



Food Preferences and Nutritional Status: Insights on Nutrition Transition in University Community

Zahwa Arshad Rana¹ *, Muhammad Ahsan¹, Muazzam Ali¹, Atif², Muhammad Uzair³

¹ Department Epidemiology and Public Health, University of Agriculture, Faisalabad 38000, Punjab, Pakistan

² Department Food Science and Technology, MNS- University of Agriculture, Multan, Punjab, Pakistan

³ National Institute of Food Science and Technology, University of Agriculture, Faisalabad 38000, Punjab, Pakistan

*Correspondence: E-mail: Zahwa.ranaa@gmail.com

ABSTRACTS

'Nutritional transition' usually entails a move towards a high-energy diet and lower levels of practice with detrimental effects. The pilot research examined whether parent education works at the home level in a small group of University employees to affect food adoptions and child nutrition. Three groups of people with different degrees of skills and education participated. In all homes, weighed food records were used to determine the per capita intake. Nutrient calculators were used to determining the nutrients. Children were classified into underweight, overweight, and normal weight using BMI scores. A total of 178 individuals were present in the research, which provided us with food log data. There were 67 children from 30 households (32 (47.8%) were girls and 35 (52.2%) were males). The age of children with median age is 5.52 ± 2.89 years. Research revealed that 43.3% of children were underweight and 25.4% were overweight by using their BMI scores. Energy consumption was higher in families with overweight children compared to families with underweight and normal children. Underweight kids come from impoverished families. The per capita consumption of the whole family in children was strongly linked with the BMI. Obesity has risen among families with medium incomes belonging to Class 2—probably in families that move up from poverty. The nutritional condition of children was largely linked with motherly education.

ARTICLE INFO

Article History:

Received 14 Aug 2021

Revised 17 Sep 2021

Accepted 19 Sep 2021

Available online 21 Sep 2021

Keyword:

Food preferences,
Nutrition transition.

1. INTRODUCTION

About 170 million children under the age of 5 are suffered from malnutrition that is the leading cause of morbidity among these children.

The world has 165 million malnourished children under the age of five. Malnutrition represents at least half of all fatalities in children worldwide (Larson-Nath & Goday, 2019). Nearly half of the death rate among children worldwide is due to malnutrition. It also presents a danger to the physical and psychological development of children, leading to low academic success (Anik *et al.*,2019). Sufficient nutrition is essential to provide a robust immune system and the appropriate early childhood physical and intellectual development. Malnutrition leads to many consequences included poor health's psychosocial disabilities and susceptibility to many diseases. Pakistan has recorded one of the highest levels of child malnutrition prevalence compared to other emerging countries (Cederholm *et al.*,2019). National nutrition survey revealed that nearly one-third of the children in Pakistan were underweight and anemic' while 44% are suffered from stunting and 15% are wasted. It is said that child malnutrition is a decline in Pakistan compared to other developing countries. In less developed countries' despite efforts of coping with socioeconomic disabilities, Child malnutrition is still a major public health concern. Malnutrition leads to many factors including low birth weight, lack of breastfeeding practices, inappropriate supplementary feeding, maternal education, poor knowledge and awareness towards Nutrition, parity, food insecurity, and vaccination hesitancy or other infectious diseases.

In addition, diet habits during pregnancy, and feeding practices are essential for meaning realizing the full life potential of a child. If this window of opportunity is lost, development, less learning, and decreased performance may be permanent and slowed down (Choi *et al.*,2019). Stunting refers to poor infant health owing to several variables such as physical growth and cognitive capacity (Anik *et al.*,2019; Sawaya, 2006). Low height against age is called Stunting, assessed using anthropometric indexes for WHO child development criteria as a proxy measure (Cederholm *et al.*,2019). Pakistan has the most stunted children in South Asia after India (Kar *et al.*,2008). In Pakistan, however, malnutrition is prevalent across all ages, and in recent decades improvement has been unpredictable (Engle & Fernández, 2010).

