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Effect of socioeconomic factors on malnutrition among children in Pakistan

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Abstract

Background: In the current era, malnutrition among children considers main reason of morbidity and mortality in the world scenario while more specifically in developing countries. Malnutrition in children severely affects their physical growth and academic achievements. This study aimed to find out the effect of socioeconomic factors on malnutrition, children aged under 5 years in Multan district of Punjab province, Pakistan. The study used the data of 2497 children, obtained from Multiple Integrated Cluster Survey 2018 and employed Binary logistic regression approach for empirical estimation the effects of socioeconomic factors on malnutrition among children.

Results: Empirical estimates of the study specified the prevalence of higher frequency of stunting (18.58), wasting (28.43) and underweight (19.54) among children particularly in rural areas of the study district Multan. Stunting status was significantly associated with children of some month (OR = 1.247, CI 95% 0.543–1.546), family size (OR = 0.589, CI 95% 0.431–3.715), maternal education (OR = 1.432, CI 95% 0.528–1.972), wealth quintile (OR = 2.174, CI 95% 1.234–3.376) and sanitation facility (OR = 0.789, CI 95% 0.627–1.987). Wasting status was mostly correlated with male children (OR = 1.208, CI 95% 0.769–1.352), children of urban areas (OR = 0.594, CI 95% 0.476–1.987) and food shortage (OR = 1.367, CI 95% 0.782–2.543). Underweight status was close relationship with male gender (OR = 1.213, CI 95% 0.821–2.897), incomplete immunization (OR = 1.342, CI 95% 1.041–2.658) and treated water access (OR = 0.689, CI 95% 0.542–2.743).

Conclusion: In this study, prevalence of higher-level malnutrition was estimated due to lower socioeconomic status among major population in the community specifically in rural areas. The government needs to enhance economic opportunities, promote healthcare education, increase nutritional access and generate improving personal hygiene habits through appropriate economic, political and social policy measures. The outcome of these policies will enhance individual economic resources; ensure nutritional safety, increasing maternal schooling and helpful for improving child health.

Keywords: Children, Malnutrition, Stunting, Wasting, Underweight

JEL Classification: I10, I12, I15, O12

Introduction

Malnutrition signifies with disproportion of energy and nutrients in physical status among children and adults [91]. Malnutrition elimination in its all forms indicated 2nd Sustainable Development Goals (SDGs) of United Nations [85] as ultimate purpose is all children free from malnutrition issue [89]. Under nutrition, prevalence (stunting, wasting and underweight) generates more chances of disease and death among children [83]. Micronutrient-related malnutrition is deficiency of vitamins and iron [90]. Over nutrition (overweight and obesity) indicates risk factors of non-communicable diseases (NCDs). Under nutrition, micronutrient-related malnutrition and over nutrition are all forms of malnutrition [71, 91]. Child malnutrition indicates as suffering in one

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or more than one forms as underweight, stunting and wasting [89]. Stunting indicated as short height for age, underweight as low weight for age while low weight as compared to height identified as wasting [90].

Community level socioeconomic factors play crucial role in prevalence and incidence of malnutrition [20, 54]. Gender inequality, education, poverty, sanitation and safe water access are some considerable socioeconomic factors to determine health outcomes in many developing and underdeveloped countries [9]. There is significant systematic literature sated with substantiation of relationship between malnutrition, low maternal schooling and poverty [1, 53, 70]. In the current scenario of advancement, malnutrition still emerging severe community health and for long time recognized as consequent of poverty [84]. Children from low socioeconomic household status are 2.5 times more vulnerable of malnutrition rather than middle or upper socioeconomic household status [46]. Higher vulnerability of food insecurity is associated with households' lower socioeconomic status because nutritious food affordability closely associated with purchasing power [9]. Households facing limitations in social and economic development are most probably face issues in physical growth [10] due to consumption of poor food, illness scenario, sanitation insufficiency, pitiable hygienic practice and inadequate safe water access [82]. Higher maternal schooling can reduce child malnutrition through enhancing awareness regarding sanitation practices, healthy practices and optimal resources allocation in children favor [73, 86]. Paternal schooling significantly influences in provision of family adequate nutrition, shelter, sanitation due to sound income and appropriate use of resources [55]. Socioeconomic development and malnutrition reduction rate in children be able to make available significant insight for get better living status in most developing countries [92].

