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Socio-Economic and Demographic Determinants of Nutritional Status in South Punjab, Pakistan: A Multinomial Logistic Regression Analysis

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Abstract

Good health and nutrition go hand in hand, providing the foundation for a vibrant and fulfilling life. This study examines the nutritional status among the youth of South Punjab of Pakistan and identifies some socioeconomic and demographic determinants of their nutritional. Using the sample of 685 students, collected through self-administered interviews and online survey, Body Mass Index (BMI) is calculated to measure the nutritional status. Results indicate that 33.1% of respondents are underweighted, 38.5% are normal or healthy-weighted, 14.6% are over-weighted and 13.7% are obese. Further, A Multinomial Logistic Regression model, carrying the socioeconomic and demographic determinants of nutritional status, is estimated by applying Maximum Likelihood Method (MLM). The results of this model suggest that the socioeconomic and demographic characteristics of youth like age, gender (male), and middle income relative to higher family Income group are positively associated with higher BMI/ obesity. While, the absence of a driver, absence of a housemaid, a parent occupation (government and private jobs relative to no employment), and lower levels of education relative to higher have more likelihood to have healthy-weight. On the other hand, the characteristics like marital status (single relative to married), family size, and Family income group (low and upper-lower relative to upper-higher income) are inversely related to higher values of BMI/obesity whereas students of the public relative to private institutes and parent occupation (self-owned small/large scale businesses relative to no-employment) have less probability of having normal weight.

Keywords: Nutritional Status, BMI, South Punjab, MLRM

1. Introduction

Good health is not just the absence of disease, but a state of complete physical, mental, and social well-being. It is a basic human right that is acknowledged in the WHO constitution of 1946. Realizing the importance of the said right, good health and ideal nutritional status remain at the heart of all development plans and policies of all nations irrespective of socio-economic conditions and development stage of their countries. However, this basic right is confronted with many challenges around the globe. As reported by United Nations Development Program (UNDP) in 2017, the number of undernourished people reached 821 million. Nearly 63 percent of the World's population is hungry in Asia. Of about 151 million children under five, 22 percent, are still stunted, more than 1 in 8 adults are obese and 1 in 3 women of reproductive age are anemic. To meet such challenges, a collection of 17 global goals, popularly known as Sustainable Development Goals (SDGs), set by the United Nations General Assembly (UNGA), were introduced in 2015 and the focus of these goals is to achieve a better and more sustainable future for all. One of those global goals is to "End hunger, achieve food security and improved nutrition, and promote sustainable agriculture" (UNDP, 2017; Ali and Senturk, 2019; Mehmood et al., 2022).

Good nutritional status is very important for a healthy life. Especially at a young age, its importance upsurges as this is the age when a person takes major decisions in one's life like the decision about the discipline of study, the decision of career, marriage, and even family planning (WHO, 2006). In UNDP reports like South Punjab's Regional Plan for Sustainable Development and South Punjab Deep Dive Report 2022, it is discussed that in the areas like South Punjab which is not very developed all such decisions are taken during this age span as there is the tendency of early marriages and the level of education is no so high (Akseer et al., 2017; Senturk and Ali, 2021).

Poor nutritional status among youth like under-weightiness, over-weightiness, obesity, and deficiencies of micronutrients, etc. put human life at various hazards. An underweight person is supposed to be weak and unhealthy and at risk of any type of disease (Rogol et al., 2000). Due to poor health and weak body, underweighted youth especially in their early adulthood face many issues of physical growth as well as hurdles in achieving a good education, healthy relation, and their desired jobs and employment owing to the low spark and inefficiencies at work and education out of their poor nutritional status. Conversely, overutilization of food lead to the overweight and a high prevalence of obesity which in itself is a disease and breeds many health issues like cardiovascular diseases, anemia, high blood pressure (BP), and diabetes among people moderately in very young age and intensively at the latter stage of age. It curtails human productivity and also causes many psychological issues due to illness and curtailed purchasing power and results in poor socio-economic status (Rogol et al., 2000; Akseer et al., 2017).

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Nutritional status is greatly influenced by many socio-economic factors like the income levels of people, prices of food, daily routine physical activities of people, their sports activities, their living standard and education level, and even literacy ratios among their families (Puciato and Rozpara, 2020). Social and economic setup and physical environment also shape eating behaviors and set trends among people.

South Punjab is the southern part of Pakistan's most populated province of Punjab which includes three divisions out of nine divisions of Punjab that are Multan (abbreviated as MUL), Bahawalpur (abbreviated as BWP), and Dera Ghazi Khan (abbreviated as DGK) divisions. South Punjab is reported, by UNDP, to be one of the most deprived areas of Pakistan in terms of its economic conditions "South Punjab Regional SDGs Indicators Comparison with Centre and North" report prepared by the UNDP in partnership with South Punjab Secretariat, says that about 55% of the population is living below the 50% of median income (per capita) in the rural southern region of Punjab in Pakistan. 31% of the population in southern Punjab is living below the predefined national poverty line whereas this percentage is relatively lower in central and north Punjab.

