



Factors Affecting the Dietary Diversity Pattern of Women and Children in Rural Areas of Southern Punjab: A Case of District Vehari

Asma Sajjad¹, Muhammad Mansha², Kiran Sarwar³, Haris Ali Siddique⁴

¹ M.Phil., Department of Economics, COMSATS University Islamabad, Vehari Campus, Pakistan.
Email: asmasajjad310@gmail.com

² PhD Scholar, School of Economics and Finance, Xi'an Jiaotong University, China.
Email: m.manshaciitvehari@gmail.com

³ M.Phil., Department of Economics, COMSATS University Islamabad, Vehari Campus, Pakistan.
Email: kiransarwar041@gmail.com

⁴ Research Assistant, School of Arts and Design, Superior University, Lahore, Pakistan.
Email: haris.alisiddique@gmail.com

ARTICLE INFO

Article History:

Received: August 15, 2022
Revised: September 28, 2022
Accepted: September 29, 2022
Available Online: September 30, 2022

Keywords:

Children & women dietary diversity scores
Children & women characteristics
Southern Punjab
Pakistan

JEL Classification Codes:

I10

Funding:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

The purpose of this study was to examine the factors that affect rural mothers' and children's dietary diversity patterns in Southern Punjab, district Vehari. Children and Women Dietary Diversity Pattern (CDDP & WDDP) illustrate how economically capable women and children are to acquire a wide range of foods. CDDP & WDDP are multi-dimensional. Various socioeconomic factors can affect CDDP & WDDP. The Primary data has been collected from 300 children and 300 women from rural areas. A detailed questionnaire was created to gather information from the respondents following the FAO's recommendations. The data analysis method employed was ordered logistic regression. The findings of this study suggest that children in rural regions' estimated coefficients of child's age, mother's age, maternal education, the income of the household, land, area, and livestock do a have positive impact on children's dietary diversity scores and statistically signify.



© 2022 The Authors, Published by iRASD. This is an Open Access Article under the [Creative Common Attribution Non-Commercial 4.0](https://creativecommons.org/licenses/by-nc/4.0/)

Corresponding Author's Email: asmasajjad310@gmail.com

Citation: Sajjad, A., Mansha, M., Sarwar, K., & Siddique, H. A. (2022). Factors Affecting the Dietary Diversity Pattern of Women and Children in Rural Areas of Southern Punjab: A Case of District Vehari. *IRASD Journal of Economics*, 4(3), 500–516. <https://doi.org/10.52131/joe.2022.0403.0095>

1. Introduction

Dietary Diversity (DD) is the total number of food groups consumed over 24 hours. There are 7 and 9 children's and women's food categories respectively, comprised of different food items like Nuts and legumes, roots, cereals and tubers, meat and fish, organ meat, dairy foods, eggs, and other fresh fruits and vegetables and starchy staples, vegetables, and fruits with vitamin A (WHO, 2007). Dietary Diversity (DD) is a suitable substitute variable for measuring nutrient intake by children and women (Amugsi, Mittelmark, & Lartey, 2014; Arimond & Ruel,

2004; Ekesa, Blomme, & Garming, 2011; Ogunba, 2010). Mothers play the most important character in the health care of their kids. A study is required which clarifies caring factors that might promote child dietary diversity. Dietary diversity based on dietary groups consumed over a 24-hour sample and easy-to-collect indicator of the dietary quality of women & children (Arimond & Ruel, 2004). DD has a positive relationship with a higher dietary quality energy and some other nutrients. In many developing countries there are consequently greater chances of daily energy requirements among children (Arimond & Ruel, 2002; Tarini, Bakari, & Delisle, 1999). Dietary diversity is known the same as a very important ingredient of sufficient and high-class diets for children (Amugsi, Mittelmark, & Oduro, 2015). Different diets utilize an assortment of nourishment items and food variety which increases the probability of suitable nutrients among the children for improving their psychological and physical development of children (Hatløy, Torheim, & Oshaug, 1998; Torheim et al., 2004).

Diverse diets and nutritious foods of adequate value and amount are important for children to meet their nutrient needs and growth. Most past studies related to child nourishment around the globe concentrated on disappointments instead of dietary diversity. Anthropometric disappointments and food assortment between investigative the circulation of food lack and food variety from corner to corner is intercessions to get better child development center on nourishment value and amount (Agrawal et al., 2019). Pakistan is a developing nation where issues with food security. Due to a lack of food, Pakistan's food security and dietary diversity for women, children, and infants have been threatened in recent years. Even though Pakistan is an agrarian economy and a major producer of wheat, rice, milk, and maize, yet is facing problems with sustainable food availability. Food behavior helps us have the energy to move around physically and create new cells, which is a basic requirement for human survival. The body is protected against sickness, disease, and infection through a balanced diet. Food is an essential element to sustain human life and has a good impact on the development of human resources. Individual people and nations should both take into account nutrition standards (Firdaus & Cahyono, 2017).

The major objectives of study are to compute the Dietary Diversity Pattern of the children and women and to find out the factors affecting the Dietary Diversity Pattern of the children and women. The study attempt to answer the research questions especially what are the children's and women's characteristics and dietary diversity patterns in District Vehari, Southern Punjab? And how these factors are affecting children's and women's dietary diversity patterns of food intake in 24 hours in rural households? So, we are going to examine the children women's characteristics and understand various socioeconomic factors that affect the children and women's dietary diversity score in rural areas of Punjab, District Vehari using guidelines of FAO (2011).

Section I contains the significance, objective, and question of this study. The review of literatures are clearly shown in Section II of the paper. Regarding the data sources and econometric approach employed in this work, specific information is provided in Section III. Section IV of the report includes the study results and their analysis. Section V of the paper contains the conclusion and policy suggestions.

2. Literature Review

This section manages hypothetical explanations and exact writing. It discusses the concepts of factors affecting the dietary diversity pattern of children & women. The diversity of foods or food groups consumed over a specified reference period is known as dietary diversity.

Agrawal et al. (2019) examined the socioeconomic pattern of dietary diversity and food utilization along with Indian children. In this study, cross-sectional data were collected. The secondary data on which this study is based. The recall period chosen in this study is based on

twenty-four hours. This study used logistic regression models. This study concluded that mediations intended to improve nourishment utilization and better dietary intake among Indian youngsters.