In the world scenario, almost 149 million as 21.9% children under five are stunted, 49.5 millions as 7.3% wasted while 40.1 millions 5.9% overweight, indicated the slower tendency of decreasing in stunting and wasting with increasing tendency in overweight regarding 2018 as compared to 2000 era [83, 88, 90]. In all forms of malnutrition, Asian region share more severe scenario regarding stunting 81.7 million (55%), wasting 33.8 million (68.28%) and 18.8 million (47%) of overweight of the world total malnutrition status [90]. In Asian region according to classification of United Nations, Southern Asian region countries share higher frequency of stunting 57.9 million (71%), 25.3 million (75%) wasting and 5.5 million (30%) overweight in the region and showing the higher severely of malnutrition in this region [88].

The aspect of malnutrition has discussed in many significant studies in Pakistan regarding provincial basis (Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan), locality scenario (rural/urban), various types (community base/hospital base), gender status (boys/girls), regarding participation (children/mother and child/guardian/mother and caretaker) and different age levels (< 5 years/5–10 years/5–12 years) with estimating different methodologies and data sets. The study of [2] focused the Quetta city of Balochistan, while the studies of [12, 21, 42, 45, 47, 59, 68, 72, 93] discussed Sindh province rural and urban areas to addressing malnutrition issue in the province. The studies of [3, 5, 33, 44, 65, 81] spotlighted different rural and urban areas of Khyber Pakhtunkhwa province, and the research work of [52, 58] focused the Islamabad urban areas for highlighting the malnutrition scenario in these areas.

In Pakistan, almost half of children less than five are stunted and one out of ten children indulged in wasting (State Bank of Pakistan (SBP), 2019) [75]. Pakistan is also categorized among those seven countries of the world accounted two-thirds of the world under nourished population as China, Bangladesh, Congo, Indonesia, India and Ethiopia [23, 75]. In the world scenario, Pakistan is unexpectedly higher malnutrition affecting county ranked as 77 out of 113 countries; it is also categorized highest stunted country in the region Southern Asian Countries (SAC) while having among higher wasting scenario among southern countries region [83, 88, 90]. Pakistan are performing slow and are still experiencing severe malnutrition issue among children less than 5-year prevalence of stunting 40.2%, wasting 17.7%, underweight 28.9% and overweight 9.5%, relatively higher among developing countries [83]. In Pakistan, rural community has higher frequency of stunting (43.2%), wasting (18.6%) and underweight (31.6%) rather than urban locality stunting (34.8%), wasting (16.2%) and underweight (24%); in gender base scenario, boys are more stunted, wasted, underweight and overweight rather than girls [82]. In province wise scenario, higher prevalence of stunting and overweight is estimated in Balochistan and higher tendency in wasting and underweight in Sindh province rather than Punjab and Khyber Pakhtunkhwa [82].

In the scenario of Punjab province, there are only limited studies of [7, 8, 13, 50, 57, 58, 66] significantly focused Eastern and Central Punjab and only the single study of [43] focused data of school children of 5–14 years from rural area of Bahawalpur to focusing southern Punjab region of Punjab province Pakistan. This region is absolutely neglected to highlighting malnutrition standing among children under 5 years in this area so to addressing such gap this study tried focus some aspects. Firstly, this study focused malnutrition status among children under 5 years in this region which not properly highlighted in southern Punjab area, secondly

this study focused both urban and rural areas and both gender in the study no research work in such scenario in this locality, and thirdly this study selected Multan city the biggest city of southern Punjab and 8th major city of Pakistan [29]. Lastly, Multan has the highest frequency of stunting, wasting and underweight in Punjab rather than other populated cities of Punjab such as Lahore, Faisalabad, Rawalpindi and Gujranwala [30]. The main objective related to this specific study is to recognize the effect of socioeconomic factors on malnutrition among children below 5 years in southern Punjab of Pakistan. This study is categorized into six sections as introduction of the study explained in the first section, theoretical frame work highlighted in section two, while section three indicated the data and methodology of the study. In section four, results of the study are elaborated as discussion of study highlighted in section five while conclusion given in the last section of the study.

