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# Household food security and WASH practices in children with undernutrition: a case study in low middle income area in Semarang, Indonesia

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## Abstract

**Purpose:** This study analyzed the correlation between household food security (HFS) and WASH practices toward nutritional status in children with undernutrition. **Methods:** This type of research was analytically observational with a cross-sectional design. The sample in this study was 55 mothers with children with a history of undernutrition aged 6 to 23 months. The Rank Spearman test was conducted to analyze this study. **Results:** The prevalence of stunted and severely stunted was 34.55%, respectively; underweight and severely underweight were 36.36%, respectively; and wasted and severely wasted were 30.91 and 16.36% respectively. The percentage of respondents with mild, moderate, and severe food insecurity were 23.6, 7.3, and 12.7% respectively. The average value of WASH practices was rated as good among all respondents. Household food security score was associated with WAZ (p=0.008 and r=0.352) and HAZ (p=0.027 and r=0.299) but was not associated with WHZ (p=0.067; r=0.248). WASH practice was associated with WAZ (p=0.000; r=0.504), HAZ (p=0.000; r=0.455), and WHZ (p=0.000; r=0.334). **Conclusion:** There were still conditions of severe food insecurity and undernutrition problems that need the focus of attention. There is a need for monitoring by looking at certain aspects, such as HFS and WASH practices in reducing undernutrition.

**Keywords:** household food security; nutritional status; undernutrition; WASH

## INTRODUCTION

A nutritional problem that has not yet been resolved, especially in developing countries, is undernutrition [1]. Undernutrition is a condition where the body receives less food than it needs and is a significant health concern. This condition is divided into wasting, stunting, and underweight [2]. The urgency of addressing this issue is underscored by the fact that, based on WHO (World Health Organization) data in 2022, the prevalence of stunting in children under five in the world reached 148.1 million, wasting reached 45 million, and underweight reached 101 million [3]. This high prevalence indicates that undernutrition is a serious problem because it impacts children's growth and development [4].

The prevalence of children with undernutrition in Central Java is still relatively high. Children with stunting reached 20.9%, wasting 7.9%, and underweight 17.6% in 2022. Meanwhile, in Semarang City, the stunting rate reached 1.66%, underweight 2.07%, and wasting 1.07% in 2022. The area with the highest stunting rate is Bandarharjo (North Semarang). Bandarharjo and Tambak Aji are areas in Semarang City with low income.

The golden period of children's growth and development occurs rapidly at 6-23 months, including the first 1000 days of life. If during this period, there is a lack of food intake (undernutrition) and it is not immediately

prevented, it will affect the quality of the child's life in the future [5]. Undernutrition occurs directly due to inadequate food intake and infection. It is indirectly influenced by many factors, including household food insecurity, inadequate care and feeding practices, inadequate health services, and environmental factors (poor hygiene) [6]. The occurrence of this will affect the nutritional status of toddlers. According to WHO, children's nutritional status can be measured from the indicators measuring weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ) [7]. These three measurements can be used to identify children who experience undernutrition. Undernourished children will have nutritional status results that fall below the typical WHO cutoff point of -2SD to 2SD [8].

These three measurement results can describe children's nutritional status influenced by household food insecurity, inadequate care and feeding practices, inadequate health services, and environmental factors (poor hygiene). The condition of household food insecurity will result in the nutritional needs of children not being met, which will result in weight loss, and if it occurs in the long term, it will cause growth disorders. In addition, children who consume food with poor hygiene can cause infectious diseases accompanied by decreased appetite and digestive system disorders. This will cause inadequate dietary intake and affect the nutritional status of children so that anthropometric measurement results are below normal (undernutrition) [6].

The Bandarharjo and Tambak Aji areas were the research locations (illustrated in **Figure 1**, the area circled in blue) with low income and the highest undernutrition rates, especially in Bandarharjo. Data on the stunting population is highest at 6-23 months, which is the golden period for monitoring children's growth. There have been many government efforts to reduce stunting, especially in areas with high levels of stunting in Semarang City, including Bandarharjo and Tambak Aji. However, there has been no review regarding the effectiveness of this effort. This research can be an initial illustration of evaluation efforts by looking at changes in the nutritional status of children who are recorded as undernourished, as well as several risk factors regarding food security and WASH practices. By looking at how HFS and WASH are in the region, we can also assess the achievements of the programs that have been implemented by the government, especially in reducing stunting and malnutrition in the Semarang area.

