of education in the 21st century confirms that education needs extensive and all-inclusive philosophical realignment and reorientation. Contemporary global issues call for education that shifts its objective from mere knowledge transmission and socialisation to identify and deal with complex global challenges. By fostering critical and creative thinking, education must prepare a man equipped with ethical responsibility and sense of global citizenship who would contribute in shaping a better world. In other words, the prime aim of education in the 21st century is to furnish learners with adaptability, innovative ideas, critical and creative faculty, and ethos. Education must train them as warriors for the uncertainties of today and tomorrow, paving the way for a brighter and more resilient future for the world we live in.

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Research Article

School Factors Affecting Food Practices among Adolescent Students in Bagmati Province, Nepal

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Abstract

This study investigated the institutional environment's role in shaping dietary behaviors among adolescents in public secondary schools within Bagmati Province, Nepal. Guided by a post-positivist paradigm and the Socio-Ecological Model, a descriptive cross-sectional survey was conducted among 397 students in grades 8 to 10 across three randomly selected districts: Lalitpur, Chitwan, and Rasuwa. Data were collected using structured self-administered questionnaires. The findings revealed that institutional policies and supportive actions are powerful facilitators of healthy eating; 61.7% of students avoided junk food due to school rules, and 59.4% were regularly encouraged by teachers to make nutritious food choices. Furthermore, canteen food availability significantly shaped practices, with 54.9% frequently choosing healthy options when offered. However, structured nutrition education remains limited, as only 38.0% regularly learned about nutrition in class. These findings highlight that school environments must move beyond passive instruction to provide active behavioral and structural facilitators of healthy adolescent nutrition

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Introduction

Adolescence represents a critical developmental period characterized by rapid biological growth, behavioral shifts, and the formulation of lifelong lifestyle habits (Adhilari et al, 2025). During this transitional phase, adolescents gradually gain autonomy over their dietary choices, moving away from strict parental supervision toward external social settings. Among these external settings, the school environment serves as the primary arena where adolescents spend a significant portion of their waking hours. Consequently, the physical availability, institutional rules, and social dynamics surrounding food within the school context play a vital role in determining what, how, and why adolescents eat. Schools are vital settings for health promotion due to the continuous and intensive access they provide to young students (Esdaile et al., 2024; Townsend & Foster, 2021). Modifying the physical environment directly affects daily choices of students (Esdaile et al., 2024).

In Nepal, adolescents face a critical public health landscape characterized by the 'double burden of malnutrition,' where severe undernutrition persists alongside emerging childhood overweight. Although public health programs have successfully raised a high baseline level of general nutrition literacy among secondary students, there remains a prominent disconnect between their theoretical knowledge and daily eating practices. Factors such as an individual drive for convenience, emotional states, peer pressure, and intense exposure to digital food marketing frequently override students' healthy intentions, leading to suboptimal meal patterns and high junk food intake.

Adolescents often fail to follow current dietary recommendations due to poor eating habits, inadequate knowledge, and irregular eating patterns (Patton-Lopez et al., 2018). Adolescents lack

the knowledge necessary to make responsible decisions in life (Aryal et al., 2023) regarding many things, including right selection of foods. Manandhar and Kakchapati (2023) also found that underweight rates among early and late adolescents were 42 and 80 percent, respectively. Another study shows that compared with students who lived outside their family home, those who lived with their parents consumed more fruit, vegetables, and meat (López-Gil et al., 2022). Similarly, one study found that adolescents with lower socio-economic status in Kathmandu Valley consume the unhealthiest snacks, highlighting the need to raise awareness about the nutritional quality of snacks (Pries et al., 2019). Adolescent females experience iron deficiency and iron deficiency anemia than males, and micronutrient deficiencies are a major underlying risk factor contributing to the worldwide burden of disease associated with these conditions (Christian & Smith, 2018). A large proportion of Nepalese adolescents are shorter or lighter than their well-nourished counterparts of the same age (Koirala, 2019). The WHO (2022) study notes that the Centers for Disease Control and Prevention, as well as other academic institutions, have consistently shown that the nutritional health of adolescents living in cities is deteriorating, with an increasing prevalence of obesity.