Contemporaneous challenges to the youth of Pakistan and especially to the youth of South Punjab includes majorly the issue of malnutrition, micronutrient deficiencies, obesity epidemic, increasing trend of eating junk and fast food, dieting trends, smoking habits and drug addiction, early marriages of girl especially in rural areas, breastfeeding among teenage mothers, lifestyle challenges due to age of the computer, Covid-19 Pandemic and its resulted in lifestyle (HRCP, 2022).

The objective of this study is to measure the height and weight of each entity in the sample and construct their respective BMI and assess their nutritional status and identify the prevalence of under-weight, normal-weight, overweight, and obesity among youth. It further intends to identify the major demographic and socio-economic determinants of nutritional status among youth.

2. Literature Review

This section reviews the empirical studies directly related to the concept, measurement, and determinants of nutritional status generally related to all age groups and genders from all over the world.

Ahmad et al. (2009) collected the anthropometric data of 654 adolescent federal school students of matriculation level aged 14 to 16 years from Islamabad city to assess their nutritional status and eating practices. For the measurement of eating practices purpose, the authors used food frequency questionnaires to acquire data on the meal as well as snacking schedules including 3 meals i.e., breakfast, lunch, and dinner, and 3 types of snacking i.e., school recess time, tea time, and bedtime snacking. Moreover, 3 days food record diary was utilized to analyze the type of consumed foods/drinks like fast or junk food, vegetable, and fruit intake, meat and dairy product intake and consumption of cereals, drinking of frizzy drinks, etc. For the measurement of nutritional status, the instrument of BMI for age was utilized.

Powell et al. (2010) explored the economic factors of increasing obesity and food consumption patterns among adolescents in the U.S. and unveiled that apart from the high food prices of healthy items relative to less healthy ones, more fast food restaurants and food point availability contributed to obesity prevalence. The number of food stores and marts was not very strongly associated with BMI in adults but many socioeconomic, ethnic, and racial disparities among adults were associated with BMI. Bhandari (2014) designed and conducted a descriptive and analytical cross-sectional study to examine the nutritional status and dietary or eating practices and to discover Bangalore city's high school girls, aged 12-17 years, beliefs regarding nutrition. By stratified random sampling, 150 students from two schools were approached to get some anthropometric data like height and weight measurements to calculate Quetelet's Index, some demographic and economic characteristics of girls and their families like education and occupation were also noted and some clinical examinations like hemoglobin tests results were also recorded via a semi-structured questionnaire and many descriptive and inferential statistical tools like mean, SD, frequency, and range, etc. were utilized for analysis and figured out that the more than 70% girls were malnourished especially undernourished as they were belonging to low-income families and less educated.

Ahsan et al. (2017) analyzed the nutritional status of children living in the slums and non-slums of Bangladesh and for that, the logistic regression models were estimated which exposed that the child's age, mother's education, and socioeconomic status of the family were significant factors of stunting and wide prevalence of underweight levels among the children of slums while in non-slums except the mothers' working outside their homes and media, all other individual characteristics like age, height, and weight were the reasons. Asmare et al. (2018) determined the relationship between the nutritional status of primary school children in Ethiopia and their academic performance by getting cross-sectional data from 436 students of both private and public sector schools via a multi-stage sampling method and found evidence of 27.5% stunting, 20.4% underweight and 8.7% wasting, among students. Moreover, poor educational performance was observed more among the stunted, underweight, and wasted students than the normal ones endorsed by the results of multivariable logistic regression.

Desai et al. (2019) analyzed the nutritional status of medical students in an Indian city called Gujarat and for this purpose, a cross-sectional study was designed according to which a self-administrated research questionnaire was developed to collect the sample data from both male and female students, especially 254 adolescents. BMI using data of Weight and height, waist to hip ratios were calculated, and found that females had more obesity and undernutrition issues than men as their physical activity was very less than men there.

The socio-demographic factors that affect Pakistani women's nutritional status were investigated by Kamal et al. in 2021. The Pakistan Demographic and Health Survey 2017–18, for which data were collected from November 2017 to April 2018 was the subject of a retrospective secondary data analysis. The women's BMI was used as a proxy for their nutritional status. The statistical study employed both quantile regression and OLS models. Women's BMI was positively impacted by their age, their education, their frequency of TV viewing, wealth index, their husband's education, and region, but negatively impacted by age at first birth, their employment status, gender of household head, and region. Among Pakistani women, being overweight and obese was shown to be more serious issues than undernutrition.

In a nutshell, research studies on the socio-economic and demographic determinants of nutritional status have shed light on the complex interplay between various factors that impact a person's overall health and well-being. These studies have highlighted the importance of addressing underlying social and economic disparities to improve the nutritional status of vulnerable populations. While there is no one-size-fits-all solution to the problem of malnutrition, findings from these studies have provided valuable insights into the specific determinants that need to be targeted to achieve meaningful improvements in nutritional outcomes. Moving forward, researchers, policymakers, and other stakeholders must continue to prioritize and invest in efforts to better understand and address the root causes of malnutrition, particularly among those most at risk.