Ali et al. (2019) examined the relationship between food protection and other socioeconomic characteristics with food categories and dietary diversity of children aged 6-59 months in rural Bangladesh. To analyze the data, this study used panel data from the district of Bangladesh. This study collected 6,468 children data between 6-59 months. The multistage cluster sampling technique is used in this study. A linear and logistic regression analysis is used. The results indicate that the prevalence of wasting, stunting, and being underweight in children aged 6-59 months were 18.2%, 36.8%, and 37.7% respectively.

Viloria et al. (2018) examined the diet diversity and nutritional status of children 2 to 5 years old situated in different ecological settings. A sum of 81 youngsters, 40% male children, and 60% female children was incorporated into the study. In this study, results showed that the dominant part of the youngsters indicate medium dietary diversity scores (62 - 96%) while their dietary statuses were generally ordinary. Ochieng, Afari-Sefa, Lukumay, and Dubois (2017) examined different factors that affect family DD and the nutritional popularity of families in Tanzania. All of the information in this study was collected through primary data. The result of this study indicated that the use of secure food is more in day-by-day consumption of meals and decreases consumption degree of notion meals consumption. So, this study concluded that the small size of households, higher earnings, and schooling families' dietary variety score is greater than smaller income families.

Powell, Bezner Kerr, Young, and Johns (2017) examined the determinants of household dietary diversity and nutrition in Tanzania. Primary data have been used in this study. 275 households have been added to this focus group discussion. This study collected information from focus group discussions and respondent interviews in Tanzania. The result of this study indicated that various socioeconomic like age, education, size, and income of household head and cultural factors are all affecting household dietary diversity score in Tanzania. Jawad, Al Jebory, and Baey (2016) analyzed the assessment of nutritional status among children less than 5 years old in Hilla city. A total of 6 primary health centers were selected and a total of 1000 non-probability convenient samples of children. The study was conducted in two parts, first, the data was collected through questionnaires and the second part was the measurement of height and weight for stunting, wasting, and underweight. Data were analyzed through frequencies. The findings of the study show that parental factors and socioeconomic characteristics also affect children's nutritional status.

Patricia and Ekebisi (2016) analyzed to examine the variety of diets and nutritional status of adult women in rural areas in Abia State, Nigeria. Simple random sampling was used to select a sample of 240 women from Abia State. A pre-tested questionnaire was used to assess socio-demographic information, dietary habits, and anthropometric characteristics. For every estimation in this study, the descriptive and chi-squared methods were applied. The results of this research showed that the score for dietary diversity was low during the reference period. Amugsi et al. (2015) examined the relationship between children and maternal dietary diversity in Ghana. For analysis of this study, data was collected from the 2008 Ghana Demographic and Health Survey. The dietary diversity score has been constructed by the summation of 15 food groups' items. For data analysis, to understand this concept multiple linear regression models are used. The result of this study indicated that positive and statistically significant relationship between child & maternal dietary diversity scores.

Rah et al. (2010) examined dietary diversity scores in lower-income countries. The DDS has been constructed by the summation of 9 food group items. The study's recall period includes data from the previous week's food consumption. In this work, the logistic regression method is employed for data analysis. According to the study's findings, children from lower-income families

had lower growth rates than children from higher-income families due to their lower dietary variety scores. Bernell, Weber, and Edwards (2006) studied many socioeconomic variables that affect the food security of households. Families in Oregon experience severe malnutrition between 1999 and 2001. Multivariate logit models have been applied to the analysis of this inquiry. The findings of this study demonstrated that the country's food insecurity is a result of population pressure and a variety of personal eating preferences.

Sodjinou, Agueh, Fayomi, and Delisle (2009) examined the dietary patterns of urban adults in Benin and their socioeconomic characteristics. A 24-hours recall period is used in this study. A 200 household is randomly selected by 10 neighbors. Estimation of diet quality is estimated by using a variety of food scores. In this study, the two dietary quality strategies first traditional and the second temporary applied. The classic style is associated with the higher socioeconomic classes. It contains sugar, saturated fat, and a greater proportion of energy from fat. Mirmiran, Azadbakht, and Azizi (2006) examined the association between dietary diversity score and dietary diversity within food groups. Cross-sectional data has been used for 24 hours. 286 females matured 18-80 years. This study is based on primary data. District 13 of Tehran is selected for this study. Data has been analyzed by SPSS statistical software program and SAS software. The conclusions of this study showed that DDS is significantly correlated with specific nutrient adequacy among Tehranian women.

In Pakistan, various studies have been conducted on determinants of food security (Anila & Adiq, 2011; Asghar & Muhammad, 2013; Hussain & Akram, 2008). The present paper focuses to estimate the factors affecting the dietary diversity pattern of children and women in rural areas of Southern Punjab: A case of district Vehari. In this study, we investigate the socioeconomic factors of children and women that influence CDDP and WDDP such as child's gender, mother age, child's age, maternal education, maternal current employment status, women's age, marital status, education level, status within household, occupation, income of household, land holding and number of livestock.

This section's summary presents a review of the literature on food security and dietary diversity. The dietary diversity pattern of children and women is considered an easy calculation of food sets to estimate the energy intake of children and women. The current study aims to evaluate the dietary diversity patterns of children and women and the defining characteristics of rural areas of Southern Punjab, District Vehari. So, the current study has been designed to survey the characteristics of children's and women's dietary diversity patterns.

3. Theoretical Framework

The number of food groups that the child had access to on the previous day was used to determine their CDDS (children's dietary diversity score). Women's dietary diversity scores (WDDSs) have been determined to be a more accurate measure of the amount of macronutrients households consume. The WDDSs depend on 24-hour recall duration, and amounts of food collections used, and reproduce the likelihood of micronutrient capability of the go on a diet. Various factors affect children's and women's food diversity. In daily consumption patterns, foods are simply liked not chosen. So, consuming a particular food in daily life is linked with taste, and smell whether food is pleasurable or not. For example, media advertising a particular food to decrease the cholesterol level; will increase the household preferences to purchase that food. Many socioeconomic factors influence children's and women's food diversity in obtaining that particular food liked by the household (Olney, Labruyere, & Price, 1989).