Punjab's stunning incidence was 36 percent in 2011 and 33.5 percent in 2014. For the country's biggest and most developed provinces, this prevalence is worrisome. Punjab provides more than 52 percent to national revenue, consisting of half of the Pakistan population were severely adhere to child nutrition with multiple associated detrimental factors as food security, lack of knowledge and awareness, lack of proper counseling towards nutrition. Similarly, prior research has shown that individual and community variables are significant predictors of childhood stun and have confirmed that 37 percent of stunts had to do with issues at the community level in their study (Boah *et al.*,2019). In addition to children's unique features and parental traits, the significance of water, sanitation, and hygiene (WASH) for children and newborns, especially in cases of stunting during the first 2 years of life, has been recognized (Anik *et al.*,2019). Recent research indicates that inadequate diets, low nutritional status, poor hygiene practices, food insecurity, poverty, and socioeconomic inequalities of mothers during and after pregnancy are major causes of infantile stunning (Ahmad *et al.*,2020). Furthermore, the quality of the child's diet is often affected by, and access to, sufficient health and/or absence of, community/village nutrition and social services (Singh *et al.*,2019). Previous research revealed that women's education, equality, and the availability of food are the major causes of stunting (Bouvier *et al.*,1995).

Although Pakistan's literature is relatively scant. In addition to national but also micro-geographic, efforts are being made to examine the determinants of under-nutrition (Ahmad *et al.*,2020; Tekile *et al.*,2019). Research from the province of Sindh also shows that maternal analphabetism, poor incomes, and overcrowding are major risk factors for stunting. Furthermore, rural mother education may decrease stunting since women are more likely to be stunted and weighty than men in these areas (Humbwavali *et al.*,2019). Contrary to that claim, research utilizing 2011 MICS data for Punjab investigated that female-headed households (a measure of women's empowerment) had 26% reduced children stunting odds (Nisar & Dibley, 2014).

All of these studies focused on the use of either normal smaller squares (OLS) or binary analysis of logistic regression. As a typical OLS, the correlation coefficient may be over-or under-evaluated at various places across the range of the stunting prevalence. These hierarchies contain essential information for better and more focused development of policies. This research thus utilizes a multi-level hierarchical modeling method to unravel variance at the micro-geographical level of households, communities, and districts that are not investigated in the instance of Pakistan. This study will set the scene for policy discussion and offer information on the data-driven formulation of public policy. Hence the study was aimed to access the parent's education associated with their children's Nutritional status.

2. METHODS

International Standard Occupational Classification (ISCO)-88 identifies four main categories considering the degrees of formal education and skills. Professionals are categorized in level 4, associate professionals at level 3, services staff at level 2 and primary profession that does not need any kind of specific training were at level 1, Professionals at level 4, nurses and associate professionals and technicians of level 3, staff and service staff at level 2 and primary professions that do not need special training at level 1. We utilized this categorization to classify families in terms of the education and skills of the main woman in the family. For simplicity, Class 1 (housekeeping personnel) Class 2 (infirmary workers), and Class 3 (doctors) are re-designated for this report. We studied all the participants in the University, each of whom were personally known by researchers and had a good relationship with to guarantee compliance with the rigors required to keep the comprehensive weighted logs of home food consumption. We investigated food consumption per capita in families and child nutrition.

The emphasis of our research was on children's nutritional status. WHO classifications underweight (BMI < 5th centile) or overweight (BMI > 5th to < 85th centile) were used. While BMI is defined as Body mass index (BMI) [weight (in kg)/height(m²)]. The consumption of food at the family unit level was examined to understand the impact of food adoptions on a child's Nutritional status. Each home was supplied with kitchen weighing devices (Venus domestic scale, KCE Model), and all the raw foodstuffs used for cooking purposes were recorded for 2 consecutive days.

Socio-demographic elements as Age, gender, precipitate income, weight, total family members were also recorded. Food records were analyzed revealing the exact raw foodstuffs weight used for cooking purposes in the kitchen. The nutritional content of meals was analyzed using dietary software to determine nutrients eaten in households per day. This dietary program has been created by Gopalan *et al* utilizing the nutritional content of Pakistani cuisine. The program has been pre-validated.

2.1. Calculation of Sample Size

Given the variance in energy use, we considered that a margin of error of 20 percent for each group was acceptable. Looking for differences at the confidence interval of 95%, we estimated that a sample of at least 30 people (adult equivalents) should be studied in each of the 3 groups [13]. To include allowances for dropouts, we selected a sample of around 50 people in each group and we intended to investigate a total of 150 persons in 30 families, taking the average family membership of 4.