3. Model Specification and Operationalization of Variables

The hypothesized model of socio-economic and demographic determinants of nutritional status is given as follows:

$$BMI = f\begin{pmatrix}\text{Age, MS, FAMM, GEN, Driver, Housemaid, Type of Institute}\\ \text{levels of Education, Family Income, Parents' occupation}\end{pmatrix}$$

3.1. Operationalization of Variables

3.1.1. Nutritional Status

Nutritional status can be defined as the physiological status of an individual human being which is measured via Body Mass Index. This dummy variable is captured by four dummies i.e., underweight, healthy weight, overweight, and obesity. Normal/ healthy weight is the reference category while the rest three are comparison categories BMI is the dependent variable in this model.

Nutritional status is measured through Body Mass Index. BMI or Quetelet's Index is a way to help you figure out if a person is at a healthy weight w.r.t his/her height. BMI is a number based on an individual's weight and height. In general, the higher the number, the more body mass a person has. BMI is used a lot as a selection tool to identify whether a person's weight might be causing him at risk for health issues such as heart disease, cancer, diabetes, etc.

Table 1: Cut-Off Values for BMI for Youth

BMI(Kg/m2) cut-offs	Nutritional status
More than 30.0	Obese
25-29.9	Overweight
18.5-24.9	Normal
Less than 18.49	Underweight

BMI in Kilograms and meters (or centimeters).

$$\boldsymbol{BMI = \frac{Weight\ (kg)}{(Height\ (m))^2}}$$

3.1.2. Age

Age is used as a continuous variable but has a lower limit of 15 years and an upper limit of 29 years, it is expected that as the age of a person will increase it will lead to the growth of a person's BMI.

3.1.3. Marital status (MS)

Marital status is a dichotomous variable where "single" is the comparison category while "married" is the reference category.

3.1.4. Family size

Family size or the number of family members (FAMM) is another demographic variable that is measured in numbers and used as a quantitative independent variable influencing the factor of BMI. It is expected that as family size will increase the BMI of a person will be expected to decrease in underdeveloped or developing economies so it would be directly related to the probability to be in the underweight category and inversely related to the probability to fall into the overweight and obese categories of BMI.

3.1.5. Gender

Gender is used as the last demographic determinant of BMI or NS of youth. This categorical variable is based on two categories male and female. The male is the comparison category while the female is the base or reference category.

3.1.6. Educational Institute

The educational institute is taken as the socio-economic indicator and here it is utilized as a two-level categorical variable having public institutes as a comparison while the private institutes of students as the referent group.

3.1.7. Car and Driver Facility

The car and driver facility is a considered reflection of the good socio-economic status of a person. This availability of drivers is taken as a dichotomous variable with "no driver facility" as a comparison while the "availability of driver facility" is the base group.

3.1.8. Housemaid Facility

The facility of housemaids is taken as a dichotomous variable with "no housemaid facility" as a comparison while the "availability of housemaid facility" as a base group. It can be a significant determinant of BMI too as the availability of this facility lead people to a sedentary lifestyle and consequently relatively high values of BMI.

3.1.9. Level of Education

The level of education is devised as a four-level categorical variable. The first three levels which include Intermediate, BS/Master, and M.Phil are comparison groups while the last category of Ph.D. Scholars are the reference group.

3.1.10. Family Income

Family income is one of the most basic measures of a person's economic condition and social status in society. This dummy variable has six income groups. The first two income levels are low-income groups and refer to the poor or less privileged economic strata. Its categories are monthly family income of "less than PRs30,000", and "PRs 30,001- PRs 60,000". 3rd and 4th category is "PRs 60,001- PRs100,000" and " PRs100,001 - PRs200,000" respectively and represents middle-income groups, While 5th and 6th categories are "PRs 200,001 – PRs 500, 000" and " more than PRs 500,001 per month" respectively which represents high-income groups and the last or 6th category is the reference category.

3.1.11. Parents' occupation

Parents' occupation has five subcategories that are 1= Govt. job, 2= Private Job, 3= Proprietorship, 4=Businesses/Enterprises, and 5th is no employment or no work/Job, and 5th category is the base category.

4. Research Design

The students or the youth (aged 15-29) of South Punjab are the population of this study. For this study, the multi-stage random sampling technique is utilized which is widely adopted and suggested by researchers for such large sample-based primary data-based studies as observed in the literature review. In the first stage, the head district of all the divisions is selected which are Multan District, Bahawalpur District, and Dera-Ghazi Khan District. In the second stage students from public and private educational institutions were randomly selected.

Multinomial Logistic Regression Model has been used to estimate the model. The dependent variable of the model i.e., BMI is a categorical variable. The multinomial logistic regression specification of the model can be given as:

$$P(BMI) = \frac{1}{1 + e^{-(\alpha_0 + \alpha_1\, AGE + \alpha_2 MS + \alpha_3 FAMM + \alpha_4 GEN + \alpha_5 NDRi + \alpha_6 NHM + \alpha_7 INST. + \alpha_8 EDU + \alpha_9\, FY + \alpha_{10} PO)}}$$

5. Preliminary Data Analysis

Table 2 presents the core variables of this research. The nutritional status is measured via BMI of youth. The table discloses that only 38.5% of respondents fall in the category of normal weight, 33.1% of the respondents are found to be underweight Likewise, 14.6% were in the overweight category and 13.7% in the obese group. It further explores that the total sample collected from SP is 685 out of which 329 participants belong to the Multan division, 176 participants were from the Bahawalpur division and 180 participants were from DG Khan Division sharing 48%, 25.7%, and 26.3% of total sample size. Regarding gender, Table 2 presents that 271 participants or 39.6% of respondents are male while 414 participants, or 60.4% are female by their gender.

