

Comparing Food Security Status Using Dietary Intake and Expenditure Methods based on Socioeconomic Factors in Newly Merged Districts of Khyber Pakhtunkhwa

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Abstract

This study analysed food security among rural households in the merged districts of Bajaur and Mohmand, Khyber Pakhtunkhwa, Pakistan, using the Dietary Intake and Expenditure Methods. Food security, linked to the Sustainable Development Goals of ending hunger, is deeply influenced by socioeconomic factors such as age, education, employment, family structure, and asset ownership. Data from 384 households revealed distinct levels of food security across demographics. The Dietary Intake Method defines a household as food secure if per capita intake is at least 2,350 kcal daily, while the Expenditure Method classifies households as food secure if monthly food spending meets two-thirds of the sample's average. Results showed that food insecurity peaks among older household heads (61-90 years), with 76.47% food insecure by expenditure and 22.06% by dietary intake methods, whereas younger heads (20-30 years) reported lower food insecurity rates underscoring 15.91% by expenditure method and 18.18% by dietary intake method. Illiterate household heads faced high food insecurity rates of 49.01% by expenditure method and 31.13% by dietary intake method, while education significantly lowered these rates. Family size also influenced outcomes undermining larger families having 16-21 members showed elevated food insecurity of 84.91% in both methods, compared to smaller families having 2-5 members. Employment substantially decreased food insecurity, illustrating that the rates dropped to 23.13% by expenditure method and 47.62% by dietary intake method for employed households. Asset ownership, especially livestock and land, helped to mitigate food insecurity. Households without livestock or land had 64.5% and 58.74% food insecurity through expenditure method respectively, compared to 33.02% and 12.24% among those with these assets. Extended families and lack of foreign remittances also correlated with higher food insecurity rates. Policy recommendations include enhancing economic opportunities, especially in rural areas, to improve employment and incomes. Investments in education, especially for household heads, could bolster food security resilience. Programs supporting asset ownership, such as livestock and land, could serve as economic buffers for vulnerable households.

Keywords: Dietary intake method, Expenditure method, socioeconomic characteristics, Food security, merged districts.

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Introduction

Agriculture is the cornerstone of Pakistan's economy, accounting for approximately 19.2% of the GDP (Economic Survey of Pakistan, 2021). Despite global food production being adequate to meet human needs, hunger persists in developing countries, presenting significant challenges for poverty alleviation and food security (Mehmood et al., 2022). The Sustainable Development Goals (SDGs), launched by the United Nations in 2015, aim to eradicate hunger and promote prosperity for all by 2030. The term "food security" first appeared in international development literature during the 1960s and 1970s and has since undergone significant evolution (Hoddinott, 1999). The United Nations defines food security through four dimensions: availability, economic and physical access, utilization, and stability over time. Pakistan, with a population of around 207.7 million (WFP, 2020), faces severe food insecurity, particularly in rural areas where market diversity is limited. Approximately 20.5% of the population is undernourished, and around 60% struggle to access sufficient food (WFP, 2020). Rapid population growth threatens future food sufficiency (Pakistan Economic Survey, 2015), while climate change exacerbates food insecurity through erratic weather patterns and natural disasters (Shah et al., 2021; Ishfaq et al., 2024). The government prioritizes food security in its Vision 2025 national development plan.

Khyber Pakhtunkhwa, a marginalized province with low literacy rates and limited health facilities, is particularly vulnerable to food insecurity due to inadequate livelihood resources and poor socio-economic conditions. The newly merged districts of Khyber Pakhtunkhwa are especially at risk, with about 1.4 million households—31% of the population—identified as food insecure (WFP, 2020). Contributing factors include high food prices, locust invasions, and natural disasters. Despite having significant agricultural potential, land utilization in the merged districts remains low, contributing to food insecurity. The population faces numerous challenges, including socio-economic disparities, food insecurity, tribal conflicts, and displacement. Comprehensive research is needed to understand food security status and its determinants in these areas.

This study aims to assess the food security status of rural households in these districts using both the dietary intake method and the expenditure method by comparing the food security status of household's based on socioeconomic characteristics.