Theoretical framework

This theory has its background in microeconomics household production models of Becker's [14] indicating as families trade in goods and time in mass production of products either utilize at home or purchase from the market. Grossman [32] expanded the theory 'Demand for Health,' and it was further improved by a number of economists like [15, 17, 76]. Becker [14] has focused household factors of nutrition as 'nutrition production function' indicates the status of child's nutrition as health 'inputs' set. Child's nutritional position reveals the joint properties of many features, together with birth order, health, nutrient intake and communication features directed by preferences of parental as follow in child's nutritional production function.

$$\begin{aligned}&\text{Childs status of nutrition}\\&= f(\text{inputs of nutrition, health of child, death of}\\&\text{child, childcare time, biological factors, births, skill elements})\end{aligned} \tag{1}$$

'Theory of Justice' presented by John Rawls' [38] suggests widespread right to use is named 'social primary goods' (similar to liberties, chances, self-confidence, etc.) intended for every one of persons in the community with most important consequence of development in human capital, human rights and adequate health and nutritional access to children [64]. Malnutrition known as component of a vicious cycle comprises three elements disease; malnutrition and poverty are associated in such a means to everyone supply to the existence of the others [61, 67]. There are different methods for the measurement of under nutrition as explained in Fig. 1. Factors why a person can be malnourished are enumerated in the left mainly column of Fig. 1. The column two or four indicates different measures of under nutrition. Column two illustrates one is to estimation expenditure directly or energy intake, second column highlights anthropometric measurements, and third column describes further indications that in a roundabout way reveals an insufficient

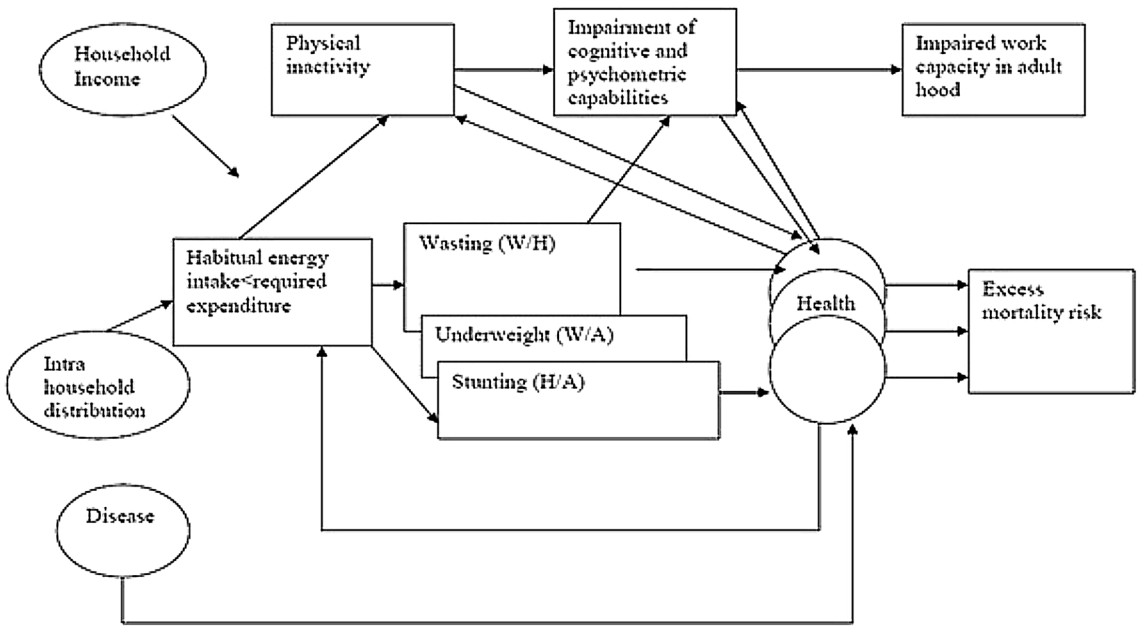

Fig. 1 Causes, Symptoms and Consequences of Under nutrition *Source*: Peter Svedberg (2000), poverty and under nutrition: Theory, Measurement and Policy

energy balance. Column four identifies quantifiable signs of negative costs of a disproportionately low down energy balance. Figure illustrated reveals the basic associations in the economics–nutrition–health composite [77].