Table 2: Preliminary Data Analysis

Variable	Category	Frequency	Percentage
Division	Multan	329	48.0
	Bahawalpur	176	25.7
	D.G Khan	180	26.3
BMI	Underweight	227	33.1
	Normal weight	264	38.5
	Overweight	100	14.6
	Obesity	94	13.7
Age	15-19	221	32.3
	20-29	464	67.7
Gender	Male	271	39.6
	Female	414	60.4
Marital Status	Single	620	90.5
	Married	65	9.5
Education Levels	Intermediate	139	20.3
	BS/Master	440	64.2
	M.Phil.	94	13.7
	PhD	12	1.8
Type of Educational Institute	Public	580	84.7
	Private	105	15.3
Driver Facility	No	662	96.6
	Yes	23	3.4
House-MAID Facility	No	532	77.7
	Yes	153	22.3
Monthly Family Income	less than 30,000	336	49.1
	30,000 to 60,000	181	26.4
	60,000 to 100,000	79	11.5
	100,000 to 200,000	57	8.3
	200,000 to 500,000	24	3.5
	More than 500,000	8	1.2
Parents Occupations	Government job	160	23.4
	Private job	147	21.5
	Proprietor	52	7.6
	Business/Enterprises	143	20.9
	Unemployed/ Do not work	183	26.7
Number of Family Members	1-4	72	10.5
	5-8	457	66.7
	9-12	123	17.9
	More than 12	33	4.9

Table 2 divides the respondents into two categories that are teenagers and above teenagers and it can be observed that most of the respondents belong to the above teenage which is 20 years to 29 years. It further shows that most of the respondents are single with respect to their marital status that is the share of single respondents is 90.5% in comparison with the 9.5% of married respondents and ratios can be justified on the grounds as students were targeted to collect data and most students prefer to remain single before completion of their studies. When it comes to the situation regarding education, only 20.3 percent of respondents are currently admitted to their intermediate program while most of the respondents are completing their BS or master's degree which is 64.2 %. 13.7 % of respondents are completing their MPhil program while Ph.D. scholars' response is observed at 1.8%. Next, 84.7% of the respondents are admitted to public institutions and 15.3% are in private colleges. Moreover, only 3.4% of respondents enjoy the facility of family car drivers while the rest of 96.6% doesn't. Similarly, out of our 685 respondents, only 22.3 % are availing of the house-maid facility while 77.7% of respondents didn't. Family income is the fundamental indicator of the

economic status of a person and Table 2 reveals that almost half (49.1%) of the respondents' Monthly Family Income (MFI) is less than 30,000 rupees and about 26.4% have MFI between PRs 30,000 to 60,000. It tells a lot about the poor economic condition of South Punjab. 11.5 % lie in the category of PRs 60 to 100 thousand per month and 8.3% have monthly family income between 100 to 200 thousand PRs. Only 1.2% of income is found more than PRs 500,000. The situation of respondents' parents' employment and occupations tell that 26.7% of respondents' parents are unemployed or do not work and out of the rest 73.3% almost 2/3rd are engaged in 64 government or private jobs and only 28.5% are self-employed or own a business.

6. Diagnostic Analysis

Table 3 concludes that the final model fits better than the intercept-only model based on the results of AIC, BIC, and -2 Log Likelihood criteria.

Table 3: Model Fitting Information

Model	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC	BIC	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	1595.472	1609.061	1589.472			
Final	1524.345	1796.110	1404.345	185.128	57	.000

Table 4: Goodness-of-Fit

	Chi-Square	Df	Sig.
Pearson	1576.865	1455	.014
Deviance	1277.568	1455	.133

The results in Table 4 show our model as a well fitted model but not a highly good fitted as both statistics have contradictory results. Table 5 reports that the results of all three tests are near about same and show that the model has moderate side effects.

Table 5: Pseudo R-Square

Cox and Snell	.333
Nagelkerke	.421
McFadden	.401

Table 6 reveals that age, marital status, number of family members, gender, type of institute, level of education, and parents' occupation are significant at a 5% level. While the no-driver (NDR), no housemaid (NHM), and family income per month (FY) are insignificant at 5%.