Materials and Methods

The study was conducted in two newly merged districts of Khyber Pakhtunkhwa i.e District Bajaur and Mohmand. These two districts were purposively selected due to easy access and security reasons. Merged districts are considered at high risk in food security situation facing serious threats of food supplement.

Sample Size Determination and Sampling Design Selection

Newly merged districts have overall population of 5 million. According to Sekaran and Bougie (2009) when the population size exceeds from one million then a sample size of 384 is selected with alpha level of 0.05 or 5%. Multistage sampling technique was adopted to select a total of 384 households from the selected districts, as determined in previous studies i.e. Mohammed, 2014. In first stage two newly merged districts of Khyber Pakhtunkhwa were selected. A total of four sub-divisions were selected from each district in second stage of sampling. Similarly tehsils from selected sub divisions were then selected randomly as adopted by Afzal et al. (2009). In last stage the method adopted by Bowley (1926) was used to select a total of 384 households by using proportional allocation sampling technique.

Data Collection and Procedure of Data Analysis

Primary data was used to analyse the food security status of households in the study area. Primary data was collected from the respondents through a well-designed interview schedule. Face to face interview method was employed for gleaning the data. After collecting data statistical software named SPSS, STATA and MS Excel was used to analyse the data. Further a combination of both statistical and econometric techniques was used to estimate the major findings under the light of specific objectives.

Theoretical Framework

This study analyzed the status of food security for rural households in the district Bajaur and Mohmand. The overwhelming majority of these districts are residing in rural region and their livelihood has substantial nexus with agriculture sector. However, owing to less resources and poor socioeconomic conditions they have less access to have a sufficient and healthy food.

Measurement of Food Security by Dietary Intake Method

Dietary Intake Method (DIM) was adopted for the measurement of food security of rural households in the study area, which is same as the one adopted by Bashir et.al, 2012 in their study. Dietary Intake method is carried out by different methods that are remembrance methods which take into account the recall of last 24 hours or seven days or 30 days. The common advantages of Dietary Intake Method are that it directly measures the food consumption by calories intake method by households. Similarly it is also considered to address the quality of diet consumed by households and is very useful to understand the present as well as the longer term dietary intake patterns (Bashir et.al, 2012; Ullah et al., 2023). So the most reliable and easily achievable method is recall method which mainly measures the calories intake by the households using the seven days recall data. One week is basically the acceptable time in which food intake behavior is easily remembered by every household. The seven days

recall calories was then converted into per capita intake after the adjustment to adult calories intake studies (Jenson and Miller, 2010). This was done so as to stabilize the influence that is caused by gender and differences in the age of respondents. After this, obtained per capita calories was compared to a threshold level which is 2350 Kcal/capita/day determined by Government of Pakistan for rural households (GOP, 2003). Subsequently, the households having calories intake equal to or above the threshold i.e. 2350 Kcal/capita/day was considered food secure whereas the one having less calories intake than this threshold was considered as food insecure. The level of food security can be estimated through the following equation.

$$Y_i = \begin{cases} 1 & \text{if } C_i^{ad} \geq 2350 \\ 0 & \text{if } C_i^{ad} < 2350 \end{cases} \dots\dots\dots (1)$$

Where “ Y_i ” denotes the status of food security for i th household which was determined as “1” which will indicate food security whereas “0” will indicate food insecurity, “ C_i^{ad} ” represents the adjusted intake of calories by “ i th” household and “ n ” was the sampled households which is 384.