Factors that can affect children's and women's dietary diversity scores are food accessibility, education, household income, and food characteristics. These are the factors that determine what, why, and how foods are engrossed. Food accessibility term denotes the availability & affordability of food and includes cost and income. But the accessibility of food is

also affected by working situation, life, and living style. Food characteristics term shows color, flavor, shape, and temperature. Children’s and women’s dietary variety scores can be impacted by household education and income levels, among other key aspects (Eertmans, Baeyens, & Van Den Bergh, 2001; Köster, 2009). The present study focuses evaluation of the women’s and children’s dietary variety pattern and its determinants such as the child’s gender, mother’s age, child’s age, maternal education, maternal current employment status, women’s age, marital status, education level, status within the household, occupation, family size, the income of a household, land holding and livestock in rural areas of Southern Punjab, district Vehari.

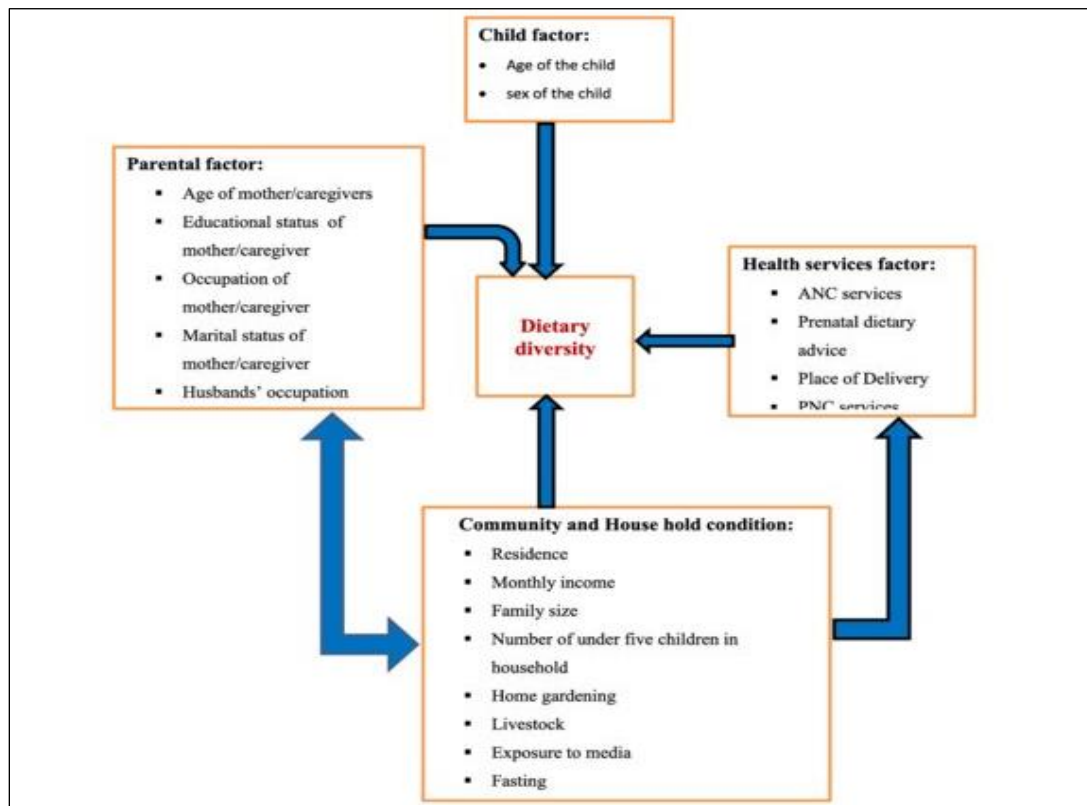


Figure 1: Conceptual Framework of Dietary Diversity Pattern of Women and Children

4. Methodology

The current study is using primary data collected from rural areas in Southern Punjab's district Vehari. Following the FAO's recommendations, a well-structured questionnaire was created to collect data from the respondents. FAO (2011) recommended that the study use the most recent 24-hour recall data of children’s and women’s food intake. Information about socioeconomic features of children and women like child’s gender, child’s age, mother’s age, maternal education, maternal current employment status, women’s age, marital status, education level, status within the household, occupation, the income of the household, land holding and livestock were collected as well.

4.1 Sampling Techniques and Sample Size

Multiple-stage sampling was used in the study. In the first stage, 10 union councils were selected and two villages were selected from each union council. In the second stage, 15 households with children and women aged 6-53 months and 15-49 years are selected. 30 responders were chosen for the third round from a sample size was 600 respondents comprising 300 children and 300 women from rural areas.

4.2 Data Collection

The interviewer collected data by asking a set of questions about the dietary diversity of children and mothers. Those who were in control of home cooking answered these questions. This study did not examine the intake of foods prepared outside the home. So, household face-to-face interviews were conducted by using prepared questionnaires to collect data on children and women’s socioeconomic characteristics such as the child’s gender, mother’s age, child’s age, maternal education, maternal current employment status, women’s age, marital status, education level, status within the household, occupation, family size, income of the household, land holding and livestock. Socioeconomic characteristics are considered a good indicator of measuring economic progress and social change and represent a good picture of the household’s living status and good quality standard of lifestyle.

4.3 CDDS and WDDS Indicator Tabulation Plan

Tabulation of the Children’s dietary diversity Score (CDDS) and Women’s dietary diversity score (WDDS) are comparatively simple themes. Firstly, the children’s and women’s dietary diversity score variables are computed for each household. The value of dietary diversity pattern of children and women score ranges from 0-7 and 0-9 respectively (FAO, 2011).

Table 1
CDDS and WDDS Indicator Tabulation Plan

CDDS (0-7) and WDDS (0-9)	The total amount of food categories consumed by household women and children. Values for A through G and A through I will be either “0” or “1”. Sum (A+B+C+D+E+F+G) Sum (A+B+C+D+E+F+G+H+I)
---------------------------	---

4.4 Combination of 7 and 9 Food Groups to produce CDDS and WDDS

FAO has categorized foods into 7 and 9 food groups to calculate the CDDP and WDDP, respectively.