2.2. Analysis of Statistics

The statistical analysis was conducted using version 17.0 of SPSS for Windows. Continuous variables are given as a mean \pm SD, while absolute numbers and percentages of categorical variables are presented. Data were verified for normality using the Shapiro Wilk test prior to doing statistical analysis. For comparing three or more groups, the Kruskal Wallis test has been employed and additional comparisons have been made using the Mann Whitney U test. Using the chi-square test, categorical variables were examined. A p-value of less than 0.05 was chosen for all statistical tests to show an important difference.

For family comparisons, the per capita consumption (per adult equivalent) in the household was utilized. Previously utilized adult-equivalent conversion factors were used. The adult scale provides for the makeup of the family and the existence of family members with different energy requirements, such as children. The home foods were believed to be properly divided in the family unit and each received a part in the household pot in accordance to its age.

Written informed permission was obtained for the children's guardian participation. The permission forms were approved by the Committee on the Institutional Ethics University of Agriculture Faisalabad, Pakistan.

3. RESULTS

A total of 178 individuals were present in the research, which provided us with food log data. There were 67 children from 30 households. Of the 67 youngsters, 32 (47.8%) were girls and 35 (52.2%) were males. The age of children with median age is 5.52 ± 2.89 years. Research revealed that 43.3% of children were underweight and 25.4% were overweight by using their BMI scores. Household Per capita intake of underweight, normal weight, and overweight/obese based on BMI Category were shown in **Table 1**. Energy consumption was higher in families with overweight children compared to families with underweight and normal children. Fat and protein were as well higher in a household with overweight children compared to families with underweight and normal children. Families with overweight children got more calories from animal sources compared to others. Intake of fat and protein in the household show significant results along with phosphorus, riboflavin, and carotene.

Children's nutritional status concerning ISCO were shown in **Table 2**. There was only one overweight child in class 1 classified according to ISCO categorization and the majority of the overweight youngsters were from class 3.

Table 3 focuses on family per capita income. In households with PCIs less than Rs 10,000/month, there was one overweight child, but 17 were underweight. No households with PCI were underweight above Rs 50,000/month while 10 were overweight. Results were statistically significant among groups.

Table 1. Household Per capita intake of underweight, normal weight, and overweight/obese based on BMI Category.

Variables	BMI Category (Mean ± SD)			P value
	Underweight (n =29)	Normal (n = 21)	Overweight (n = 17)	
Energy (Kcal)	2143 ± 328.98	2278±431.23	2708±503.21	0.018
CHO(g)	289.76 ± 71.76	398.21±387.45	601.89±521.22	0.301
Fat (g)	61.91 ± 11.89	71.4±12.56	91.45±23.12	0.004
Protein (g)	61.78 ± 16.12	76.21±12.98	111.87±27.89	0.003
Animal source(kcal)	324.78 ± 161.45	501.45± 171.45	675.21±181.21	0.032
Dietary fiber(g)	7.01 ± 2.6	9.12±3.1	7.76±2.12	0.512
Minerals (g)	12.43 ± 2.98	13.54±3.12	14.89±2.16	0.019
Iron (mg)	15.98 ± 4.56	198.21±5.12	19.12±6.78	0.504
Calcium (mg)	783.54 ± 278.76	10879.76±267.89	1267±287.34	0.043
Phosphorus (mg)	1519.87 ± 338.12	1702.45±418.12	2098.65±433.67	0.004
Carotene (mcg)	1289.76 ± 1098.4	1801.34±489.98	712.31±312.89	0.005
Thiamine (mcg)	1.63 ± 0.5	1.52±0.6	1.67±0.5	0.401
Riboflavin (mg)	0.71 ± 0.23	1.02±0.5	1.6±0.4	0.003
Niacin (mg)	15.1 ± 4.37	15.12±1.2	16.22±1.9	0.790
Total B6 (mg)	0.17 ± 0.08	0.16±0.12	0.13±0.1	0.398
Folic acid (free) (mcg)	67.43 ± 17.12	73±18.12	92.56±17.43	0.043
Folic acid (total) (mcg)	195.5 ± 55.43	215.67±61.98	293.67±73.56	0.033

Table 2. Children's nutritional status concerning ISCO.