In previous research, results showed that there was an association between HFS and WASH practice with children's nutritional status [9,10]. However, other studies reported that HFI and WASH were unrelated to nutritional status indicators [11,12]. Not many studies in Indonesia, especially in Semarang, assess HFS and WASH in children with a history of undernutrition and relate it to their nutritional status. This study, therefore, provides a unique analysis of the association between HFS and WASH practices on the nutritional status of children with a history of undernutrition aged 6-23 months.

## METHODS

This research adopted an analytic observational approach with a cross-sectional design. The population was children aged 6-23 months with undernutrition, according to the local health center. The research area was an area with lower middle income in Semarang, also with the highest stunting rate in Semarang.

The sample for this study was 55 mothers with children with a history of undernutrition aged 6–23 months. Secondary data was taken to determine the population of children experiencing undernutrition in August 2023 at the Puskesmas Bandarharjo and Puskesmas Tambakaji Semarang. Primary data collection was carried out in October 2023. The sampling technique used was non-random cluster sampling. The data sources for this study include the Puskesmas Bandarharjo and Puskesmas Tambakaji Semarang, as well as the WHO-Anthro software for calculating nutritional status.

This research data was collected by measuring the weight and height of toddlers. WHO-Anthro software was used to calculate the HAZ, WAZ, and WHZ from anthropometric data to assess the nutritional status of children. HFS assessment is carried out by interviewing mothers of toddlers with a history of undernutrition. Food Nutrition Technical Assistance released the Household Food Insecurity Access Scale (HFIAS), a nine-question questionnaire that underwent validity and reliability testing to measure household food security. The questionnaire analyzes food availability and household access to food [13]. Assessment of WASH practices is carried out by observing and interviewing mothers of toddlers who have a history of undernutrition using guided questions adapted from UNICEF guidelines, which have been consulted through the Expert Judgment test to assess WASH practices. In this form, four aspects are assessed: the hygiene promotion aspect, which includes washing hands with soap, food hygiene, and environmental hygiene; the sanitation aspect in households, communities, babies, toddlers, and vulnerable groups, as well as the water supply aspect, which includes access, safe water processing, and storage carried out through interviews and direct observation [6].

Inclusion criteria include mothers with children aged 6-23 months with a history of undernutrition. Exclusion criteria include children suffering from bronchitis, pneumonia, tuberculosis, congenital abnormalities, and premature birth. Data analysis uses the Spearman rank test to determine the association between the independent and dependent variables. However, it's important to note that this study has some limitations, including the small sample size and non-random cluster sampling, which may limit the generalizability of the findings.


**Figure 1. Semarang area map**

## RESULTS

**Table 1** shows that the majority of mothers are adults (83.6%), their highest level of education is senior high school (52.7%), are housewives (76.4%), and have male children (56.4%). Most respondents were in the food-secure household category (56.4%). The results of the assessment of WASH practice averaged 89.9% ± 13.9% (52.4%–100%). Based on the WAZ, the highest nutritional status categories are severely underweight and underweight, each at 36.36%. The highest nutritional status categories, according to the HAZ, are severely stunted and stunted, each at 34.55%. Based on the WHZ, most respondents had a nutritional status classified as normal, 52.73%, and 16.36% were classified as severely wasted.

**Table 2** shows that respondents in the food-secure household category most often have toddlers in the underweight category (38.7%), severely stunted (41.9%), and normal WHZ category (54.8%). Toddlers in moderate food insecure households most often experience severe underweight (38.5%), underweight (38.5%), stunted (38.5%), and normal WHZ status (46.2%). The majority of toddlers in moderate food insecure households experience severely underweight (50%), normal WAZ (50%), stunted (100%), and normal WAZ status (50%). In comparison, most toddlers in households with severe food insecurity experienced severe underweight (42.9%), underweight (42.9%), stunted (42.9%), and normal WHZ status (42.9%).