Table 2
Combination of 7 Food Groups to DDS

Question No.	Food Groups	Yes = 1, No = 0
1	Cereals and tubers	if yes=1, otherwise=0
2	Meat products	if yes=1, otherwise=0
3	Dairy products	if yes=1, otherwise=0
4	Eggs	if yes=1, otherwise=0
5	Vegetables and fruits with vitamin A	if yes=1, otherwise=0
6	Legumes and nuts	if yes=1, otherwise=0
7	Other fresh vegetables and fruits	if yes=1, otherwise=0

Table 3
Combination of Food Groups to produce WDDS

Question No.	Food groups	Yes = 1, No = 0
1	Starchy staples	if yes=1, otherwise=0
2	Vegetables (dark green leafy)	if yes=1, otherwise=0
3	Vegetables and fruits with vitamin A	if yes=1, otherwise=0
4	Other fresh fruits and vegetables	if yes=1, otherwise=0
5	Organ meat	if yes=1, otherwise=0
6	Meat and seafood	if yes=1, otherwise=0
7	Eggs	if yes=1, otherwise=0
8	Nuts, seeds, and legumes	if yes=1, otherwise=0
9	Milk and milk-related items	if yes=1, otherwise=0

4.5 Formula of DDP

The formula of DDP is

$$DDP = \sum_{i=1}^n P_i$$

P_i = displays the *ith* food item's score.
 $n = 7$ and 9 food classes for children and women, respectively.
 The CDDP score is between 0 and 7.
 The DDP score is between 0 and 9.

4.6 CDDS and WDDS Ordering

There are three levels of dietary diversity score, according to FAO (2011).

Table 4: CDDS Classification

CDDS	Ordering
0-3	Lower dietary diversity
4-5	Medium dietary diversity
6-7	Higher dietary diversity

- The lower range consist of (0-3)
- The medium range consist of (4-5)
- The higher range consist of (6-7)

**Table 5
WDDS Classification**

WDDS	Classification
0-3	Lower dietary diversity
4-5	Medium dietary diversity
6-9	Higher dietary diversity

- The lower range consist of (0-3)
- The medium range consist of (4-5)
- The high range consist of (6-9)

For analysis, ordered logistic regression will be suitable.

4.7 Econometric Model

Descriptive statistics have been used to explain the characteristics of children and women. For data analysis in this study, ordered logistic regression was performed. The ordered logistic regression approach is appropriate given most of the properties of this data (Arene & Anyaeji, 2010; Felker-Kantor & Wood, 2012).

4.8 General Form

We assumed that our n regressions would be in odd ratio form or j -ordered alternatives.

$$Y_i = j, \text{ if } a_{j-1} \leq Y_i \leq a_j \tag{1}$$

The probability that observation i will select alternative j .

$$P_{ij} = P(Y_i = j) = p(a_{j-1} < Y_i < a_j) = \exp(a_j - X_i\beta) / 1 + \exp(I - X_i\beta) \quad (2)$$

Our study has three categories, each of which is determined by the formula $y_i=j$. Each category that results from the division of observation I into j subcategories ($i=j$) is larger and has a higher level of significance. As a result, two are larger than one, while one is less than two. Cutoff or threshold parameters are used to differentiate between these groups. In the above equation (b) a_{j-1} 's intercept term is smaller or less than a_j . So, intercept a_j is therefore more than a_{j-1} .

In an ordered logistic model, for each category the independent variables' slope coefficients are the same; the only variable that differs is the intercept (cutoff) term. The common form of an ordered logistic regression model is

$$Y_i = \sum_n^k \beta_n X_{in} + \mu \quad (3)$$

Where,

- β_i = estimation of the b parameter
- Y_i = dependent variable
- X_i = independent variable
- μ = error term
- I = observation 1,.....k

4.9 Empirical Model

$$Y_1 = \beta_1 X_1 + \beta_2 X_2 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_8 X_8 + \mu \quad (4)$$

$$Y_2 = \beta_1 X_1 + \beta_2 X_2 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_9 X_9 + \mu \quad (5)$$

4.9.1 For Children

Y_1 =CDDS, X_1 =child's age, X_2 =child's gender, X_3 =mother's age, X_4 =maternal education, X_5 =maternal current employment status, X_6 =income of household, X_7 =land holding and X_8 =number of livestock.

4.9.2 For Women

Y_2 =WDDS, X_1 =women's age, X_2 =marital status, X_3 =education level, X_4 =occupation, X_5 =status within the household family size, X_7 =income of household land holding, X_8 = land holding and X_9 =number of livestock.

5. Empirical Results

5.1 Socioeconomic Characteristics of Children and Women

Socioeconomic characteristics are explained in a given table (6 and 7) containing children and women. The children's and women's dietary variety score was estimated using socioeconomic factors and ordered logistic regression analysis was done to look at the variables influencing the score.

5.2 Socioeconomic Characteristics of Children

Table 6 explain the children's CDDP mean score and socioeconomic factors. It shows the total variable that is used in estimate techniques. With a minimum age of 6 and a maximum age of 53, children are 30.61 months old on average. 1.46 percent is the mean value for a child's gender, its minimal value is 1, and its highest value is 2. The mean value of the mother's age is

28.06 (years), with the mother's age minimum value being 18 and its maximum value being 45. The mean value of maternal education is 8.173 (schooling year), with a minimum value of maternal education of 0 and a maximum value of 14. The average maternal current employment status is 1.047 percent, with the minimum and maximum values being 0 and 2, respectively. The mean value of household income is 25303.33 rupees, with the minimum value of income of a household of 7000 (per month) and a maximum value of 80000 (per month). The average value of landholding is 0.52, with the value of landholding minimum and maximum values being 0 and 1. The numbers of livestock mean value is 0.55 animals, and the minimum and maximum values of the number of livestock are 0 and 1 respectively. The children's dietary diversity score (CDDS) has an average value of 4.27 and a range of 1 to 7, with 7 being the highest possible score. The dependent variable y (order) has a mean value of 1.84, and minimum and maximum values are 1 and 3, respectively.