To systematically analyze these multidimensional influences, public health researchers utilize the Socio-Ecological Model (SEM), which segments behavioral determinants into individual, interpersonal, organizational/ institutional, and policy-level systems (Jalambadani, 2018; Schölmerich & Kawachi, 2018). Within this analytical framework, organizational-level factors, specifically the school micro-environment, serve as critical points of leverage (Park et al., 2025). The physical environment of the school canteen, classroom nutrition curricula, institutional rules, and teacher encouragement interact dynamically to either support or restrict adolescents' nutritional choices. The organizational structure and climate significantly influence student health outcomes (Townsend & Foster, 2021).

Despite the recognized significance of the school environment, a major practice and evidence gap exists in Nepal's educational policy. School feeding programs are highly effective; however, the demand for mid-day meals primarily pertains to basic-level students, rather than adolescents at the secondary level (Sapkota et al., 2025). Many stakeholders appreciate the effectiveness of mid-day meal programs for school students in Nepal (Pokhrel et al., 2025), but the government's free midday meal program is mandated and funded strictly up to Grade 5 or 6 in most public community schools, leaving secondary-level adolescents (Grades 8–10) completely unassisted during school hours. Left to manage their midday meals independently, secondary students are forced to rely on school canteens, bring home-cooked food, or skip lunch entirely, yet there is minimal local research documenting how these institutional environments shape their eating practices.

Understanding the precise nature of these school-level enablers and barriers is essential for designing evidence-based, school-based nutrition programs tailored to Nepalese public schools. By identifying which factors, such as explicit junk food bans, canteen menu availability, or teacher modeling, are most influential, policymakers and educators can bridge the gap between students' theoretical knowledge and daily practices. Therefore, the primary objective of this article is to investigate the school-level factors, including canteen food choices, institutional rules, teacher encouragement, and classroom curriculum, that affect the food consumption practices of adolescent students in Bagmati Province, Nepal.

Method and Materials

This study was grounded in a post-positivist paradigm (Creswell et al., 2021), which assumes that while an objective reality regarding adolescent health and dietary behavior exists, it can only be estimated with a degree of human conjecture and inherent measurement error. Under this paradigm, the study implemented a quantitative descriptive cross-sectional survey design (Creswell & Creswell, 2021) to investigate the relationships between school environment variables

and dietary behaviors. The target population consisted of secondary-level students in grades 8 to 10 enrolled in public schools across Bagmati Province, Nepal. A final sample size of 397 students was analyzed, derived from the Cochran formula (Cochran, 1977) with adjustments for non-response and class enrollment. A multistage sampling technique was employed: first, Bagmati Province was purposively selected; second, three districts representing distinct ecological regions were randomly selected via a lottery, Lalitpur (Hill), Chitwan (Terai), and Rasuwa (Mountain); third, six public secondary schools (one urban and one rural per district) were purposively selected; and finally, individual students within grades 8–10 were randomly chosen in the field using lottery methods.

Data were collected using a structured self-administered questionnaire containing 51 coded items designed to assess socio-demographic backgrounds, dietary practices, and a comprehensive set of school-level environmental factors. To ensure face and content validity, the instrument was reviewed and validated by the Tribhuvan University (TU) Graduate School of Education (GSE) and pre-tested among 40 public school students in Kathmandu. Reliability analysis performed on pilot data yielded a Cronbach's alpha of 0.778 (standardized alpha of 0.782) for a 72-item scale, indicating strong internal consistency. Anthropometric measurements (height and weight) were taken directly by the researcher using calibrated equipment to calculate BMI, which was processed via WHO Anthro Plus software (Blössner et al., 2009) based on 2007 WHO growth reference standards. Collected data were cleaned, coded, entered into EpiData 3.5, and analyzed using SPSS version 25. Statistical analyses included univariate and bivariate descriptive statistics, Chi-square tests to assess demographic variations, and Binary Logistic Regression to estimate odds ratios (OR) for predicting inadequate food practices. Approval was formally obtained from the TU GSE and the Dean's Office of the Faculty of Education. Written administrative permission was secured from school administrators, and written informed consent alongside student assent was obtained from all participants before data collection, ensuring absolute confidentiality and anonymity.