**Table 1. Demographic characteristics**

| Demographic characteristics | n | % |
|---|---|---|
| **Mothers's Age (years)** | | |
| Teens (18-25) | 8 | 14,5 |
| Adult (26-45) | 46 | 83,6 |
| Elderly (46-60) | 1 | 1,8 |
| **Mother's Highest Educational Level** | | |
| Elementary School | 1 | 1,8 |
| Junior High School | 18 | 32,7 |
| Senior High School | 29 | 52,7 |
| College | 7 | 12,7 |
| **Mother's Occupation** | | |
| Work | 13 | 23,6 |
| Housewives | 42 | 76,4 |
| **Toddler Gender** | | |
| Male | 31 | 56,4 |
| Female | 24 | 43,6 |
| **Household Food Security Category** | | |
| Food secure (score 0-1) | 31 | 56,4 |
| Mildly food insecure (score 2-7) | 13 | 23,6 |
| Moderate food insecure (score 8-14) | 4 | 7,3 |
| Severely food insecure (score 15-27) | 7 | 12,7 |
| **Weight-for-Age (WAZ)** | | |
| Severely underweight (<-3 SD) | 20 | 36,36 |
| Underweight (-3 SD to <-2 SD) | 20 | 36,36 |
| Normal (-2 SD to +1 SD) | 15 | 27,28 |
| **Height-for-Age (HAZ)** | | |
| Severely stunted (<-3 SD) | 19 | 34,55 |
| Stunted (-3 SD to <-2 SD) | 19 | 34,55 |
| Normal (-2 SD to +3 SD) | 17 | 30,9 |
| **Weight-for-Age (WHZ)** | | |
| Severely wasted (<-3 SD) | 9 | 16,36 |
| Wasted (-3 SD to <-2 SD) | 17 | 30,91 |
| Normal (-2 SD to +1 SD) | 29 | 52,73 |

The average percentage of WASH practice assessments in feeding severely underweight toddlers is 82.3% ± 17.9% (52.4%–100%); in underweight toddlers, the average is 91.8% ± 10.3% (52.4%–100%); and in toddlers with normal WAZ status, the average was 97.1% ± 4.01% (90.5%–100%). In severely stunted children, the average percentage is 81.46% ± 17.95% (52.4%-100%); in toddlers who are stunted, the average is 93.0% ± 11.0% (52.4%-100%). In toddlers with normal HAZ status, the average was 95.8% ± 4.6% (85.7%-100%). Then, for severely wasted toddlers, the average percentage is 87.3% ± 12.1% (61.9%–95.2%). For stunted toddlers, the average is 85.28% ± 16.1% (52, 4%-100%); in toddlers with normal WHZ status, the average is 95.8% ± 4.9% (85.71%-100%). This average value shows that WASH practices in all categories of

toddler nutritional status are classified as good (80%-100%).

The Rank Spearman Test revealed that household food security was significantly linked to WAZ nutritional status (p-value = 0.008, r = 0.352) and to HAZ nutritional status (p-value = 0.027, r = 0.299). However, it was not significantly linked to WHZ nutritional status (p-value = 0.067). In addition, there is a significant association between feeding hygiene practices and WAZ status, which is moderately positively correlated (p-value = 0.000, r = 0.504), and HAZ status (p-value = 0.000, r = 0.455). A significant association with WHZ status is weakly positively correlated (p-value = 0.000, r = 0.334).

**Figure 2. The bathroom and kitchen of one of the respondent houses**

The condition of one of the respondent houses looks like in **Figure 2**. Most residents have simple toilets or kitchens, following the limited space of their houses. Apart from that, from the results of the WASH practices assessed, although the majority of respondents have carried out the majority of WASH practices well, there are still some that are not yet standardized. The assessment results are shown in **Table 3**. As can be seen in the results, all respondents have carried out assessments according to standards on handwashing with soap after cleaning a child's bottom and defecation, using safe water for food hygiene, promoting actions and products, e.g., potties and scoops that facilitate getting feces into latrines for safe disposal, safe collection and transport of water to the point of use, as well as safe storage for water.