Table 6
Socioeconomic Characteristics of Children

Variables	Mean	Std. Dev.	Min	Max
Child's age (months)	30.61	16.97	6	53
Child's gender	1.46	0.4992	1	2
Mother's age	28.06	6.807	18	45
Maternal education	8.173	3.833	0	14
Maternal current employment status	1.047	0.7702	0	2
Income of household	25303.33	12423.33	7000	80000
Holdings on land	0.5167	0.5005	0	1
Number of animals	0.5467	0.4986	0	1
CDDS	3.92	1.85	1	7
Y (order)	1.84	0.732	1	3

5.3 Socioeconomic Characteristics of Women

Table 7 describe the WDDP mean score for women and socioeconomic characters. It displays each variable that is used in the estimation methods. Women's median ages range from 29.23 to 49 years old, with 15 being the youngest and 49 being the oldest. The marital status means the value is 0.61 percent, with the minimum value of marital status being 0 & maximum value being 1. The education level means the value is 9.41, with the minimum value of education level being 0 & maximum value being 16. The occupation's mean value is 1.873 percent, with 1 being the least valuable occupation, and 3 being the highest.

Table 7
Socioeconomic Characteristics of Women

Variables	Mean	Std. Dev.	Min	Max
Women's (years)	29.23	8.114	15	49
Marital status	0.61	0.4886	0	1
Education Level	9.41	4.397	0	16
Occupation	1.873	0.812	1	3
Status within household	2.08	0.806	1	3
Family size	5.98	2.11	2	9
Income of household	28330	16291.07	7000	80000
Holdings on land	0.573	0.495	0	1
Number of animals	0.59	0.493	0	1
WDDS	3.89	1.88	1	9
Y (order)	1.723	0.674	1	3

The average size of a family is 5.98 (number of household members), with a minimum family size of 2 and a maximum family size of 9. The average household income is 28330 rupees, with the lowest monthly income being 7000 and the highest monthly income being 80000 (per month). The average value of landholding is 0.573, with the smallest value being 0 (having no land) and the highest value being 1 (having land). The number of livestock mean value is 0.59

animals, with the smallest value of the number of livestock being 0 and the highest value is 1. The women’s dietary diversity score (WDDS) has a mean value of 4.87 and ranges from 1 to 9, with 1 being the lowest value and 9 being the highest. The dependent variable y (order) has a mean value of 1.723 and a range of values between 1 and 3.

5.4 Children’s Dietary Diversity Score Information

Children’s Dietary Diversity Score (CDDS) is classified into low, medium, and high categories in our data analysis.

5.5 CDDS Order for Children

Information about the ranking of children’s dietary diversity is shown in table 7.

Table 8
CDDS Order

Y order category	Frequency	Percentage
1 = (0-3)	108	36.00
2 = (4-5)	132	44.00
3 = (6-7)	60	20.00
Total	300	100.00

Table 8 displays the ranking of the children's dietary diversity score. Lower order category one is 36 percent in rural areas, higher order categories are 20 percent and middle order categories are 44 percent.

5.6 WDDS Order for Women

Information about the ranking of women’s dietary diversity is shown in table 9.

Table 9
WDDS Order

Y order category	Frequency	Percentage
1 = (0-3)	121	40.33
2 = (4-5)	141	47.00
3 = (6-9)	38	12.67
Total	300	100.00

Table 9 shows the ranking of the women's dietary diversity score. Lower order category one is 40.33 percent in rural areas, higher order categories are 12.67 percent and middle order categories are 47 percent. Both children and women data indicate that the lower order category is higher in women and lower in children. The medium-order category is lower in children and higher in women. The higher-order category is higher in children and lowers in women.

5.7 Children’s Dietary Diversity Score Information

The children’s dietary diversity score (CDDS) provides information on the foods that are consumed by children.

5.8 CDDS information for Villages

Children’s dietary diversity score information is presented in table 10. The greater dietary diversity score in the village is 7, or 9.67%, whereas the lower dietary diversity score is 1, or 15.33%.

Table 10
CDDS for Children in the village of District Vehari, Southern Punjab

CDDS	Frequency	Percentage
1	46	15.33
2	33	11.00
3	29	9.67
4	71	23.67
5	61	20.33
6	31	10.33
7	29	9.67
Total	300	100.00

5.9 WDDS Information for Villages

Women's dietary diversity score information is presented in table 10. In terms of dietary diversity, the village has a lower score of 1 or 5.33 percent, and a higher score of 9 or 3.33 percent.

Table 11
WDDS for Women in the village of District Vehari, Southern Punjab

WDDS	Frequency	Percentage
1	16	5.33
2	76	25.33
3	29	9.67
4	77	25.67
5	64	21.33
6	9	3.00
7	10	3.33
8	9	3.00
9	10	3.33
Total	300	100.00

5.10 Estimation of Ordered Logistic Regression

There are a variety of factors that influence the score for dietary diversity in women and children. The socioeconomic characteristics of children are crucial in determining children's dietary diversity Patterns. Regression results for children and women's nutritional diversity patterns in District Vehari, Southern Punjab are presented in table 10 for children and 11 for women.

5.11 Results of Ordered Logistic Regression for Children

Table 12 presents the characteristics of children's dietary diversity scores. Calculations were made using an OLRM (Ordered Logistic Regression Model) to estimate the impact of different independent variables on the dependent (y order) variable, children's dietary diversity. In this model dependent variable is Y ordered and the independent variables are the age of the children, the gender of the children, the mother's age, maternal education, the income of the household, the maternal current employment status land holding, and the number of livestock. The results of the chi-square test are 149.42 and the p-value at the 1% level of significance is 0.0000, which is highly significant. It illustrates the statistical significance of our model. The Breusch-Pagan test was used in this study to examine the data's heteroscedasticity. In this regard, the null hypothesis was set equal to the constant variance. The result of the test showed the chi-square test value was 24.82 with p value less than 0.01. It indicated that in children data heteroscedasticity existed. So, in that situation, we used robust standard errors to remove heteroscedasticity (Williams, Patricia Taylor, & Schwannauer, 2016).

The explanatory variables which were found significant are the age of the children, the mother’s age, the household’s income, maternal education level, land holding, and the number of livestock while the gender of children and maternal current employment status was found insignificant. These results are given in below table 12. The pseudo R² gives R-square a value of 0.55. This pseudo- R² score shows that the model is reasonably efficient. According to the regression's findings, children's ages show positive coefficients that are significant at the 1% level. In other words, the ordered log odds of being in the high category would increase by 0.187 for every unit increase in the variable X1 (child's age). While X2 (children's gender) has negative coefficients, they are insignificant.