	BMI category		
	Underweight N (%)	Normal N (%)	Overweight N (%)
Class 1	23 (74.0)	7 (22.6)	1 (3.2)
Class 2	6 (37.5)	4 (25.0)	6 (37.5)
Class 3	0 (0.0)	10 (50.0)	10 (50.0)
Total	29 (43.3)	21 (31.3)	17 (25.4)

Table 3. Child nutritional status concerning family per capita income.

	BMI category		
	Underweight N (%)	Normal N (%)	Overweight N (%)
10,000 or less	17 (77.2)	4 (18.2)	1 (4.6)
20,000–30,000	12(50.0)	6 (25.0)	6 (25.0)
50,000\ More	0 (0.0)	11 (52.4)	10 (47.6)
Total	29 (43.3)	21 (31.3)	17 (25.4)

The impact of the education level of mothers on BMI is seen in **Table 4**. Twenty-seven children were born to mothers who studied for a college degree or did not attend high school. 21 of them were underweight and one overweight. 19 children were belonging to mothers having a professional postgraduate degree. Out of these 19, none of the children were underweight but 9 were overweight.

Table 5 illustrates children's nutrition versus father education levels. It has a similar tendency, but the differences are less pronounced and are not statistically relevant.

Table 4. The impact of the education level of mothers on Nutritional status.

	BMI category		
	Underweight N (%)	Normal N (%)	Overweight N (%)
College degree or less (Services staff)		21 (77.8)	5 (18.5)
Graduate degree (Assistants)	8 (38.0)	6 (28.6)	7 (33.4)
Post Graduate degree (Professionals)	0 (0.0)	10 (52.6)	9 (47.4)
Total	29 (43.3)	21 (31.3)	17 (25.4)

Table 5. children's nutrition versus father education levels.

	BMI category		
	Underweight N (%)	Normal N (%)	Overweight N (%)
College degree or less (Services staff)	19(70.3)	7 (25.9)	1 (3.7)
Graduate degree (Assistants)	10 (50.0)	4 (20.0)	6 (30.0)
Post Graduate degree (Professionals)	0 (0.0)	10 (50.0)	10 (50.0)
Total	29 (43.4)	21 (31.3)	17 (25.4)

4. DISCUSSION

A key determinant of child malnutrition is socioeconomic vulnerability. Southeast Asia and Africa report that the incidence of malnutrition among girls has risen regularly in contrast to boys (Fujiwara *et al.*, 2019). For example, Bangladesh research has shown a higher rate of malnutrition (54 percent) among females and a higher risk (1,44 times) of malnutrition compared to males (Zysman *et al.*, 2019). This higher risk is presumably due to disparities in food allocation in a household. In such circumstances, girls succumbed to hunger rather than boys. These fragile females are susceptible to malnutrition problems, died at an early age, or may establish an intergeneration malnutritional loop if survived (Swinburn *et al.*, 2019). These circumstances often occur in certain cultures in South Asia and Africa, where males are given cultural preferences to specified meals and consume more nutritious diets. In contrast, several reports from similar areas reported conflicting results showing a greater malnutrition incidence among children than girls (Modjadji & Madiba 2019). Malnutrition has been observed in the current research in the increasing frequency of boys. Our results show a greater incidence of malnutrition in males than women in different areas of the globe. This result of the research is counter to the widespread assumption that in South-East Asia, female children are exposed to discrimination compared with male children. Whereas, Laghari *et al* found a greater incidence of severe malnutrition among females than males under the age of five. Ansari *et al.*, have previously found comparable results in urban slum youngsters. Unlike the studies mentioned, the difference in research conditions may be ascribed to the existence of a greater incidence of malnutrition among children in the current study. The current research was carried out on youngsters going to school. Parents who send their girls to school may, therefore, be considered to have a more loving and less discriminating attitude towards their female offspring. Their love for daughters may lead to greater access to food for women. It may also be assumed that these families are more informed of excellent practices in health (Cowardin *et al.*, 2019). Whatever the cause, it is difficult to infer greater malnutrition in boys in this research and different literature findings.

We have specifically chosen youngsters in three groups with varying levels of education, skills, and per-capita income. Our research aimed at studying diets in families in various categories of education and skills towards discourse one element of this disparity.