Results

Institutional Food Environment and Canteen Use

Table 1

School Canteen Characteristics and Student Food Choices (N=397)

The school canteen represented a highly influential physical micro-environment for			adolescents, particularly because the government-provided midday meal program is restricted only up to Grade 5 in the studied schools. Consequently, secondary students managed their lunches independently; only 29.2% (N=116) brought a homemade tiffin to school every day, while 35.0% (N=139) reported "never" bringing lunch and relying entirely on purchasing food at school. Bivariate analysis of the canteen environment demonstrated that the availability of healthy food
Canteen Variables	Frequency	Percentage	
Most Influential Factor on School Food Choices			
Availability of healthy options	143	36.0	
Taste and appearance of food	104	26.2	
What friends are eating	88	22.2	
Price of food in cafeteria	62	15.6	
Influence of Canteen Options on Choices			
Often choose healthy because that is offered	218	54.9	
Sometimes choose healthy, often go for unhealthy	93	23.4	
Avoid canteen food, bring own lunch	58	14.6	
Mostly choose unhealthy as they are appealing	28	7.1	
Satisfaction with Canteen Food Options			
Very satisfied (healthy and delicious)	164	41.3	
Somewhat satisfied (okay, could be healthier)	122	30.7	
Not satisfied (unhealthy or limited options)	67	16.9	
Not satisfied at all (rarely buy)	44	11.1	

options emerged as the single most influential school factor affecting student choices, cited by 36.0% (N=143), followed by the taste and appearance of canteen options (26.2%, N=104) and peer choices (22.2%, N=88), while price was the primary factor for only 15.6% (N=62) (see Table 1).

Furthermore, 54.9% (N=218) of students reported that they frequently chose healthy options specifically because they were offered by the school canteen, while 23.4% (N=93) admitted that they sometimes chose healthy items but frequently opted for unhealthy foods when both were available. Overall satisfaction with canteen selections was moderate to low: only 41.3% (N=164) were "very satisfied" with the canteen options (considering them healthy and delicious), while 30.7% (N=122) were "somewhat satisfied" (stating options were okay but could be healthier), and a combined 28.0% (N=111) were unsatisfied due to unhealthy options or a limited selection⁴⁸. Portions were also a challenge, as only 37.0% (N=147) found canteen portions adequate to fill them, while the rest either skipped buying canteen food or went hungry.

School Rules, Policies, and Behavior Control

Explicit institutional regulations proved highly effective in shaping student behavior. A significant 61.7% (N=245) of students reported actively avoiding junk food and bringing healthier alternatives to school specifically in response to school junk food bans (e.g., restrictions on chips and candies)⁴⁹. In contrast, 13.9% (N=55) attempted to bring junk food but tried to avoid getting caught, while 13.1% (N=52) openly violated the regulations, and 11.3% (N=45) felt unaffected by school rules⁴⁹. Furthermore, 47.9% (N=190) of adolescents stated that school rules directly motivated them to bring healthier food from home, while 19.9% (N=79) complied but felt the rules limited their choices, and 15.4% (N=61) adhered to rules strictly during school hours but reverted to unhealthy behaviors outside school grounds

Nutrition Instruction and Classroom Curriculum

Table 2.

School Rules and Nutrition Education Characteristics (N=397)