In our sample size, the mother's age has a positive coefficient. One unit of the variable X3 (mother's age) increase would indicate a 0.059 increase in log odds of being at a high level of Y order, which is significant at 1%, assuming all other variables are kept constant. Maternal education level shows a positive correlation and is statistically significant at 1%. The ordered log odds of being in the high category will increase by 0.194 units for every unit increase in X4 (maternal education level).

In our sample size, maternal current work status has a positive but insignificant impact. The coefficient for the household income is positive and statistically significant at 1%. For each unit increase in X6, the ordered log odds of being in a higher category will increase by 0.000359 levels (income). A 5 percent level of land holding has a positive impact and is significant. The probability of being in the high category increase by 1.22 unit for every unit increase in X7. In our sample size, livestock has a positive effect. For every unit of X8 increase, the ordered log odds of being in the highest category will increase by 0.94 units, or a significant 10% increase.

Table 12
Results of Ordered Logistic Regression for Children with Robust Standards Errors

Variables	Coefficient	Robust Std. Err.	P value
Child’s age	0.187	0.02	0.000***
Child’s gender	-0.297	0.34	0.334
Mother’s age	0.059	0.02	0.007***
Maternal education	0.194	0.05	0.000***
Maternal current employment status	0.105	0.22	0.631
Income of household	0.001	0.001	0.05**
Landholding	1.22	0.616	0.048**
Landholding	0.94	0.56	0.093*
Number of observation		300	
Wald chi(8)= 149.42			P value= 0.0000***
Log-likelihood		-140.3	
Pseudo R ²		0.55	
Breusch-Pagan test			
Chi-square (1)		24.82	
P value		0.000	

Notes: * Significance level at 10%, ** Significance level at 5%, *** Significance level at 1%.

5.12 Results of Ordered Logistic Regression for Women

Table 13 presents the characteristics of women’s dietary diversity score. To estimate the impact of various independent variables on the dependent (y order) variable, women's dietary diversity was using the ordered logistic regression model (OLRM). It estimates the coefficients of the ordered logistic regression model. In this model dependent variable is Y-ordered and the independent variables are the age of women, marital status, education level, occupation, the income of the household, family size, land holding, and the number of livestock. The results of the chi-square test are 104.90 and the p-value at the 1% level of significance is 0.0000, which is highly significant. It illustrates the statistical significance of our model.

The Breusch-Pagan test was used in this study to examine the data's heteroscedasticity. In this regard, the null hypothesis was set equal to the constant variance. The result of the test showed the chi-square test value was 8.98 with p value less than 0.01. It indicated that in women's data heteroscedasticity existed. So, in that situation, we used robust standard errors to remove heteroscedasticity (R. Williams, 2012). The explanatory variables which were found significant are the age of women, education level, the income of the household, marital status, land holding, and the number of livestock while the occupation, family size, and status within the household were found insignificant. These results are given in below table 4.8. The pseudo R^2 gives R-square a value of 0.29. This pseudo- R^2 score shows that the model is reasonably efficient.

The regression analysis's findings indicate that women's ages have positive coefficients and are significant at the 5% level. To put it another way, we may say that a 1 unit rise in the variable X1 (women's age) would result in an increase of 0.035 in the ordered log odds of falling into the high category. Even though the coefficients for X2 (married status) are negative, they are still significant at the 1% level. In our sample size, the education level of women has a positive coefficient. Given that all other variables are maintained constant and it is significant at 1% and a 0.12 increase in log odds of being at a high level of Y order would be predicted for every unit increase in variable X3 (women's education level). While occupation has a negative coefficient, it is insignificant. The household income has a positive coefficient and is statistically significant at a level of 1%. The ordered log odds of being in the high category will rise by 0.0000757 units for every unit increase in X5 (income). In our sample size, family size and status within the household had negative and insignificant effects. Our sample size's land area has a positive and significant impact. The odds of being in a higher category increase by 1.18 units for every unit increase in X8. In our sample size, livestock has a positive effect. For every unit increase in X9, the ordered log odds of being in the high group increase by 0.56 units, which is significant at 5%.

Table 13
Results of Ordered Logistic Regression for Women with Robust Standards Errors

Variables	Coefficient	Robust Std. Err.	P value
Woman's age (Years)	0.035	0.02	0.033**
Marital status	-1.95	0.36	0.000***
Education Level	0.12	0.04	0.002***
Occupation	-0.04	0.18	0.816
Income of household	0.001	0.001	0.000***
Status within household	-0.25	0.21	0.236
Family size	-0.0009	0.06	0.988
Holdings on land	1.18	0.35	0.001***
Number of animals	0.56	0.27	0.038**
Number of observation		300	
Wald chi(9)= 104.90			P value= 0.0000***
Log-likelihood		-210.1	
Pseudo R^2		0.29	
Breusch-Pagan Test			
Chi-square (1)		8.98	
P value		0.0027	

Notes: * Significance level at 10%, ** Significance level at 5%, *** Significance level at 1%.

6. Conclusion

The major aim of this study is to investigate the variables that affect women's and children's dietary diversity patterns. The findings of this study show that rural children's and women's diets are diverse in Southern Punjab, and District Vehari, which are impacted by their characteristics. The finding of this study indicates that the age of the child has positive

coefficients and a significant effect on the diversity of children's diets. It indicates that the age of the child affects to higher dietary diversity score. The same results for rural children of all ages were reported by Amugsi et al. (2015). It suggests that a woman's age has an impact on her score on dietary diversity. Because in older age they prefer fewer food choices as compared to the youth. The findings of this study indicate that gender of the child has negative coefficients and an insignificant effect on the children's dietary diversity pattern. The results of the mother's age have positive coefficients and significant effects on the children's dietary diversity pattern.