In our research, 38% of kids were malnourished, 21% underweight and 17% overweight and obese, which illustrates the 'double burden of malnutrition' articulated in India by

Ravishankar (Tebeje *et al.*, 2019). We examined that Children's BMI was directly linked with family precipitate caloric intake. More children were overweight in those families that have high energy intake as lipids and animal sources. Food fads and a propensity to eat "junk food" are provided to urban youngsters, high in calories from sugar and fat, with little protein, fiber, vitamins, or minerals, frequently blamed for the growing obesity among the kids. Our research has shown that obesity is linked to the family diet and in some manner transfers the responsibility from children to parents. The high proportion of underweight children in Class 1 households indicates that financial limitations limit the consumption of calories in this group. The poverty line is defined by the Government of Pakistan as minimal income required to maintain the basic needs of foods, by not taking into consideration other elements as education and health. Hence in our study level, 1 participant was more likely to suffer from being underweight due to lack of financial resources to meet their needs of nutrition.

We would intuitively anticipate that wealthy households in class 3 (education and level 4 with the greatest income per capita) would consume richer and denser food. However, in Class II (education and level 3) we discovered more overweight children and they eat more calories, protein, and fat. Although not officially recorded in this research, it is known that many of the children in Class 2 went from class 1 into school and developed skills in their lives. We may assume that these women from impoverished homes tend to overcompensate so that they do not suffer in their youth from the deprivations they experienced. This result is similar to other reports in the United Kingdom, who looked at the mid-dole class separately from children in both lower and higher classes and found that children of the middle class were more likely than the other groups to be obese (Asoba *et al.*, 2019). They observed that the greatest likelihood of being categorized as obese is among the English Deprivation Indexes in all mean-sures of adiposity (Maehara *et al.*, 2019). Parents of lower-middle households. hard and children's education and partner ownership are fundamental objectives. This may influence their repeatability in other situations. We believe that our results will assist the production of hypotheses to examine the fundamental dynamics of the food transition (Polak *et al.*, 2019).

Rural, urban disparities in child malnutrition are widely shown worldwide. The research shows that children of low socioeconomic backgrounds are more likely to acquire malnutrition because of poor living standards, unsanitary eating habits, unsanitary drinking water, and inadequate sanitation. Therefore, it is generally believed that urban slum inhabitants have greater access to health services than rural populations due to their near physical proximity to urban regions (Dreher *et al.*, 2019). However, compared to metropolitan populations, these squatter settlers have worse health conditions. However, a few types of research revealed inconsistent results (Van Cooten *et al.*, 2019). The nutritional status of children in slums in Bangladesh, for example, was considerably poorer than that of rural, non-slum, and urban children. Similarly, in Nairobi slums residing in Kenya, the incidence of infancy diseases was greater than in rural and urban regions (Fongar *et al.*, 2019). In contrast, the death rate in Egypt for children under five in slums was much higher than in other metropolitan areas. It was nevertheless determined to be less than rural and domestic numbers (van Cooten *et al.*, 2019). Similar findings were also made in India, where childhood malnutrition in rural regions was greater in comparison with slums and urban areas. The nutritional condition of that section of society is addressed by a lack of literature in Pakistan. Urn-rural comparison research was performed by Anwar *et al.*, in Faisalabad, Pakistan, where the prevalence of stumping (33% urban vs 40,9% rural), waste (32.7% urban vs 33.3% rural), and low weight (32.3% urban vs 64.7% rural) were considerably greater in rural regions. In comparison with Asim Met all's research, the rate of stunting was shown to be lower in this

study (38 percent) than in rural regions (40.9 percent) but higher than in urban areas (33 percent). Whereas both waste and underweight rates were found to be lower in slum regions than in urban and rural areas.

The cross-sectional design of this research is limited. Through such study, causal connections cannot be proven, only founded associations may be reported and recall-bias can be included.

Income a confounder of the association, may not have been consistent. If the income in the questionnaire was lower than answered, the connection might be surpassed since malnutrition is less likely with a greater family income. In accordance with the previously stated partialities, it is noteworthy that dads were not explicitly questioned in this study. The mother answered all inquiries because most of the dads were not there and had to get money for their family. Men are not likely to be at health centers since it is the mother's job to look after the kid and to visit health centers. For this reason, additional missing data about the father are added. This lack of money, for example, may lead the relationship of paternal education to reduce statistical power and dependability. The very small population of the study is another constraint of this research (N = 67). Many factors, such as education, income, and job, were grouped. The increased dispersion of educational groups, unfortunately, resulted in a loss of important information.