Institutional Variables	Frequency	Percentage	
Response to School Rules on Junk Food			promotion was less robust. Only 38.0% (N=151) of students reported frequently learning about nutrition and healthy eating within their regular classroom curriculum, while 50.1% (N=199) received lessons only occasionally, and 11.8% (N=47) reported learning about nutrition rarely or never ⁴⁸ . Similarly, the dissemination of supportive educational materials (e.g., posters, workshops) was inconsistent: only 29.0% (N=115) reported regular promotional programs and resources, while 50.9% (N=202) saw occasional posters, and 20.1% (N=80) were unaware of any educational materials in their school ⁴⁸ . Despite limited curriculum resources, teacher reinforcement was strong: 59.4% (N=236) of students reported that teachers and staff regularly and actively encouraged them to make healthy food choices, while 22.4% (N=89) received occasional tips.
Avoid junk food, bring healthier alternatives	245	61.7	
Try to bring junk food, avoid getting caught	55	13.9	
Do not follow rules, bring what I want	52	13.1	
Do not feel affected by rules	45	11.3	
Frequency of Classroom Nutrition Learning			
Occasionally (lessons from time to time)	199	50.1	
Frequently (learn often)	151	38.0	
Rarely (do not remember learning)	24	6.0	
Never (not taught in school)	23	5.8	
Encouragement by Teachers and Staff			
Regularly (actively encourage)	236	59.4	
Sometimes (occasional reminders/tips)	89	22.4	
Rarely (not much emphasis)	40	10.1	
Never (no encouragement)	32	8.1	

Socio-Demographic and Spatial Predictors of Food Practices

Bivariate Chi-square analysis demonstrated a statistically significant association between municipality type and students' overall level of food practices ($\chi^2 = 9.360$, $p = 0.002$)⁵⁰. Specifically, urban students were more likely to report low-level (suboptimal) food practices (58.5%, $N=117$) compared to rural students (43.1%, $N=85$)⁵⁰. Conversely, 56.9% ($N=112$) of rural students maintained adequate food practices⁵⁰. Age was also significantly associated with food practices ($p = 0.006$), with 14-year-olds showing the highest prevalence of low practices (55.3%) and 16-year-olds showing the highest rate of adequate practices (54.8%).

Table 3.

Adjusted Logistic Regression for Predicting Inadequate Food Practices

Predictor Variables	Odds Ratio (OR)	p-value	95% Confidence Interval (CI)
Rural Municipality (vs. Urban)	1.897	0.009	[1.174, 3.064]
Female Gender (vs. Male)	1.262	0.293	[0.818, 1.946]
Joint Family (vs. Single)	1.133	0.567	[0.738, 1.741]
Normal Weight BMI (vs. Underweight)	0.880	0.592	[0.552, 1.405]
Chitwan District (vs. Lalitpur)	1.333	0.273	[0.797, 2.230]

In the adjusted Binary Logistic Regression model predicting inadequate food practices (Table 3), spatial context remained the most robust predictor⁵¹. Controlling for gender, age, family structure, and BMI, adolescents residing in rural municipalities had nearly double the odds of engaging in inadequate food practices compared to their urban counterparts ($OR = 1.897$, $p = 0.009$, 95% CI: 1.174–3.064)⁵¹. Subgroups across district, gender, family type, school grading, and BMI did not show statistically significant adjusted odds ratios, indicating that structural geographic disparities in food access override individual demographic factors.

Discussion

The quantitative findings of this research provide robust, empirical validation for the SEM, proving that adolescents' dietary practices are heavily conditioned by the institutional organizational systems in which they reside. In the studied public schools of Bagmati Province, the school environment operates as a highly influential micro-environment. This is evidenced by the finding that 36.0% of students identified canteen food availability as the primary determinant of their daily choices, and 54.9% frequently chose healthy items when they were actively made available by the school cafeteria. These findings align with international literature emphasizing that modifying the physical cafeteria environment is far more effective at promoting nutritious eating than passive classroom instruction. For instance, research by Esdaile et al. (2024) indicates that institutional food availability is the most direct facilitator of adolescent diet quality. Conversely, when schools fail to provide high-quality canteen choices, adolescents revert to buying processed convenience snacks, which is supported by the fact that 53.4% of Nepalese students frequently choose junk foods based on convenience and speed.