Children's and women's dietary diversity patterns are positively impacted by maternal and female schooling outcomes. The result indicates that maternal current employment status has positive coefficients and insignificant effects on the dietary variety pattern of children. The results of this study show that occupation has a negative coefficient and an insignificant impact on the diversity of diet among women. The findings of this study indicate that the family size of rural households has negative coefficients and insignificant effects on the women's dietary diversity pattern. In comparison to households with lower levels of income, households with greater incomes have women who score higher on dietary diversity. The results show that mothers' and children's dietary variety patterns are significantly impacted by land ownership, with a positive coefficient. According to Beyene and Muche (2010); Mallick and Rafi (2010); Mbwana, Kinabo, Lambert, and Biesalski (2016) the findings of rural areas' land holdings are similar. Landholding is considered a vital factor in determining children's and women's dietary diversity scores. The higher size of land holding indicates a higher dietary diversity score of children and women (Firdaus & Cahyono, 2017; Mbwana et al., 2016). The results demonstrate that the quantity of cattle has a positive coefficient and a sizable impact on the dietary diversity pattern of women and children.

In this study, an ordered logistic regression model (OLRM) is used to examine the association between the characteristics of women and children and the Dietary Diversity Score (DDS). Samples are taken from 300 women and 300 children from rural areas of district Vehari, Southern Punjab. The average value of women's dietary diversity score is (3.89) and children's dietary diversity score is (3.92). The WDDS and CDDS provide a summary of the food consumed by women and children in terms of whether it contains good nutrients or not. Furthermore, according to OLRM's final findings, various socioeconomic characteristics have an impact on both mother's and children's dietary diversity scores such as the age of the children, gender of the children, the mother's age, maternal education, the income of the household, maternal current employment status, age of women, education level, occupation, marital status, family size, land holding and the number of livestock. So, it can be concluded that the average age of the child is (30.61) in rural areas. The average mother's age is 28.06. The average education of maternal is (8.173). The average child's gender in a rural area is 1.46. The average maternal current employment status is (1.047) in rural areas. It can be also concluded that the average women's age is 29.23 in rural areas. The average marital status is 0.61 while the average status within the household is 2.08. The average women's education level is 9.41. The average occupation of women is (1.873). The average family size in rural areas is 5.98. The results of this study indicated that these socioeconomic influences have an impact on children and women's dietary diversity scores as well as the status of children and women in rural areas. Generally, it is a good tool to measure human well-being in rural areas. In this scenario, it can be concluded that various socioeconomic factors influence the children's & women's dietary diversity scores in selected areas.

6.1 Policy Recommendations

The research provides information on several significant policy implications that affect mothers' and kids' dietary variety scores in rural areas. Pakistan is a developing nation where food security and dietary diversity for women and children are issues. Some important policy recommendations to increase children's and women's dietary diversity in selected areas of

Pakistan. To improve the dietary variety scores of women and children, authorities should implement programs for food diversification in rural areas. To increase rural women's levels, the government may undertake such programs. Government should give more liberal grants to girls' schools. The government should start educating people about maternal nutrition in rural areas. The programs should focus on maternal nutrition and childcare practices. The government should provide subsidies to help rural residents keep more cattle, as this will improve the variety of foods available. Investment schemes may be created with a rural focus, which would significantly improve household income and facilitate easy access to food.

6.2 Future Research Directions

In the future, this research can be conducted in some other areas of Pakistan like Baluchistan, Sindh, and KPK. This model can also be used to assess the nutritional standard of children, men & women with different recall periods. This can also be used to calculate the number of calories in various household food products consumed each day.

Authors Contribution

Asma Sajjad: conceptualization, data curation, writing, original draft preparation

Muhammad Mansha: methodology, results, and discussion

Kiran Sarwar: visualization, investigation, writing, reviewing and editing

Haris Ali Siddique: study design and editing

Conflict of Interests/Disclosures

The authors declared no potential conflicts of interest w.r.t the research, authorship and/or publication of this article.

References

- Agrawal, S., Kim, R., Gausman, J., Sharma, S., Sankar, R., Joe, W., & Subramanian, S. (2019). Socio-economic patterning of food consumption and dietary diversity among Indian children: evidence from NFHS-4. *European Journal of Clinical Nutrition*, 73(10), 1361-1372. doi:<https://doi.org/10.1038/s41430-019-0406-0>
- Ali, N. B., Tahsina, T., Hoque, D. M. E., Hasan, M. M., Iqbal, A., Huda, T. M., & El Arifeen, S. (2019). Association of food security and other socio-economic factors with dietary diversity and nutritional statuses of children aged 6-59 months in rural Bangladesh. *PloS one*, 14(8), e0221929. doi:<https://doi.org/10.1371/journal.pone.0221929>
- Amugsi, D. A., Mittelmark, M. B., & Lartey, A. (2014). Dietary diversity is a predictor of acute malnutrition in rural but not in urban settings: evidence from Ghana. *Child Care Practices, Resources for Care, and Nutritional Outcomes in Ghana: Findings from Demographic and Health Surveys*.
- Amugsi, D. A., Mittelmark, M. B., & Oduro, A. (2015). Association between maternal and child dietary diversity: an analysis of the Ghana demographic and health survey. *PloS one*, 10(8), e0136748. doi:<https://doi.org/10.1371/journal.pone.0136748>
- Anila, S., & Adiq, K. (2011). Determinants of food security at household level in Pakistan. *African journal of business Management*, 5(34), 12972-12979.
- Arene, C., & Anyaeji, R. (2010). Determinants of food security among households in Nsukka Metropolis of Enugu State, Nigeria. *Pakistan Journal of Social Sciences*, 30(1), 9-16.
- Arimond, M., & Ruel, M. T. (2002). *Progress in developing an infant and a child feeding index: an example using the Ethiopia Demographic and Health Survey 2000*. Retrieved from
- Arimond, M., & Ruel, M. T. (2004). Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. *The Journal of nutrition*, 134(10), 2579-2585. doi:<https://doi.org/10.1093/jn/134.10.2579>
- Asghar, Z., & Muhammad, A. (2013). Socio-economic determinants of household food insecurity in Pakistan.