Data and methodology

This study used the data of Multiple Indicator Cluster Survey (MICS) 2018 [31] for empirical analysis. According to availability of MICS survey data, overall numbers of children under 5 years of age from Multan were 2521 and after removing all missing values, almost 2497 children's data were used in final analysis. Stunting (height for age), wasting (weight for height) and underweight (weight for age) were three major anthropometric indicators [90] used to measure malnutrition association with response variables. The significant socioeconomic factors linked by child malnutrition used in this study were age, gender, mother education (none/pre-school, primary, middle, secondary and higher), family income (lowest, secondary, middle, higher and highest), family size, area (rural, urban), food access, treated water, immunization status and sanitation facility [83]. There are some significant reasons for the selection of study area, firstly Pakistan was selected for the study due to relatively higher prevalence of malnutrition among Southern Asian developing countries and slower malnutrition reducing scenario among these countries [23, 90], secondly Punjab province among four provinces was chosen for the study the basis of most populated province and sharing 53% population of the country [30], thirdly in Punjab province, southern Punjab region was chosen for the study owing to higher occurrence of stunting, wasting, overweight and underweight from the rest of the region of Punjab province [31], and lastly Multan district was selected for the study as most populated main city of southern Punjab and 8th major city of Pakistan as indicated in Fig. 2 [29].

Child's height (height for age), weight (weight for height) and weight (weight for age) more than two standard deviations below the median (−2SD) of WHO indication population then (s) child as considered stunted, wasted and underweight in that order [90]. Estimating the impact of various socioeconomic factors on malnutrition status by considering various dependent variables for stunting, wasting and underweight, three logistic regression models were used. Statistical data were reported as mean, standard deviation and categorical variables reported as N (percentage).

Ordinary least square (OLS), probit regression model, logit regression model and tobit regression model were most probably used for the empirical estimation of research studies. In the scenario of binary-dependent variable 0 or 1, ordinary least square (OLS) may not be suitable because the residual (error) would not be distributed normally. Linear probability model violates all