Measurement of Food Security Status: Expenditure Survey Method (HESM)

This method is a direct method to obtain information from the households. The respondents are required to provide information about their expenditures on food and other necessities (Bickel et al., 2000). For this, different time references have been used i.e. week(s) or month(s). To obtain quality data, it requires getting information about the quantity of food bought and expenditures on different food types (items) consumed within and outside the house. The tool must also capture information on foods received as gifts or aid by any household member and self-grown foods. Food security index estimation, using the expenditure method of Omonona, et al. (2007), was employed to classify the respondents into food secure and food insecure households in a bid to establish the food security status of the individual households. The formula is given as:

$$F_i = \frac{\text{Per capita food expenditure for } i\text{th households}}{\frac{2}{3} \text{ means per capita food expenditure of all households}} \dots\dots\dots (2)$$

Where:

F_i = Food security index. When $F_i \geq 1$ it implies that the i th household is food secure, but when $F_i < 1$, it implies that the i th household is food insecure. A food secure household is, therefore, one whose per capita monthly food expenditure is at least two-thirds of the mean per capita monthly food expenditure. On the other hand, a food insecure household is one whose per capita monthly food expenditure is less than two-thirds of the mean monthly per capita food expenditure.

Results and Discussion

This section gives a clear picture about the findings, their results and discussions of the study. The section is comprised to measure the food security status of rural household's through dietary intake method. At last, it included the results of binary logistic regression to probe the determinants of food security through dietary intake method in the study area.

Distribution of food security based on socioeconomic characteristics

The distribution of food security is intricately linked to socioeconomic characteristics, reflecting how various factors such as income, education, employment status, and social class influence individuals' and communities' access to adequate and nutritious food. Understanding this relationship is crucial in addressing disparities and developing targeted interventions to combat food insecurity. Socioeconomic status determines not only purchasing power but also access to resources, information, and networks that contribute to food security. The detailed distribution of socioeconomic characteristics and their relation with food security status in the study area is given below.

Distribution of household's food security based on Head's Age

The household food security distribution based on the age of the household head is indicated in table 1, assessed through both expenditure and dietary intake methods. The youngest age group 20-30 years of age indicates a notable prevalence of food insecurity, with 15.91% of households experiencing challenges in accessing adequate food according to the expenditure method. However, the dietary intake method reveals a slightly lower percentage of food insecurity at 18.18%. Despite this, the majority of households in this age group are food secure, suggesting a relatively stable economic situation, although early financial constraints or limited income sources might contribute to the observed food insecurity rates. Transitioning to the 31-40 age group, the prevalence of food insecurity increases significantly, particularly evident through the expenditure method, with 39.36% of households classified as food insecure. These demographic exhibits a substantial disparity between food secure and insecure households, indicating potential economic pressures associated with familial responsibilities or career advancement challenges. The dietary intake method reveals a lower food insecurity rate at 26.6%, suggesting potential coping mechanisms such as dietary adjustments or reliance on support networks to mitigate food insecurity risks.

Table 1: Distribution of household's food security based on Head's Age

Head Age	Expenditure Method		Dietary Intake Method		Total
	Food Insecure	Food Secure	Food Insecure	Food Secure	
20-30	7 (15.91%)	37 (84.09%)	36 (81.82%)	8 (18.18%)	44 (100%)
31-40	37 (39.36%)	57 (60.64%)	69 (73.4%)	25 (26.6%)	94 (100%)
41-50	45 (40.91%)	65 (59.09%)	60 (54.55%)	50 (45.45%)	110 (100%)
51-60	39 (57.35%)	29 (42.65%)	47 (69.12%)	21 (30.88%)	68 (100%)
61-90	52 (76.47%)	16 (23.53%)	53 (77.94%)	15 (22.06%)	68 (100%)
Total	180 (46.88%)	204 (53.13%)	265 (69.01%)	119 (30.99%)	384 (100%)

Source: Survey data, 2023

Data pertaining age group 41-50, indicates a slight reduction in food insecurity compared to the previous cohort, with 40.91% of households experiencing food insecurity under the expenditure method. However, disparities between food secure and insecure households persist, highlighting ongoing economic challenges within this demographic. The dietary intake method reveals a relatively higher food insecurity rate at 45.45%, indicating nuanced variations in food security outcomes based on assessment methodology.