7. Multinomial Logistic Regression Results and Discussions

The Maximum Likelihood method was applied for the estimation of the parameters of MLRM in the model. The dependent variable is BMI and normal weight is the reference category. Age is taken as a continuous variable in the model and it is a very basic demographic determinant of nutritional status. It can be observed in Table 7 that for one year increase in the age of the respondent, the log odds of outcome underweight relative to the normal weight is expected to decrease by 0.19 units holding all other explanatory variables in the model constant. Wald test results show that the relationship between these two variables is statistically significant with a p-value of 0.00. Relative risk ratio or Exp (B) <1 indicates that as age increases by one year, the risk of outcome falling in the referent group or the normal weight group increases relative to falling in the underweight category. The possible reason is that as age increases the person's physiological growth like an increase in height becomes less likely to increase drastically or even height stops increasing and the person's BMI becomes more stable. Similarly, for one year (a unit) increase in the age of respondents, the log odds of overweight /obese relative to the normal weight is expected to increase by 0.70 / 0.61 respectively, keeping all other explanatory variables of the model constant. So, age is positively associated with BMI which means as the age of the person increases, he/she is less likely to be underweight and more likely to have

more weight than normal weight. In simple, higher ages are correlated with higher BMI or simply obesity (Kamal et al. 2021).

Table 6: Likelihood Ratio Tests Results

Effect	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	Df	Sig.
Intercept	1524.345	1796.110	1404.345	.000	0	.
AGE	1521.609	1779.786	1407.609	3.264	3	.053
MS	1533.645	1791.822	1419.645	15.300	3	.002
FAMM	1539.406	1797.583	1425.406	21.061	3	.000
GEN	1526.353	1784.530	1412.353	8.009	3	.046
NDR	1521.723	1779.900	1407.723	3.378	3	.137
NHM	1519.339	1777.516	1405.339	.994	3	.103
INST	1526.680	1757.680	1424.680	20.335	9	.016
EDU	1504.022	1707.846	1414.022	9.677	15	.040
FY	1513.388	1730.800	1417.388	13.043	12	.166
PO	1538.266	1796.443	1424.266	19.921	3	.000

Table7: Demographic and Socioeconomic Determinants of Nutrition Status

BMI	B	Std. Error	Wald	Df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
UNDERWEIGHT VS NORMAL WEIGHT								
Intercept	-13.608	1.771	59.064	1	.000			
Demographic Variables								
AGE	-.194	.048	16.401	1	.000	.824	.750	.905
MS (Single)	2.917	.979	8.871	1	.003	18.48	2.711	125.98
FAMM	.419	.243	2.972	1	.085	1.520	.944	2.44
GEN (Male)	-.422	.207	4.153	1	.042	.656	.437	.984
Socio-Economic Variables								
DRIVER (No)	-2.367	1.350	3.074	1	.080	.094	.007	1.322
H-MAID (No)	-.222	.167	1.760	1	.185	.801	.577	1.112
INST. (Public)	4.069	2.385	2.911	1	.088	58.495	.546	6268.36
Education Levels								
Intermediate	-.574	.354	2.630	1	.105	.564	.282	1.127
BS/Master	-.902	.303	8.889	1	.003	.406	.224	.734
MPhil	-.253	.247	1.048	1	.306	.776	.478	1.261
Family Income Levels								
Less than 30000	5.099	2.449	4.335	1	.037	163.797	1.349	19892.11
30001-60000	2.426	1.161	4.362	1	.037	11.312	1.161	110.20
60001-100000	-.262	.132	3.957	1	.047	.770	.595	.996
100001-200000	-.307	.132	5.372	1	.020	.736	.568	.954
200001-500000	2.610	1.210	4.650	1	.031	13.601	1.268	145.847
Parents' Occupation								
Govt Job	-.883	.447	3.892	1	.049	.414	.172	.994
Private Job	-2.123	1.355	2.454	1	.117	.120	.008	1.705
Proprietorship	.440	.245	3.238	1	.072	1.553	.961	2.508
Business/Enterprises	4.203	2.355	3.186	1	.074	66.892	.662	6754.84
OVERWEIGHT VS NORMAL WEIGHT								
Intercept	2.101	.954	4.853	1	.028			
Demographic Variables								