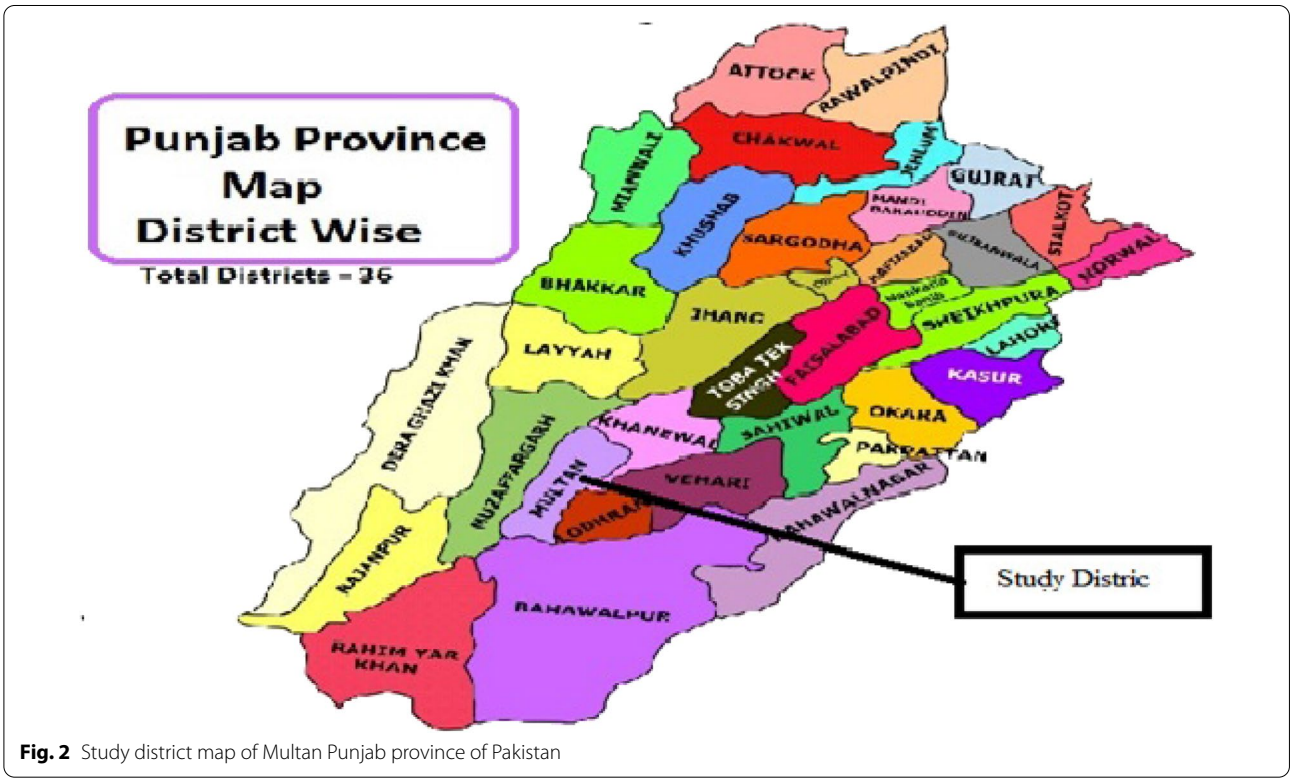

Fig. 2 Study district map of Multan Punjab province of Pakistan

the assumptions on which binary models are based then the logistic regression model more appropriate for estimating regarding the binary-dependent variables [35]. Logistic regression is a statistical method which is widely used in different research areas especially in health sciences when dependent variable is of qualitative nature means variables that are not numerical. Regression with dependent variable having two categories is called binary logistic regression. In this regression, dependent variable is converted into logit function to get maximum likelihood estimation using an iterative technique that returns the 'best explaining values for the population parameters' [36, 39, 40]. The binary logistic regression equation for the model which has to be estimated based on the functional form will be as:

$$\begin{aligned} \mathrm{MSC} = {} & \beta_0 + \beta_1 \mathrm{age} + \beta_2 \mathrm{gender} + \beta_3 \mathrm{MED} + \beta_4 \mathrm{family\ size} \\ & + \beta_5 \mathrm{area} + \beta_6 \mathrm{family\ income} + \beta_7 \mathrm{food\ access} \\ & + \beta_8 \mathrm{immunization\ status} + \beta_9 \mathrm{treated\ water\ access} \\ & + \beta_{10} \mathrm{sanitation\ access} + \mu_i \end{aligned} \tag{2}$$

where MSC = malnutrition status of children 1 or 0. Child who has stunted, wasted or underweight or any combination of three is measured as malnutrition. Independent variables are indicated as Age as age of child (in years), Gender as gender status of child (male/female), MED as mother education (in schooling years), FI as family income (various categories), FS as family size, Area as location (rural or urban), food access (yes/no), immunization status (yes/no), treated water access (yes/no) and sanitation access (yes/no). In this study for statistical analysis of data estimation, SPSS software version 23 has used.

Results

Socioeconomic variables descriptive statistics of the study are reported in Table 1, and logistic regression model estimated parameters to recognize socioeconomic factors influencing stunting, wasting and underweight of children age < 5 years presented in Table 2. In total sample size of 2497 children, 1193 were male and 1304 female children as representing 47.78% and 52.22%, respectively, with estimated mean value 1.62 and standard deviation of 0.465. Out of total sample size of 2497 children, 584 (23.39%) aged of some months, 462 (18.5%) children aged 1 year, 479 (19.18%) children aged 2 years, 503 (20.14%) children as of 3 years, and 469 (18.78%) children were aged 4 years or above while below 5 years. Child age estimated mean value is 1.89 with standard deviation of 1.397. In total sample of 2497 children, 986 (39.49%) children were living in household family size of (less than 5) while almost 1321 (54.14%) children household family size (6–10). Out of total sample, 181 (7.25%) children were living

Table 1 Socioeconomic characteristics descriptive statistics of the study

Characteristics	Number	Percentage	Mean	Standard deviation
Gender	2497		1.62	0.465
Male	1193	47.78		
Female	1304	52.22		
Age of child	2497		1.89	1.397
0 (some month)	584	23.39		
1 (in the year)	462	18.5		
2 (in the year)	479	19.18		
3 (in the year)	503	20.14		
4 (in the year)	469	18.78		
Family size	2497		1.68	0.594
> 5	986	39.49		
6–10	1321	54.14		
11–15	181	7.25		
16 and above	9	0.36		
Area	2497		1.47	0.471
Urban	1052	42.13		
Rural	1445	57.87		
Mother education level	2497		2.11	1.329
Non/pre-school	1293	51.78		
Primary	495	19.82		
Middle	256	10.25		
Secondary	235	9.41		
Highest	218	8.73		
Wealth quintile	2497		2.87	1.342
Lowest	584	23.39		
Secondary	496	19.86		
Middle	488	19.54		
Fourth	544	21.79		
Highest	385	15.42		
Food access	2497		2.73	1.431
Food shortage	1870	74.89		
Sufficient food	627	25.11		
Immunization status	2497		1.67	0.942
Incomplete	1927	77.17		
Complete	570	22.83		
Treated water access	2497		1.43	0.874
Yes	1143	45.77		
No	1354	54.23		
Sanitation access	2497		1.89	1.327
Yes	1958	78.41		
No	539	21.59		
Stunting	2497		0.97	0.389
Yes	464	18.58		
No	2033	81.42		
Wasting	2497		0.81	0.492
Yes	710	28.43		
No	1787	71.57		