As the age of household heads increases, a mixed trend emerges. The 51-60 age group experiences a resurgence in food insecurity, particularly evident through the expenditure method, where 57.35% of households face challenges in accessing adequate food. This demographic exhibits the highest percentage of food insecurity among all age groups, potentially influenced by factors such as health issues, retirement, or economic downturns affecting this cohort disproportionately. However, the dietary intake method reveals a lower food insecurity rate at 30.88%, suggesting potential discrepancies in self-reported dietary intake versus expenditure-based assessments.

Lastly, the oldest age group 61-90 years demonstrates a concerning prevalence of food insecurity, with 76.47% of households experiencing challenges in accessing adequate food according to the expenditure method. This demographic exhibits the highest vulnerability to food insecurity, likely influenced by factors such as declining health, limited income sources, or dependence on pensions with inadequate purchasing power. However, the dietary intake method reveals a slightly lower food insecurity rate at 22.06%, highlighting potential discrepancies between self-reported dietary intake and expenditure-based assessments within this demographic.

Distribution of household's food security based on education level of Household's Head

The household food security distribution based on the education level of the household head, evaluated through both expenditure and dietary intake methods is illustrated in table 2. Households who were illiterate data revealed a substantial prevalence of food insecurity, with 49.01% of households experiencing challenges in accessing adequate food according to the expenditure method. However, the dietary intake method painted a slightly more optimistic picture, with 31.13% of households classified as food insecure. Despite efforts to manage food resources, the high percentage of food insecurity among illiterate households highlighted the need for personalized interventions to improve economic opportunities and resource management among the vulnerable group.

Similarly, primary education (1-5 years), the data indicated a notable prevalence of food insecurity, albeit slightly lower compared to illiterate households. Approximately 44.44% of households experienced food insecurity according to the expenditure method, with 33.33% classified as food insecure under the dietary intake method. While households in this category exhibited relatively lower food insecurity rates, compared to illiterate households, the data underscored persistent economic challenges associated with limited education levels, necessitating targeted interventions to improve livelihood opportunities and enhance food security outcomes.

Table 2: Distribution of household's food security based on the education level of the Household's Head

Head Education	Expenditure Method		Dietary Intake Method		Total
	Food Insecure	Food Secure	Food Insecure	Food Secure	
Illiterate	74 (49.01%)	77 (50.99%)	104 (68.87%)	47 (31.13%)	151 (100%)
1-5	28 (44.44%)	35 (55.56%)	42 (66.67%)	21 (33.33%)	63 (100%)
6-10	32 (46.38%)	37 (53.62%)	47 (68.12%)	22 (31.88%)	69 (100%)
11-16	46 (45.54%)	55 (54.46%)	72 (71.29%)	29 (28.71%)	101 (100%)
Total	180 (46.88%)	204 (53.13%)	265 (69.01%)	119 (30.99%)	384 (100%)

Source: Survey data, 2023

Moving to households headed by individuals with secondary education (6-10 years), the data revealed a similar pattern of food insecurity prevalence, with approximately 46.38% of households experiencing challenges in accessing adequate food according to the expenditure

method. However, the dietary intake method indicated a lower food insecurity rate at 31.88%. Despite efforts to improve education levels, households in this category continue to face economic vulnerabilities, underscoring the importance of comprehensive strategies aimed at enhancing economic resilience and livelihood opportunities.

However, households with higher education levels (11-16 years) exhibited the lowest prevalence of food insecurity among all education categories. Approximately 45.54% of households experience food insecurity according to the expenditure method, with 28.71% classified as food insecure under the dietary intake method. While this demographic demonstrates relatively lower food insecurity rates compared to households with lower education levels.

Distribution of household's food security based on Dependency ratio

Data presented in table 3 shows a comprehensive overview of household food security distribution categorized by dependency ratio, delineated by family size, and assessed through both expenditure and dietary intake methods.

The table shows that smaller families was comprised of 2-5 members, which indicates a notable prevalence of food security, with 87.1% of households classified as food secure according to the expenditure method, and 96.77% via dietary intake assessment. This suggests relatively stable economic conditions and efficient resource allocation within smaller family units, resulting in higher food security rates compared to larger families. However, despite this overall positive trend, it's crucial to address the 12.9% of households experiencing food insecurity, highlighting the presence of vulnerable households even within this demographic.