A particularly compelling finding of this study is the high rate of policy compliance among public school students⁶⁰. A significant 61.7% of adolescents reported complying with institutional junk food bans, opting to bring healthier alternative foods to school. This remarkable adherence highlights that explicit school rules and administrative control are highly potent enablers of healthy eating. This supports the argument of Townsend and Foster (2018) that formal organizational policies establish healthy institutional norms that override peer pressure or individual cravings. Furthermore, nearly 60% of students reported receiving active encouragement from teachers to eat nutritiously, confirming that school staff represents vital behavioral role models. This finding is strongly supported by the work of Aryal (2022) and Adhikari et al. (2024), who argued that Nepalese teachers' health behaviors and role-modeling significantly shape students' self-efficacy and behavioral intentions.

However, the results also expose a critical systemic weakness in the capacity of public schools to deliver consistent Food and Nutrition Education. Only 38.0% of students frequently learn about nutrition in the classroom, with the vast majority (50.1%) receiving instruction only occasionally. This fragmented implementation represents a common institutional barrier highlighted by Mahmood et al. (2025), where health messages are frequently undermined by a lack of structured curricula and educational materials. Teachers acknowledge their responsibility to educate students about nutrition, but their capacity is severely constrained by heavy academic workloads, high-stakes testing, and a lack of standardized training resources. This curricular neglect is particularly concerning because the Pearson correlation matrix demonstrated that nutritional knowledge alone has only a very weak correlation with dietary practices ($r = 0.114$, $p = 0.023$). This weak association, supported by Chagas et al. (2020), proves that theoretical knowledge is highly insufficient to drive dietary modification unless it is reinforced by physical canteen availability, teacher support, and strict school regulations.

Finally, the multivariable logistic regression analysis revealed a profound spatial disparity. Controlling for demographic and metabolic covariates, rural students had nearly double the odds of engaging in inadequate food practices compared to urban students ($OR = 1.897$, $p = 0.009$). This finding is critical for public health policy, suggesting that structural inequalities inherent in rural school communities, such as the complete absence of school canteens, limited local food markets, and the lack of diverse agricultural supplies, prevent rural youth from practicing healthy behaviors even if they have theoretical knowledge. This structural constraint is further exacerbated by the government's policy of terminating free midday meals after Grade 5 or 6, which leaves older adolescents in low-income rural schools (such as the Chepang students in rural Chitwan) to manage their nutrition with zero institutional support.

Conclusion

In conclusion, this study demonstrates that the institutional school environment represents a dominant force in shaping adolescent dietary practices in Bagmati Province, Nepal. Bivariate and multivariate analyses confirm that physical canteen availability, explicit junk food restrictions, and consistent teacher encouragement are powerful facilitators that drive healthy eating practices and control adolescent junk food consumption. However, a significant gap remains due to the lack of structured classroom Food and Nutrition Education and the government's restricted midday meal policy, which ignores secondary-level students. Ultimately, these findings confirm that passive health education is highly insufficient to overcome behavioral barriers; sustainable behavioral modification can only be achieved when schools implement comprehensive structural changes that actively facilitate healthy choices.

The implications of these findings suggest that Nepalese schools must shift from occasional classroom instruction to comprehensive, continuous school-based interventions that integrate nutrition education with behavioral support and environmental modifications. First, school canteens must be systematically regulated to ensure that healthy, diverse, and affordable food options are consistently available, as canteen availability is the most direct driver of student choices. Second, educational administrators should establish continuous, structured Food and Nutrition Education programs within the core secondary curriculum to ensure consistent health literacy. Third, the Government of Nepal must revise its current midday meal policy to extend free or subsidized school meals beyond Grade 5/6 to secondary school students (Grades 8–10), addressing a critical nutritional deficit during a period of rapid adolescent growth. Finally, public health policies must prioritize targeted structural support and food market accessibility for high-risk, resource-poor rural school settings.

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Conflict of Interest

No conflict of interest

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Authors' Contributions

Both authors met the criteria of authorship and were involved in (1) the conception of the original research idea and study design: TMP & RKM; (2) data collection: TMK collected data under the supervision of TMP; (3) data analysis and synthesis: TMP & RKM; (4) drafting, revising, and finalizing the manuscript: TMP & RKM; and (5) acknowledge shared responsibility for all aspects of the work and the final manuscript: TMP & RKM

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