5. CONCLUSION

Regarding the main question of the research: "What is the impact of parental education on malnutrition in children under five in Pakistan?" and the hypothesis that the risk of child malnutrition is reduced by higher parental education, it may be assumed that maternal education has a significant effect. The risk of child malnutrition is reduced by higher maternal education, middle and high-level education. This connection is affected by the father and the age of the child's income and education. Paternal education cannot be linked to child malnutrition based on the study findings.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

7. REFERENCES

- Ahmad, D., Afzal, M., and Imtiaz, A. (2020). Effect of socioeconomic factors on malnutrition among children in Pakistan. *Future Business Journal*, 6(1), 1-11.
- Anik, A. I., Rahman, M. M., Rahman, M. M., Tareque, M. I., Khan, M. N., and Alam, M. M. (2019). Double burden of malnutrition at household level: A comparative study among Bangladesh, Nepal, Pakistan, and Myanmar. *PloS one*, 14(8), e0221274.
- Asoba, G. N., Sumbele, I. U. N., Anchang-Kimbi, J. K., Metuge, S., and Teh, R. N. (2019). Influence of infant feeding practices on the occurrence of malnutrition, malaria and anaemia in children ≤ 5 years in the Mount Cameroon area: A cross sectional study. *Plos one*, 14(7), e0219386.
- Boah, M., Azupogo, F., Amporfro, D. A., and Abada, L. A. (2019). The epidemiology of undernutrition and its determinants in children under five years in Ghana. *Plos One*, 14(7), e0219665.

- Bouvier, P., Papart, J. P., Wanner, P., Picquet, M., and Rougemont, A. (1995). Malnutrition of children in Sikasso (Mali): prevalence and socio-economic determinants. *Sozial-und Präventivmedizin*, *40*(1), 27-34.
- Cederholm, T., Jensen, G. L., Correia, M. I. T. D., Gonzalez, M. C., Fukushima, R., Higashiguchi, T., Blaauw, R., Coats, A. J. S., Crivell, A. N., Evans, D. C., Gramlich, L., Fuchs-Tarlovsky, V., Keller, H., Llido, L., Malone, A., Mogensen, K. M., Morley, J. E., Muscaritoli, M., Nyulasi, I., Pirlich, M., Pisprasert, V., de van der Schueren, M. A. E., Siltharm, S., Singer, P., Tappenden, K., Velasco, N., Waitzberg, D., Yamwong, P., Yu, J., Van Gossum, A., Compher, C., and GLIM Core Leadership Committee, GLIM Working Group. (2019). GLIM criteria for the diagnosis of malnutrition—A consensus report from the global clinical nutrition community. *Journal of Cachexia, Sarcopenia and Muscle*, *10*(1), 207-217.
- Choi, S. R., Lee, Y. K., Cho, A. J., Park, H. C., Han, C. H., Choi, M. J., Koo, J. R., Yoon, J. W., and Noh, J. W. (2019). Malnutrition, inflammation, progression of vascular calcification and survival: Inter-relationships in hemodialysis patients. *PLoS One*, *14*(5), e0216415.
- Cowardin, C. A., Ahern, P. P., Kung, V. L., Hibberd, M. C., Cheng, J., Guruge, J. L., Sundaresan, V., Head, R. D., Barile, D., Miils, D. A., Barrat, M. J., Huq, S., Ahmed, T., and Gordon, J. I. (2019). Mechanisms by which sialylated milk oligosaccharides impact bone biology in a gnotobiotic mouse model of infant undernutrition. *Proceedings of the National Academy of Sciences*, *116*(24), 11988-11996.
- Dreher, Michele. M., Ronda, G., Hughes, Patricia. A. Handley., and Abbas. S. Tavakoli. (2019). Improving retention among certified nursing assistants through compassion fatigue awareness and self-care skills education. *Journal of Holistic Nursing*, *37*(3), 296–308.
- Engle, Patrice. L., and Patricia. D. Fernández. (2010). INCAP Studies of Malnutrition and Cognitive Behavior. *Food and Nutrition Bulletin* *31*(1):83–94.
- Fongar, A., Gödecke, T., and Qaim, M. (2019). Various forms of double burden of malnutrition problems exist in rural Kenya. *BMC Public Health*, *19*(1), 1-9.
- Fujiwara, A., Minakuchi, H., Uehara, J., Miki, H., Inoue-Minakuchi, M., Kimura-Ono, A., Nawachi, K., Maekawa, K., and Kuboki, T. (2019). Loss of oral self-care ability results in a higher risk of pneumonia in older inpatients: A prospective cohort study in a Japanese rural hospital. *Gerodontology*, *36*(3), 236-243.
- Humbwavali, J. B., Giugliani, C., Nunes, L. N., Dalcastagnê, S. V., and Duncan, B. B. (2019). Malnutrition and its associated factors: A cross-sectional study with children under 2 years in a suburban area in Angola. *BMC Public Health*, *19*(1), 1-11
- Kar, B. R., Rao, S. L., and Chandramouli, B. A. (2008). Cognitive development in children with chronic protein energy malnutrition. *Behavioral and Brain Functions*, *4*(1), 1-12.
- Larson-Nath, C., and Goday, P. (2019). Malnutrition in children with chronic disease. *Nutrition in Clinical Practice*, *34*(3), 349-358.
- Maehara, M., Rah, J. H., Roshita, A., Suryantan, J., Rachmadewi, A., and Izwardy, D. (2019). Patterns and risk factors of double burden of malnutrition among adolescent girls and boys in Indonesia. *Plos One*, *14*(8), e0221273.