Transitioning to medium-sized families (6-9 members), the data unveils a significant proportion of food insecurity, particularly pronounced through the expenditure method, with 38.29% of households facing challenges in accessing adequate food. This disparity is further emphasized by the relatively lower food security rate of 56.57% under the dietary intake method. Moving to larger families (10-15 members), the data presents a concerning picture, with over 63.83% of households experiencing food insecurity, particularly evident through the expenditure method. Despite efforts to manage resources, economic pressures associated with sustaining larger families likely contribute to compromised food security outcomes. The relatively higher food security rate of 64.89% under the dietary intake method suggests varying coping mechanisms or adaptive strategies within these demographic, indicating potential areas for further research to elucidate effective resilience-building measures.

Table 3: Distribution of Household's food security based on Dependency ratio

Family Size	Expenditure Method		Dietary Intake Method		Total
	Food Insecure	Food Secure	Food Insecure	Food Secure	
2-5	8 (12.9%)	54 (87.1%)	60 (96.77%)	2 (3.23%)	62 (100%)
6-9	67 (38.29%)	108 (61.71%)	99 (56.57%)	76 (43.43%)	175 (100%)
10-15	60 (63.83%)	34 (36.17%)	61 (64.89%)	33 (35.11%)	94 (100%)
16-21	45 (84.91%)	8 (15.09%)	45 (84.91%)	8 (15.09%)	53 (100%)
Total	180 (46.88%)	204 (53.13%)	265 (69.01%)	119 (30.99%)	384 (100%)

Source: Survey data, 2023

Lastly, the highest dependency ratio category (16-21 members) demonstrated the most acute food insecurity, with a staggering 84.91% of households experiencing food insecurity under both assessment methods. This alarming prevalence underscores the immense challenges faced by extremely large families in securing consistent access to food, necessitating urgent and targeted interventions to alleviate economic hardships and enhance food security outcomes for this vulnerable demographic.

The table also shows the interaction between family size, dependency ratio, and food security status, which need personalized policies and programs to address the diverse needs of households across different demographic categories. Effective interventions should prioritize economic empowerment, resource management, and resilience-building strategies for challenges faced by households within each dependency ratio category.

Distribution of household's food security based on Employment status of Household's head

The distribution of household food security based on the employment status of the household head, assessed through both expenditure and dietary intake methods is outlined in table 4. The table regarding household who were non-employed revealed a concerning prevalence of food insecurity, with 61.6% of households experiencing challenges in accessing adequate food according to the expenditure method. Conversely, only 38.4% of non-employed households were classified as food secure. This definite divergence shows the liability of non-employed households to economic instability and result in compromised food security outcomes. The dietary intake method corroborated these findings, with 82.28% of non-employed

households facing food insecurity, further highlighting the severity of the situation within the region.

Table 4: Distribution of household's food security based on Employment status of Household's head

Employment Status	Expenditure Method		Dietary Intake Method		Total
	Food Insecure	Food Secure	Food Insecure	Food Secure	
Non Employed	146 (61.6%)	91 (38.4%)	195 (82.28%)	42 (17.72%)	237 (100%)
Employed	34 (23.13%)	113 (76.87%)	70 (47.62%)	77 (52.38%)	147 (100%)
Total	180 (46.88%)	204 (53.13%)	265 (69.01%)	119 (30.99%)	384 (100%)

Source: Survey data, 2023

In contrast, employed households demonstrated significantly lower rates of food insecurity, with only 23.13% classified as food insecure according to the expenditure method. The majority of employed households (76.87%) were classified as food secure, highlighting the positive impact of stable employment on food security outcomes. The dietary intake method revealed a similar trend, with 47.62% of employed households experiencing food insecurity, indicating a relatively lower prevalence compared to non-employed households. These findings underscored the importance of stable employment in providing households with the means to access adequate food and mitigate food insecurity risks.