Table 1 (continued)

Characteristics	Number	Percentage	Mean	Standard deviation
Underweight	2497		0.74	0.368
Yes	488	19.54		
No	2009	80.46		

in household family size (11–15) and 9 (0.36%) children with household family size (above 15). Family sizes mean value was reported 1.68 with value of standard deviation of 0.594. In total sample, 1052 (42.13%) children were inhabited in urban area while 1445 (57.87%) from rural area of Multan district of Punjab province, Pakistan with mean value of 1.47 and standard deviation 0.471. Mother education level showed almost 1293 (51.78%) children's mothers were illiterate while 495 (19.82%) with primary education and 256 (10.25%) as middle education. Out of total sample, 235 (9.41%) children mother education was secondary schooling and 218 (8.73%) schooling of higher education with estimated mean value 2.11 and standard deviation of 1.329.

In sample size of 2497 children, 584 (23.39%) children were living in the lowest household wealth quintile while 496 (19.86%) children related to secondary wealth quintile and 488(19.54%) children associated with middle wealth quintile index. Out of total sample, 544 (21.79%) children were in fourth wealth quintile index and 385 (15.42%) children in highest household wealth quintile index with mean value of 2.87 and standard deviation 1.342. In food access status in total sample, 1870 (74.89%) children were facing food shortage while 627 (25.11%) using adequate food with mean value of 2.73 and standard deviation 1.431. A higher frequency of children 1927 (77.17%) not completed their immunization of age and only 570 (22.83%) completed their immunization status with mean of 1.67 and standard deviation 0.942. A limited number of children 1143(45.77) were access of treated water while 1354 (54.23%) not use treated water with estimated mean value of 1.43 and standard deviation 0.874. Out of total sample, 539 (21.59%) were not using sanitation facility and 1958(78.41%) access of sanitation as mean of 1.89 and standard deviation 1.327. In total sample, 18.58% children stunted, 28.43% children wasted, and 19.54% were underweight in study area as indicated in Table 1.

In Table 2, empirical findings of the study elaborated male children were 1.208 and 1.213 time more risk of wasting and underweight rather than female children (OR = 1.208, CI 95% 0.769–1.352, p value < 0.003) and (OR = 1.213, CI 95% 0.821–2.897, p value < 0.002). Children of some month were 1.247, 1.329 and 1.497 times more stunted, wasted and underweight rather than children aged of 4 years (OR = 1.247, CI 95% 0.543–1.546, p value < 0.002), (OR = 1.329, CI 95% 1.068–2.487, p value 0.001) and (OR = 1.497, CI 95% 0.761–2.754, p value 0.003). Children of 1 year were 1.181 and 1.246 times higher prevalence of stunting and wasting rather than 4 year children (OR = 1.181, CI 95% 0.719–1.487, p value 0.003) and (OR = 1.246, CI 95% 0.683–1.854, p value < 0.002). Lower family size 0.589, 0.473 and 0.387 times less risk of stunting, wasting and underweight rather than large family size (OR = 0.589, CI 95% 0.431–3.715, p value < 0.003), (OR = 0.473, CI 95% 0.348–1.249, p value 0.001) and (OR = 0.387, CI 95% 0.264–2.327, p value < 0.002). In urban areas, children were 0.594 times less risk of wasted rather than rural areas children (OR = 0.594, CI 95% 0.476–1.987, p value 0.002). Children of illiterate, primary and middle educated mother were 1.432, 1.274 and 1.127 times more stunted than higher educated mothers children's (OR = 1.432, CI 95% 0.528–1.972, p value 0.012), (OR = 1.274, CI 95% 0.386–2.431, p value < 0.003) and (OR = 1.127, CI 95% 0.247–2.327, p value 0.001). Children belong to lowest wealth quintile family were 2.174, 2.243 and 1.258 times more expected to stunted rather than children's related to highest wealth quintile (OR = 2.174, CI 95% 1.234–3.376, p value 0.027), (OR = 2.243, CI 95% 1.261–3.287, p value < 0.002) and (OR = 1.258, CI 95% 0.831–2.473, p value 0.016).