AGE	.706	.338	4.349	1	.037	2.026	1.043	3.932
MS (Single)	-1.792	.525	11.644	1	.001	.167	.060	.466
FAMM	-.893	.487	3.357	1	.067	.410	.158	1.064
GEN (Male)	.610	.361	2.861	1	.091	1.841	.908	3.735
Socio-Economic Variables								
DRIVER (No)	-1.418	.741	3.663	1	.056	.242	.057	1.035
H-MAID (No)	-1.233	.689	3.200	1	.074	.291	.076	1.125
INST (Public)	.743	.353	4.422	1	.035	2.103	1.052	4.204
Education Levels								
Intermediate	-.120	.120	1.012	1	.314	.887	.701	1.121
BS/Master	-.795	.260	9.331	1	.002	.452	.271	.752
MPhil	-1.103	.469	5.523	1	.019	.332	.132	.833
Family Income Levels								
Less than 30000	-1.400	.500	7.823	1	.005	.247	.093	.658
30001-60000	-1.500	.644	5.417	1	.020	.223	.063	.789
60001-100000	2.169	.718	9.130	1	.003	8.751	2.143	35.733
100001-200000	.496	.279	3.162	1	.075	1.642	.951	2.835
200001-500000	-1.534	.496	9.558	1	.002	.216	.082	.570
Parents' Occupation								
Govt Job	-1.036	.473	4.788	1	.029	.355	.140	.898
Private Job	-1.537	.519	8.766	1	.003	.215	.078	.595
Proprietorship	.482	.220	4.786	1	.029	1.619	1.051	2.492
Business/Enterprises	.552	.276	4.010	1	.045	1.736	1.012	2.979
OBESITY VS NORMAL WEIGHT								
Intercept	-.920	.374	6.033	1	.014			
Demographic Variables								
AGE	.617	.311	3.930	1	.047	1.853	1.007	3.408
MS (Single)	-2.413	.245	97.204	1	.000	.090	.055	.145
FAMM	-2.438	.247	97.626	1	.000	.087	.054	.142
GEN (Male)	.632	.297	4.530	1	.033	1.882	1.051	3.370
Socio-Economic Variables								
DRIVER (No)	-.154	.112	1.905	1	.168	.857	.689	1.067
H-MAID (No)	-.769	.259	8.825	1	.003	.463	.279	.770
INST (Public)	.669	.296	5.090	1	.024	1.952	1.092	3.490
Education Levels								
Intermediate	-1.478	.554	7.112	1	.008	.228	.077	.676
BS/Master	-.141	.152	.864	1	.353	.869	.645	1.169
MPhil	1.507	.757	3.968	1	.046	4.514	1.025	19.891
Family Income Levels								
Less than 30000	-1.089	.469	5.389	1	.020	.337	.134	.844
30001-60000	-.105	.291	.129	1	.719	.901	.509	1.594
60001-100000	.290	.181	2.564	1	.109	1.336	.937	1.905
100001-200000	1.010	.268	14.148	1	.000	2.745	1.622	4.645
200001-500000	-1.777	1.019	3.041	1	.081	.169	.023	1.246
Parents' Occupation								
Govt Job	-1.915	.905	4.477	1	.034	.147	.025	.868
Private Job	-.303	.856	.126	1	.723	.738	.138	3.956
Proprietorship	1.726	.320	29.151	1	.000	5.616	3.002	10.506
Business/Enterprises	.416	3.726	3.673	1	.054	2.233	.988	5.049

The nest demographic variable is marital status and the Table 7 reveals that the sign of the coefficient of MS (single) is positive with a 2.91 value coefficient that means single relative to those married are 2.91 times more likely to be underweight than normal weight. So, it can be said that there is a positive relationship between being single relative

to married, and being underweight than normal weight. The estimate is statistically significant with a p-value of 0.003. Exp(B) >1 indicates that single people in comparison with married are more likely to be underweight than being normal weight among the youth of SP. The possible reason for this is those single people are more likely to be young, more physically active, and have fewer hormonal changes in body than married people. In the overweight and obese categories, keeping normal weight as the reference category, single relatives to married are 1.792 times less likely to be overweight and 2.413 times less likely to be obese than normal weight. In short, single people in comparison with married have more chances to be underweight than normal weight and fewer chances to be overweighed or obese than being normal weight (Martinez et al., 1999).

For the family size (FAMM), the results in Table 7 report that for one member increase in the family size, the logit of outcome underweight relative to the normal weight is expected to increase about 0.419 times holding the rest of the explanatory variables in the model constant but Wald test results show that the relationship is not statistically significant at 5%. For the overweight VS normal weight, the coefficient is -0.89 and insignificant at 5%. And in the case of the obese VS Normal weight the coefficient is -2.43 and statistically significant at 5% as recommended by the Wald test. From the above-mentioned results of SP and discussion, it is inferred that family size is found to be negatively associated with over weightiness (higher values of BMI) or positively related with under-weightiness (lower values of BMI). As the number of members in the family increases the BMI of family members tends to lower in their families or simply families with a larger number of members are less prone to obesity (Puciato and Rozpara, 2020; Khatri and Ashutosh 2021).

For UWC VS NWC, the coefficient of gender is negative and statistically significant which means that the males have less risk of falling into the underweight category than the normal weight category relative to females. The possible reason may be that the males are more economically independent and they can better fulfill their physiological needs with more mobility and choice than women. This variable is statistically significant. For the OWC and OBC cases, the coefficient of gender is positive and 0.61 and 0.63 respectively. It simply means that the male has a greater relative risk of being overweight /obese relative to females than being normal weight. The results can be justified because of being more economically independent and less skillful in cooking the male is more prone to use fast and junk food or food outside of the home which is a major cause of obesity among them. In a few words, it can be said that gender male has more chances to have overweight or greater values BMI than their counter gender. Global average data suggest that the prevalence of obese and overweight males is much higher than that of females in some regions (Kim and Shin, 2020).

Considering estimates of all three sections about the absence of a driver, It is inferred that the absence of a driver facility makes it more likely for people to remain in the normal weight (reference) category than any other category (comparison) of weight in Southern Punjab. The reason may be that the driver facility may cause the youth to remain away from an active lifestyle and consequently from healthy weight too. A more sedentary lifestyle keeps a person away from the ideal BMI. The same is true for the absence of a housemaid facility as the same negative association is observed here between the absence of a housemaid facility and all three comparison weight categories. It simply means that people who do not have a housemaid facility have to do their domestic work by themselves and due to that physically active lifestyle they feel easy to maintain an ideal or normal weight. Many studies like Martínez-González et al, 1999 and Silveira et al, 2022 have found that a more sedentary lifestyle increases the obesity risks among adults.