Distribution of household's food security based on Livestock Ownership

The distribution of household food security based on livestock ownership, evaluated through both expenditure and dietary intake methods is presented in table 5. The results concerning households without livestock ownership indicated a substantial prevalence of food insecurity, with 64.5% experiencing challenges in accessing adequate food according to the expenditure method. In contrast, only 35.5% of households without livestock are classified as food secure. This stark contrast underscored the vulnerability of households lacking livestock assets to economic shocks and income instability, resulting in compromised food security outcomes. The dietary intake method corroborated these findings, with 79.29% of households without livestock experiencing food insecurity, further emphasizing the severity of the situation within this demographic.

Table 5: Distribution of household's food security based on Livestock Ownership

Livestock Ownership	Expenditure Method		Dietary Intake Method		Total
	Food Insecure	Food Secure	Food Insecure	Food Secure	
No Livestock	109 (64.5%)	60 (35.5%)	134 (79.29%)	35 (20.71%)	169 (100%)
Livestock	71 (33.02%)	144 (66.98%)	131 (60.93%)	84 (39.07%)	215 (100%)
Total	180 (46.88%)	204 (53.13%)	265 (69.01%)	119 (30.99%)	384 (100%)

Source: Survey data, 2023

Conversely, households owning livestock demonstrate significantly lower rates of food insecurity, with only 33.02% classified as food insecure according to the expenditure method. The majority of livestock-owning households (66.98%) were classified as food secure, highlighting the positive impact of livestock ownership on food security outcomes. The dietary intake method revealed a similar trend, with 60.93% of livestock-owning households experiencing food insecurity, indicating a relatively lower prevalence compared to households without livestock. These findings underscored the importance of livestock assets in providing households with additional sources of income, food, and resilience against economic shocks.

The table further shows the critical link between livestock ownership and food security outcomes, with households owning livestock exhibiting significantly lower rates of food insecurity compared to those without. Livestock ownership provides households and dairy products for consumption, sale and a buffer against income volatility and agricultural risks.

Distribution of household's food security based on Family type

The distribution of household food security based on family type, measured through both expenditure and dietary intake methods is given in table 6. The table revealed significant variations in food security outcomes between extended and nuclear family types, highlighting the socio-cultural dynamics influencing food security in rural settings.

Beginning with extended families, the data indicated a substantial prevalence of food insecurity, with 58.22% experiencing challenges in accessing adequate food according to the expenditure method. Conversely, only 41.78% of extended families were classified as food secure. This stark contrast underscored the vulnerability of extended families to economic shocks and income instability, resulting in compromised food security outcomes. The dietary intake

method corroborated these findings, with 64.38% of extended families experiencing food insecurity, further emphasizing the severity of the situation within this demographic.

Table 6: Distribution of household's food security based on Family type

Family type	Expenditure Method		Dietary Intake Method		Total
	Food Insecure	Food Secure	Food Insecure	Food Secure	
Extended	170 (58.22%)	122 (41.78%)	188 (64.38%)	104 (35.62%)	292 (100%)
Nuclear	10 (10.87%)	82 (89.13%)	77 (83.7%)	15 (16.3%)	92 (100%)
Total	180 (46.88%)	204 (53.13%)	265 (69.01%)	119 (30.99%)	384 (100%)

Source: Survey data, 2023

Conversely, nuclear families demonstrated significantly lower rates of food insecurity, with only 10.87% classified as food insecure according to the expenditure method. The majority of nuclear families (89.13%) were classified as food secure, highlighting the positive impact of smaller family units on food security outcomes. The dietary intake method reveals a similar trend, with 83.7% of nuclear families experiencing food insecurity, indicating a relatively lower prevalence compared to extended families. These findings underscored the importance of family size and structure in shaping food security outcomes, with nuclear families exhibiting greater economic resilience and resource allocation efficiency compared to extended families.

The results in table also shows the critical link between family type and food security outcomes, with extended families exhibiting significantly higher rates of food insecurity compared to nuclear families. The extended family structure, characterized by larger household sizes and potentially higher dependency ratios, poses greater economic challenges and resource constraints, thereby compromising food security outcomes.