Household families facing the status of food shortage their children were 1.874, 1.367 and 1.783 time more risk of stunting, wasting and underweight rather the families sufficient access of food (OR = 1.874, CI 95% 0.764–2.851, p value 0.021), (OR = 1.367, CI 95% 0.782–2.543, p value 0.004) and (OR = 1.783, CI 95% 0.857–2.647, p value < 0.002). Families with incomplete children immunization status their children were 1.387, 1.541 and 1.342 times more occurrence of stunting, wasting and underweight rather the children with complete immunization status (OR = 1.387, CI 95% 1.123–2.431, p value < 0.019), (OR = 1.541, CI 95% 0.754–2.687, p value 0.001) and (OR = 1.342, CI 95% 1.041–2.658, p value 0.004). Children with access of treated water were 0.593 and 0.689 times less risk of stunting and underweight rather the children having no access of treated water (OR = 0.593, CI 95% 0.387–1.965, p value 0.031) and (OR = 0.689, CI 95% 0.542–2.743, p value < 0.002). Families with access of sanitation facility their children was 0.789 times less risk of stunting rather children of children no access of sanitation (OR = 0.789, CI 95% 0.627–1.987, p value 0.001).

Discussion

In developing countries like Pakistan, child malnutrition is emerging as foremost public issues. Inadequate dietary intake, insufficient caring, infectious disease and

Table 2 Parameters estimates of logistic regression model and factors affecting stunting, wasting and underweight

Parameters	Stunting		Wasting		Underweight	
	Odd ratio (95% CI)	*p* value	Odd ratio (95% CI)	*p* value	Odd ratio (95% CI)	*p* value
Gender						
Male	1.712 (0.684–2.187)	0.279	1.208 (0.769–1.352)	0.003*	1.213 (0.821–2.897)	0.002*
Female®	1		1		1	
Age						
0 (in months)	1.247 (0.543–1.546)	0.002**	1.329 (1.068–2.487)	0.001*	1.497 (0.761–2.754)	0.003*
1 (year)	1.181 (0.719–1.487)	0.001**	1.246 (0.683–1.854)	0.002*	1.347 (0.854–1.987)	0.478
2 (year)	1.347 (0.687–3.781)	0.529	0.467 (0.393–1.866)	0.287	0.834 (0.587–1.673)	0.824
3 (year)	1.234 (0.768–1.974)	0.481	0.687 (0.498–1.873)	0.794	0.752 (0.456–1.239)	0.263
4 (year)®	1		1		1	
Family size						
1–5	0.589 (0.431–3.715)	0.003*	0.473 (0.348–1.249)	0.001*	0.387 (0.264–2.327)	0.002*
6–10	0.729 (0.681–4.289)	0.725	0.693 (0.378–1.324)	0.864	0.448 (0.281–2.347)	0.693
1–15	0.654 (0.459–5.781)	0.378	0.711 (0.529–1.281)	0.679	0.376 (0.298–4.412)	0.478
16–20®	1		1		1	
Area						
Urban	0.871 (0.679–1.548)	0.486	0.594 (0.476–1.987)	0.002*	0.697 (0.397–1.473)	0.579
Rural®	1		1		1	
Mother education						
Pre-school	1.432 (0.528–1.972)	0.012**	1.576 (1.322–2.337)	0.268	1.335 (1.114–3.482)	0.192
Primary	1.274 (0.379–2.431)	0.003*	1.496 (1.237–2.832)	0.371	1.389 (1.131–2.156)	0.489
Middle	1.127 (0.247–2.327)	0.001*	1.102 (0.497–2.568)	0.749	0.514 (0.161–1.642)	0.261
Secondary	1.231 (0.417–2.247)	0.147	0.781 (0.348–1.823)	0.647	0.526 (0.164–1.690)	0.281
Higher®	1		1		1	
Wealth quintile						
Lowest	2.174 (1.234–3.376)	0.027**	2.243 (1.261–3.287)	0.002*	1.258 (0.831–2.473)	0.016*
Secondary	1.852 (1.288–2.015)	0.471	1.603 (1.340–2.543)	0.431	1.719 (0.273–1.941)	0.571
Middle	1.317 (0.426–2.474)	0.787	1.450 (1.240–3.618)	0.262	0.619 (0.359–1.764)	0.439
Fourth	1.143 (0.549–2.712)	0.438	1.302 (1.275–2.051)	0.636	0.513 (0.289–1.438)	0.213
Higher®	1		1		1	
Food access						
Food shortage	1.874(0.764–2.851)	0.021**	1.367 (0.782–2.543)	0.004*	1.783 (0.857–2.647)	0.002*
Sufficient Food®	1		1		1	
Immunization status						
Incomplete	1.387 (1.123–2.431)	0.019**	1.541 (0.754–2.687)	0.001*	1.342 (1.041–2.658)	0.004*
Complete®	1		1		1	
Treated water access						
Yes	0.593 (0.387–1.965)	0.031**	1.243 (1.023–2.763)	0.714	0.689(0.542–2.743)	0.002*
No®	1		1		1	
Sanitation access						
Yes	0.789 (0.627–1.987)	0.001*	1.479 (1.087–2.857)	0.491	0.817 (0.679–1.572)	0.241
No®	1		1		1	