- Bernell, S. L., Weber, B. A., & Edwards, M. E. (2006). Restricted opportunities, personal choices, ineffective policies: what explains food insecurity in Oregon? *Journal of Agricultural and Resource Economics*, 31(2), 193-211.
- Beyene, F., & Muche, M. (2010). Determinants of food security among rural households of Central Ethiopia: an empirical analysis. *Quarterly Journal of International Agriculture*, 49(892-2016-65219), 299-318. doi:<https://doi.org/10.22004/ag.econ.155555>
- Eertmans, A., Baeyens, F., & Van Den Bergh, O. (2001). Food likes and their relative importance in human eating behavior: review and preliminary suggestions for health promotion. *Health education research*, 16(4), 443-456. doi:<https://doi.org/10.1093/her/16.4.443>
- Ekesa, B., Blomme, G., & Garming, H. (2011). Dietary diversity and nutritional status of pre-school children from Musa-dependent households in Gitega (Burundi) and Butembo (Democratic Republic of Congo). *African Journal of Food, Agriculture, nutrition and development*, 11(4), 4896-4911. doi:10.4314/ajfand.v11i4.69141
- FAO. (2011). The State of Food and Agriculture 2010-2011. Retrieved from <https://www.fao.org/3/i2050e/i2050e00.htm>
- Felker-Kantor, E., & Wood, C. H. (2012). Female-headed households and food insecurity in Brazil. *Food Security*, 4(4), 607-617. doi:<https://doi.org/10.1007/s12571-012-0215-y>
- Firdaus, N., & Cahyono, B. D. (2017). How food consumption pattern and dietary diversity influence food security: Evidence from DI Yogyakarta and East Nusa Tenggara. *Jurnal Ekonomi dan Pembangunan*, 25(1), 27-38. doi:<https://doi.org/10.14203/JEP.25.1.2017.27-38>
- Hatløy, A., Torheim, L. E., & Oshaug, A. (1998). Food variety—a good indicator of nutritional adequacy of the diet? A case study from an urban area in Mali, West Africa. *European Journal of Clinical Nutrition*, 52(12), 891-898. doi:<https://doi.org/10.1038/sj.ejcn.1600662>
- Hussain, Z., & Akram, W. (2008). Persistent food insecurity from policy failures in Pakistan. *The Pakistan development review*, 47(4), 817-834.
- Jawad, I. H., Al Jebory, K. H. H., & Baey, H. A. (2016). Assessment of Nutritional Status among Children less than 5 years old in Hilla City. *International Journal of Scientific and Research Publications*, 6(8), 276-280.
- Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food quality and preference*, 20(2), 70-82. doi:<https://doi.org/10.1016/j.foodqual.2007.11.002>
- Mallick, D., & Rafi, M. (2010). Are female-headed households more food insecure? Evidence from Bangladesh. *World development*, 38(4), 593-605. doi:<https://doi.org/10.1016/j.worlddev.2009.11.004>
- Mbwana, H. A., Kinabo, J., Lambert, C., & Biesalski, H. K. (2016). Determinants of household dietary practices in rural Tanzania: Implications for nutrition interventions. *Cogent Food & Agriculture*, 2(1), 1224046. doi:<https://doi.org/10.1080/23311932.2016.1224046>
- Mirmiran, P., Azadbakht, L., & Azizi, F. (2006). Dietary diversity within food groups: an indicator of specific nutrient adequacy in Tehranian women. *Journal of the American college of nutrition*, 25(4), 354-361. doi:<https://doi.org/10.1080/07315724.2006.10719546>
- Ochieng, J., Afari-Sefa, V., Lukumay, P. J., & Dubois, T. (2017). Determinants of dietary diversity and the potential role of men in improving household nutrition in Tanzania. *PLoS one*, 12(12), e0189022. doi:<https://doi.org/10.1371/journal.pone.0189022>
- Ogunba, B. O. (2010). Diet diversity in complementary feeding and nutritional status of children aged 0 to 24 months in Osun State, Nigeria: a comparison of the urban and rural communities. *ICAN: Infant, Child, & Adolescent Nutrition*, 2(6), 330-335. doi:<https://doi.org/10.1177/1941406410385451>
- Olney, J. W., Labruyere, J., & Price, M. T. (1989). Pathological changes induced in cerebrocortical neurons by phencyclidine and related drugs. *Science*, 244(4910), 1360-1362.
- Patricia, O., & Ekebisi, C. (2016). Assessing dietary diversity score and nutritional status of rural adult women in Abia State, Nigeria. *Food Sci Nutr Technol*, 1(1), 000106.
- Powell, B., Bezner Kerr, R., Young, S. L., & Johns, T. (2017). The determinants of dietary diversity and nutrition: Ethnonutrition knowledge of local people in the East Usambara

- Mountains, Tanzania. *Journal of ethnobiology and ethnomedicine*, 13(1), 1-12.
doi:<https://doi.org/10.1186/s13002-017-0150-2>
- Rah, J. H., Akhter, N., Semba, R. D., De Pee, S., Bloem, M. W., Campbell, A. A., . . . Kraemer, K. (2010). Low dietary diversity is a predictor of child stunting in rural Bangladesh. *European Journal of Clinical Nutrition*, 64(12), 1393-1398.
doi:<https://doi.org/10.1038/ejcn.2010.171>
- Sodjinou, R., Agueh, V., Fayomi, B., & Delisle, H. (2009). Dietary patterns of urban adults in Benin: relationship with overall diet quality and socio-demographic characteristics. *European Journal of Clinical Nutrition*, 63(2), 222-228.
doi:<https://doi.org/10.1038/sj.ejcn.1602906>
- Tarini, A., Bakari, S., & Delisle, H. (1999). The overall nutritional quality of the diet is reflected in the growth of children from Niger. *Cahiers d'études et de recherches francophones/Santé*, 9(1), 23-31.
- Torheim, L. E., Ouattara, F., Diarra, M. M., Thiam, F. D., Barikmo, I., Hatløy, A., & Oshaug, A. (2004). Nutrient adequacy and dietary diversity in rural Mali: association and determinants. *European Journal of Clinical Nutrition*, 58(4), 594-604.
doi:<https://doi.org/10.1038/sj.ejcn.1601853>
- Williams, C., Patricia Taylor, E., & Schwannauer, M. (2016). A web-based survey of mother-infant bond, attachment experiences, and metacognition in posttraumatic stress following childbirth. *Infant Mental Health Journal*, 37(3), 259-273.
doi:<https://doi.org/10.1002/imhj.21564>