Distribution of household's food security based on Foreign Remittances

The analysis of household food security status based on the presence or absence of foreign remittances, by using two methods the Expenditure Method and the Dietary Intake Method is shown in table 7. The results regarding expenditure method revealed that among households receiving no foreign remittances, 57.09% were classified as food insecure, while 42.91% are deemed food secure. Conversely, households receiving foreign remittances displayed a notable improvement in food security, with only 21.1% categorized as food insecure and a significant 78.9% classified as food secure. This suggests a clear association between foreign

remittances and enhanced food security, as indicated by the contrast in percent remittance including both receiving and non-receiving households.

Table 7: Distribution of household's food security based on Foreign Remittances

Foreign Remittances	Expenditure Method		Dietary Intake Method		Total
	Food Insecure	Food Secure	Food Insecure	Food Secure	
No Foreign Remittances	157 (57.09%)	118 (42.91%)	207 (75.27%)	68 (24.73%)	275 (100%)
Foreign Remittances	23 (21.1%)	86 (78.9%)	58 (53.21%)	51 (46.79%)	109 (100%)
Total	180 (46.88%)	204 (53.13%)	265 (69.01%)	119 (30.99%)	384 (100%)

Source: Survey data, 2023

Data concerning dietary intake method among households without foreign remittances, 75.27% were classified as food insecure, contrasting with 53.21% of remittance receiving households falling into this category. Similarly, 24.73% of non-remittance receiving households were considered food secure, compared to 46.79% of households benefiting from foreign remittances.

Similarly, the total distribution across both methods, the impact of foreign remittances on whole food security becomes even more apparent. Among all the households, 46.88% are food insecure and 53.13% are food secure when foreign remittances are absent. However, with the presence of foreign remittances, the proportion of food insecure households drops significantly to 30.99%, while the proportion of food secure households rises to 69.01%.

Distribution of household's food security based on Agriculture Land Ownership

The distribution of household food security categorized by ownership of agricultural land, by using two assessment methods the expenditure method and dietary intake method is illustrated in table 8. Statistics regarding Expenditure Method showed that households without agricultural land constitute the majority of the sample, with 286 households comprising 58.74% classified as food insecure and 118 households (41.26%) as food secure.

Conversely, among households owning agricultural land, the majority are deemed food secure, with 86 households (87.76%) falling into this category compared to 12 households (12.24%) classified as food insecure. The figures showed a significant correlation between

agricultural land ownership and food security, with a higher likelihood of food security among land-owning households.

Table 8: Distribution of household's food security based on Agriculture Land Ownership

Agriculture Land Ownership	Expenditure Method		Dietary Intake Method		Total
	Food Insecure	Food Secure	Food Insecure	Food Secure	
No Agri-Land	168 (58.74%)	118 (41.26%)	217 (75.87%)	69 (24.13%)	286 (100%)
Agri-Land	12 (12.24%)	86 (87.76%)	48 (48.98%)	50 (51.02%)	98 (100%)
Total	180 (46.88%)	204 (53.13%)	265 (69.01%)	119 (30.99%)	384 (100%)

Source: Survey data, 2023

Similarly, among the Dietary Intake Method, a similar trend appears. However, data concerning households lacking agricultural land, 217 (75.87%) are categorized as food insecure, while only 69 (24.13%) are classified as food secure. On the other hand, households with agricultural land display a higher prevalence of food security, with 50 (51.02%) classified as food secure compared to 48 (48.98%) categorized as food insecure. This further reinforces the association between agricultural land ownership and improved food security status.

Whereas, majority of households were food insecure according to both methods, with 180 (46.88%) and 265 (69.01%) households in Expenditure and Dietary Intake Methods, respectively. However, it is notable that a higher proportion of households owning agricultural land are food secure under both assessment methods compared to those without agricultural land. The data indicate a potential role of land ownership in enhancing food security outcomes among rural households.