Regarding the Type of educational institution, all three comparison categories of BMI are positively associated with public institutions relative to private. The possible reason for this may be that the students of public colleges and universities mostly belong to poor or middle-class families who find many financial constraints in attaining and maintaining ideal weight. This variable is statistically significant to our model.

Level of education results makes it evident that in all three comparison categories of BMI, the coefficients of all comparison categories of level of education are negative which means that holding all other influencers static, for being a scholar of Intermediate or BS/Master or M.Phil. program relative to a Ph.D. scholar, risk of falling in any of comparison categories remain less than of falling in the normal weight. However, the estimates of a few categories are not statistically significant. Puciato and Rozpara, 2020 also find that relatively lower levels of education have more likelihood to have normal weight.

The next explanatory variable is the level of family income It can be observed in Table 7 that for the UWC VS NWC section, the coefficients are positive for the 1st, 2nd, and 5th income groups and negative for the 3rd and 4th income groups. Wald Test statistics and their respective p-values depict that almost all the estimates are statistically significant as the p-value remains below 0.05. In the result section of the 2nd and 3rd comparison categories of BMI, it is explored that for income levels 1st,2nd, and 5th income groups, there is less risk of being overweighed/ obese than normal weighted and all coefficients are negative and almost all of their p-values are less than 0.05 leading to the conclusion that there exists a strong association between indicators. Puciato and Rozpara in 2020, also find the results that low

incomes have a negative association with obesity. While for the people of middle income (3rd and 4th) groups, this can be identified that there is more probability of being overweighed/obese rather than normal.
Parents' Occupation is the last explanatory variable in the model. For all three comparison categories of BMI, the signs of the coefficients are negative for both job types i.e., Govt. and Private while for both categories of self-employment the sign is positive. It can be interpreted as an individual belonging to the category where any of their parents is doing any type of job rather than doing no work there is more chance of that person falling in the category of normal weight rather than any comparison category. The results are contradictory for proprietorships and businesses which means that an individual is more likely to be underweighted/over-weighted/obese rather than ideally weighted. Puciato and Rozpara in their study in 2020 also found almost similar results in which it was concluded that the parents' occupation based on non-steady sources of income like self-employment is weakly correlated with normal weight while the regular income-based occupations of parents like private and government jobs increase the chances to have good health and normal weight rather than obese.

8. Conclusions and Policy Implications

It is concluded that the socioeconomic and demographic characteristics of youth age, male gender, and middle-income group relative to higher are positively associated with higher BMI. While, the absence of a driver, absence of housemaid, government and private job relative to no employment and intermediate, BS/master, and M.Phil. Levels of education relative to a Ph.D. have more likelihood to have normal/ ideal weight. On the other hand, the characteristics like marital status single, family size and low-income group and upper lower income group relative to the upper higher-income group are inversely related to higher values of BMI while people attached to public institutes relative to private ones and self-owned small or large scale businesses relative to no employment have less probability of having normal or ideal weight. All the determinants are statistically significant in influencing the nutritional status of youth except family size and the absence of a driver. Now we may suggest some policies for nutritional status:

Age:

- Develop age-specific nutritional guidelines and programs that cater to the unique nutritional needs of individuals across different age groups.
- Increase awareness among older adults about the importance of a balanced diet and regular physical activity to maintain good health.

Marital Status:

- Provide nutrition education and support for individuals who are newly married, as they may be at higher risk of malnutrition due to lifestyle changes and increased responsibilities.
- Implement policies to support single-parent households, as they may face additional barriers to accessing healthy and nutritious food.

The Number of Family Members:

- Promote the importance of family meal planning and budgeting to ensure that all family members have access to nutritious food.
- Implement policies to provide financial support for low-income families with large numbers of dependents, as they may struggle to afford healthy food for everyone.

Gender:

- Implement policies to address gender inequalities in education and employment, as these can have a significant impact on women's nutritional status.
- Increase access to affordable and nutritious food for women, who may face additional barriers to accessing healthy food due to their roles and responsibilities within the household.

Type of Institute and Level of Education:

- Implement nutrition education programs in schools and universities to promote healthy eating habits among students and staff.
- Increase access to affordable and nutritious food on college and university campuses, as students may struggle to afford healthy food while studying.

Parents' Occupation:

- Implement policies to support low-income families with parents who work in low-wage jobs, as they may struggle to afford healthy food due to low wages and limited benefits.
- Increase access to affordable and nutritious food in areas with a high concentration of low-wage jobs, as these areas may be food deserts.

No-Driver Facility and No Housemaid Facility:

- Increase access to affordable and nutritious food in areas with limited public transportation and no housemaid facilities, as these factors can make it difficult for individuals to access healthy food.
- Implement policies to support individuals who may have limited mobility or who are unable to cook their own meals due to a lack of kitchen facilities.

Family Income per Month:

- Implement policies to support low-income families with access to affordable and nutritious food, such as food subsidies or vouchers.
- Increase access to affordable and nutritious food in areas with a high concentration of low-income households, as these areas may be food deserts.