- Modjadji, P., and Madiba, S. (2019). The double burden of malnutrition in a rural health and demographic surveillance system site in South Africa: A study of primary schoolchildren and their mothers. *BMC Public Health*, *19*(1), 1-11.
- Nisar, Y. B., and Dibley, M. J. (2014). Determinants of neonatal mortality in Pakistan: secondary analysis of Pakistan Demographic and Health Survey 2006–07. *BMC Public Health*, *14*(1), 1-12.
- Polak, R., Reilly, J. M., Elson, L. E., Gallegos-Kearin, V. C., Bhatnagar, S., Schneider, J. C., and Silver, J. K. (2019). Nutrition Education Services Described on National Cancer Institute (NCI)-Designated Cancer Center Websites. *Journal of Cancer Education*, *34*(5), 860-864.
- Sawaya, S. M. (2006). Malnutrition and poor academic performance: critical contributions. *Estudos Avançados*, *20*, 133-146.
- Singh, S., Srivastava, S., and Upadhyay, A. K. (2019). Socio-economic inequality in malnutrition among children in India: An analysis of 640 districts from National Family Health Survey (2015–16). *International Journal for Equity in Health*, *18*(1), 1-9.
- Swinburn, B. A., Kraak, V. I., Allender, S., Atkins, V. J., Baker, P. I., Bogard, J. R., and Dietz, W. H. (2019). The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report. *The Lancet*, *393*(10173), 791-846.
- Tebeje, N. B., Biks, G. A., Abebe, S. M., and Yesuf, M. E. (2019). Parent's food preference and its implication for child malnutrition in Dabat health and demographic surveillance system; community-based survey using multinomial logistic regression model: North West Ethiopia; December 2017. *BMC Pediatrics*, *19*(1), 1-10.
- Tekile, A. K., Woya, A. A., and Basha, G. W. (2019). Prevalence of malnutrition and associated factors among under-five children in Ethiopia: evidence from the 2016 Ethiopia Demographic and Health Survey. *BMC Research Notes*, *12*(1), 1-6.
- van Cooten, M. H., Bilal, S. M., Gebremedhin, S., and Spigt, M. (2019). The association between acute malnutrition and water, sanitation, and hygiene among children aged 6–59 months in rural Ethiopia. *Maternal and Child Nutrition*, *15*(1), e12631.
- Zysman, M., Burgel, P. R., Brinchault-Rabin, G., Nesme-Meyer, P., Surpas, P., Deslée, G., Perez, T., Rouzic, O. L., Jebrak, G., Chanez, P., Paillasseur, J. L., Caillaud, D., Roche, N., Burgel, P. R., Deslee, G., Surpas, P., Rouzic, L., Perez, T., Roche, N., Brinchault-Rabin, G., Caillaud, D., Chanez, P., Court-Fortune, I., Escamilla, R., Jebrak, G., Nesme-Meyer, P., Zysman, M., Pinet, C., and Roche, N. (2019). Relationship between gender and survival in a real-life cohort of patients with COPD. *Respiratory Research*, *20*(1), 1-5.