* 10% level of significance

** 5% level of significance

*** 1% level of significance

household level discriminatory food distribution are major causes of children higher vulnerability to malnutrition [26, 80, 87]. Male children were identified higher risk of malnutrition in this study with higher frequency of wasting, stunting and underweight comparative to female children as could partially explained reasoned of as male

consider more vulnerable due to health inequalities to early childhood diseases and health problems rather than female children [19]. These results are consistent with previous research work of [4, 19, 26, 41, 51, 79]. Children of some months and 1 year were more risk of malnutrition as children of 4 years with frequency of stunting, wasting and underweight it may be the reason community with lower socioeconomic status and less delivery of health services as these findings are in contrast with the studies of [6, 27, 78]. Family size significantly associated with malnutrition status of wasting, stunting and underweight as family size increases malnutrition status wasting, stunting and underweight increases, reason underlying is this with family increase resources become scare and less nutrition and care focused to children. These findings are consistent with studies of [10, 16, 22, 78] and in contrast the studies of [11, 42]. Urban areas children indicated a reduced frequency to be stunted rather than rural area the reason of more appropriate nutrition and access of health services and these findings are supported in the study [22]. In developing countries, children from rural area consider more vulnerable to malnourishment due to differences of limited economic resources, inadequate education access and poor availability of poor health facilities as these findings supported by the studies of [24, 74]. Mother education has significant relation with reducing stunting; increasing mother education reduces stunting status of children because the educated mothers have more knowledge related to child health, nutrition and usage of health services [41]. These findings are alike with the studies of [18, 26, 34, 50, 69]. Children of lowest wealth quintile were higher frequency of malnutrition (stunting, wasting and underweight) rather than higher wealth quintile family children due to underlying reason of less affordability of healthcare, quality nutrition and hygiene rather than rich families. These results are similar with the studies of [25, 79]. Households with food shortage were higher prevalence of malnutrition (stunting, wasting and underweight) in children rather than children adequate access of food. Adequate nutrition promotes health and resistance against diseases, while inadequate nutrition causes to increase severity of stunting, wasting and underweight. These findings are consistent with the study of [63]. Children with incomplete immunization status were found more prevalence of malnutrition compared to those children with completed immunization. Incomplete immunization increases risk of diseases among children [26]. These findings are consistent with the studies of [26, 48, 49, 60, 62]. Household access of treated water their children was 47–70% less chance of stunting and underweight rather than children not access of treated water, and findings are alike the study of [79]. Households access of sanitation facility their children were 80% less prevalence of stunting compared to those children having of access of sanitation facility as findings are similar the studies of [62, 79].

Conclusion

Results of the study indicated higher frequency of malnutrition risk that causing foremost health problem among children aged under five in district Multan of Punjab province, Pakistan. This study identified gender, age, area, level of maternal education, family income, family size, sufficient food access and completed immunization are derived factors and significantly associated with childhood malnutrition. Male children have more threat of malnutrition rather than female children need to appropriately focus male child nutrition needs to reducing vulnerability of malnutrition. In overcoming the malnutrition issue, there is need to promote awareness about education and trainings specifically in rural areas about food nutritional value, diseases of nutritional deficiency, significance of personal hygiene, value of maternal education, use of treated water and sanitation facility. Mutual cooperation among government, Non-Governmental Organizations (NGOs) and community is prerequisite for developing and implementing strategies and policy measures of nutrition and awareness campaigns for improving child health. Health extension institutions need to use print media, social media and electronic media as significant sources for promoting the nutrition education awareness of malnutrition among children and its protective measures. Improving nutritional status of child, there is need of proper intervention through promoting the programs of children vaccination for competing immunization and adequate nutrition for children as increasing resistant to diseases and enhancing physical strength.

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Authors' contributions
Dilshad Ahmad developed idea, wrote the manuscript and estimated the data, Aisha Imtiaz compiled data, while Muhammad Afzal finally reviewed it.

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