References

Ahmad, H., Liaqat, P., Paracha, P. I., Abdul Q., and Uppal, M. A. (2009). Assessment of the nutritional status of adolescents versus eating practices in Islamabad city. *Pakistan Journal of Nutrition*. 8(8), 1304-1308.

Ahsan, K. Z., Shams, A., AlMamun, M., A., Khan, S. H., and Chakraborty, N. (2017). Effects of Individual, household and community characteristics on child nutritional status in the slums of urban Bangladesh. *Archives of Public Health*, 75(9).

Akseer, N., Al-Gashm, S., Mehra, S., Mokdad, A. and Bhutta, Z. A. (2017). Global and regional trends in the nutritional status of young people: a critical and neglected age group. *Annals of The New York Academy of Science, Women's and Adolescent Nutrition, 1393(1),* 1-73.

Ali, A., & Şenturk, İ. (2019). Justifying the impact of economic deprivation, maternal status and health infrastructure on under-five child mortality in Pakistan: An empirical analysis. *Bulletin of Business and Economics (BBE)*, *8*(3), 140-154.

Asmare, B., Taddele, M., Sileshi, B., and Fasil, W. (2018). Nutritional status and correlation with academic performance among primary school children, northwest Ethiopia.*BMC Research Notes*, 11 (805).

Bhandari, V. (2014). Nutritional Status, dietary practices and nutrition related beliefs of high school girls in urban area of Bangalore city. *Journal of Nursing and health Science.*, 3(3: I), 01-06.

Desai, N., Shobha, M., and Bhaveshbhai, B. (2019). Assessment of available health services as per Indian public health standards at sub-centers of Vadodara district of middle Gujarat, India. *International Journal of Medical Science and Public Health.* 9(9).

HRCP (2022). South Punjab: Excluded, exploited. https://hrcp-web.org/hrcpweb/wp-content/uploads/2020/09/2022-South-Punjab-Excluded-exploited-EN.pdf

Kamal, A., Ali, A.A. and Irfan, S. (2021). Socio-demographic determinants of BMI of Pakistani women: An evidence from PDHS (2017-18) using quantile regression analysis. *Journal of Pakistan Medical, 71(4),* 1069-1075.

Khatri, N. and Ashutosh, K. (2021). Impact Of Family Size On Body Mass Index (Bmi) And Self-Esteem: A Comparative Analysis Of Male And Female Adolescents. *Elementary Education Online,* 20 (5),7931-7943.

Kim, K. B. and Shin, Y. A. (2020). Males with obesity and overweight. *Journal of Obesity & Metabolic Syndrome, 29(1),*18-25.

Martínez-González, M.A., Martínez, J.A., Hu, F.B., Gibney, M.J. and Kearney, J. (1999). Physical inactivity, sedentary lifestyle and obesity in the European Union. *International Journal of Obesity Related Metabolic Disorders, 23*(11), 1192-201.

Mehmood, A., Siddique, H. M. A., & Ali, A. (2022). Impact of Health on Worker Productivity: Evidence From South Asia. *Bulletin of Business and Economics (BBE), 11*(2), 1-8.

Powell , L.M., Han, E., and Chaloupka, F.J. (2010). Economic contextual factors, food consumption, and obesity among US adolescents. *The Journal of Nutrition,*140(6), 1175–1180.

Puciato, D., & Rozpara, M. (2020). Demographic and Socioeconomic Determinants of Body Mass Index in People of Working Age. *International journal of environmental research and public health*, *17*(21), 8168. https://doi.org/10.3390/ijerph17218168

Rogol, A.D., Clark, P. A. and Roemmich, J. N. (2000). Growth and pubertal development in children and adolescents: effects of diet and physical activity. *The American Journal of Clinical Nutrition,72(2),* 521–528.

Şentürk, İ., & Amjad, A. L. İ. (2021). Socioeconomic Determinants of Gender-Specific Life Expectancy in Turkey: A Time Series Analysis. *Sosyoekonomi*, *29*(49), 85-111.

Silveira ,E. A., Mendonca, C.R., Delpino , F. M., Souza, G. V. E., Rosa , L. P. D., Oliveira, C. D. and Noll, M. (2022). Sedentary behavior, physical inactivity, abdominal obesity and obesity in adults and older adults: A systematic review and meta-analysis. *Clinical Nutrition ESPEN. 50*, 63-73.

UN (2022). South Punjab Deep Drive Report 2022. https://pakistan.un.org/en/177830-south-punjab-deep-dive-report

UN (2022). South Punjab Regional Development Plan. https://www.undp.org/pakistan/press-releases/undp-and-south-punjab-secretariat-launch-two-sdgs-reports-equitable-development-punjab

UNDP. (2017). *UNDP Annual Report 2017.*

United Nations. 2015. The 17 Goals". *Sustainable Development Goals*. UN. https://sdgs.un.org/goals

WHO (1946) *Constitution of World Health Organization 1946*. https://www.who.int/about/governance/constitution

WHO (2006). *National Action Plan for Food and Nutrition for Food and Nutrition 2006 – 2010.*