Comparison of Food security in study area

The provided table offers a comparison of food security status in both the selected districts, Bajaur and Mohmand, utilizing both the Expenditure Method and the Dietary Intake Method. In Bajaur, based on the Expenditure Method, 112 households were categorized as food secure, while 80 households were considered food insecure. However, the Dietary Intake Method identifies only 65 households as food secure and 127 households as food insecure. The total surveyed households in Bajaur were 192, with 177 being food secured and 207 being food insecure.

Table 9: Comparison of food Security in the study area

District Bajaur			
Food Security Status	Expenditure Method	Dietary Intake Method	Total
Food Secured	112	65	177
Food Insecure	80	127	207
Total	192	192	384
District Mohmand			
Food Security Status	Expenditure Method	Dietary Intake Method	Total
Food Secured	92	54	146
Food Insecure	100	138	238
Total	192	192	384

Source: Survey data, 2023

In Mohmand, the Expenditure Method indicated 92 food secure households and 100 food-insecure households. Conversely, the Dietary Intake Method shows 54 food secure households and 138 food insecure households. Mohmand's total surveyed households amount to 192, with 146 being food secure and 238 being food insecure. The reason for getting higher results of food secured households through the expenditure method is that it measures only financial capacity and economic access to food whereas the dietary intake method tends to show lower food security. After all, it directly measures the food intake and provides a more accurate picture of nutritional adequacy and dietary quality.

Discussion and relation to previous Research done

The findings on food security distribution based on socioeconomic characteristics highlight the strong link between these factors and food access. Coleman-Jensen et al. (2019) found that low income and education levels significantly increase food insecurity in U.S. households. In developing contexts, Mazzocchi et al. (2019) confirmed that higher educational attainment leads to better employment opportunities and improved access to nutritious food. The age of the household head is another critical factor, with younger and older individuals facing higher rates of food insecurity. The World Bank (2020) indicates that older adults are often economically vulnerable due to fixed incomes and health issues. Similarly, Gundersen and Ziliak (2015) highlight the financial challenges younger households encounter, exacerbating their risk of food insecurity. Employment status is also vital; Stiglbauer et al. (2021) emphasize that unemployment greatly contributes to food insecurity, as non-employed individuals struggle to afford adequate food. Additionally, livestock ownership serves as a crucial asset for many rural

households, reinforcing food security through both food production and income, as shown by Okwu et al. (2020). Finally, the positive impact of foreign remittances on food security is evident in the research of Adams and Page (2005), which illustrates how remittances enhance economic stability and food access in developing countries. Collectively, these studies underscore the complexity of food security and the importance of targeted interventions to address the socioeconomic factors that contribute to food insecurity.

Conclusions and Recommendations

The analysis of food security distribution across various socioeconomic characteristics reveals significant disparities that warrant immediate attention. Households led by younger individuals exhibit a mix of food security levels, while those headed by older individuals, particularly the elderly, face alarming rates of food insecurity, highlighting the impact of health, income sources, and economic pressures. Education levels are directly correlated with food security, as illiterate households display the highest vulnerability, necessitating targeted educational interventions to enhance economic opportunities. Similarly, households with lower dependency ratios, typically smaller families, enjoy better food security, whereas larger families struggle due to increased economic burdens. Employment status emerges as a critical factor, with non-employed heads of households suffering from significantly higher food insecurity, underscoring the need for job creation and vocational training programs. Livestock ownership is also pivotal, as it provides an additional income source and food security buffer, indicating the importance of supporting rural livelihoods through agricultural initiatives. The data shows that family type influences food security outcomes, with nuclear families exhibiting better resilience than extended families. Furthermore, the presence of foreign remittances substantially enhances food security, suggesting that policies facilitating remittance flows could alleviate food insecurity challenges. Agricultural land ownership plays a crucial role in determining food security status; therefore, promoting access to land and agricultural resources is essential for improving food outcomes in rural areas. Based on these findings, it is recommended that policymakers focus on comprehensive interventions that integrate education, employment, and agricultural support while fostering community-based programs that enhance resource management and resilience-building.

Tailored strategies addressing the unique needs of vulnerable households, particularly those led by the elderly or with lower educational attainment, should be prioritized to combat food insecurity effectively.

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