Not all respondents handle with soap before preparing food or cooking and eating or feeding children; keep a clean environment for handling food; use safe water for food hygiene, keep animals away from food preparation; regularly clear compound of any animal or child feces, at least daily; control disease vectors such as flies, mosquitoes, cockroaches and rats

**Table 3. Frequency distribution of WASH practice**

| Variable | n (%) |
|---|---|
| Handwashing with soap | |
| Before preparing food or cooking | 42 (76,36) |
| Before eating or feeding a child (including breastfeeding) | 39 (70,91) |
| After cleaning a child's bottom | 55 (100) |
| After defecation | 55 (100) |
| Keep a clean environment for handling food | |
| Yes | 47 (85,45) |
| No | 8 (14,55) |
| Use safe water for food hygiene | |
| Yes | 55 (100) |
| No | 0 (0) |
| Keep animals away from food preparation and child feeding areas, child play areas and water sources | |
| Yes | 41 (74,55) |
| No | 14 (25,45) |
| Regularly clear compound of any animal or child faeces, at least daily | |
| Yes | 42 (76,36) |
| No | 13 (23,64) |
| Control disease vectors such as flies, mosquitoes, cockroaches and rats by covering food, improving drainage and safely disposing of garbage into a waste receptacle or protected pit | |
| Yes | 39 (70,9) |
| No | 16 (29,1) |
| Clean key surfaces, e.g., latrines, basins and kitchen floors and surfaces with soap and water | |
| Yes | 49 (89,1) |
| No | 6 (10,9) |
| Use of a hygienic toilet by all. | |
| Yes | 52 (94,55) |
| No | 3 (5,45) |
| Safely remove and treat faecal waste | |
| Yes | 54 (98,18) |
| No | 1 (1,82) |
| Use of diapers/nappies and safe disposal of faecal matter into toilets and safe washing of diapers | |
| Yes | 51 (92,73) |
| No | 4 (7,27) |
| Promote actions and products, e.g., potties and scoops that facilitate getting faeces into latrines for safe disposal | |
| Yes | 55 (100) |
| No | 0 (0) |
| Make latrines 'child friendly' | |
| Yes | 47 (85,45) |
| No | 8 (14,55) |
| Make structural improvements to latrine to make it easy to use, e.g., handrails/support poles, lower seats | |
| Yes | 54 (98,18) |
| No | 1 (1,82) |
| Ensure entrance to latrine is accessible, e.g., smooth pathway | |
| Yes | 49 (89,1) |
| No | 6 (10,9) |
| Construct or improve water supply systems or services, e.g., piped water on-site, public standpipes, boreholes, protected dug wells, protected springs and rainwater | |
| Yes | 49 (89,1) |
| No | 6 (10,9) |
| Strengthening water safety planning and capacity for the operation and maintenance (O&M) of new/ existing systems | |
| Yes | 54 (98,18) |
| No | 1 (1,82) |
| Safe collection and transport of water to point of us | |
| Yes | 55 (100) |
| No | 0 (0) |
| Safe storage of water, safe use practices | |
| Yes | 55 (100) |
| No | 0 (0) |

**Table 2. Cross tabulation of household food security and WASH practices with nutritional status of toddlers**

| | Weight-for-Age-Z score (WAZ) | | | Height-for-Age-Z score (HAZ) | | | Weight-for-Height-Z score (WHZ) | | |
|---|---|---|---|---|---|---|---|---|---|
| Household food security | Severely n (%) | Underweight n (%) | Normal n (%) | Severely n (%) | Stunted n (%) | Normal n (%) | Severely n (%) | Wasted n (%) | Normal n (%) |
| Secure | 10 (32,3) | 12 (38,7) | 9 (29,0) | 13 (41,9) | 7 (22,6) | 11 (35,5) | 2 (6,5) | 12 (38,7) | 17 (54,8) |
| Mildly | 5 (38,5) | 5 (38,5) | 3 (23,1) | 4 (30,8) | 5 (38,5) | 4 (30,8) | 5 (38,5) | 2 (15,4) | 6 (46,2) |
| Moderate | 2 (50) | 0 (0) | 2 (50) | 0 (0) | 4 (100) | 0 (0) | 1 (25) | 1 (25) | 2 (50) |
| Severely | 3 (42,9) | 3 (42,9) | 1 (14,3) | 2 (28,6) | 3 (42,9) | 2 (28,6) | 1 (14,3) | 2 (28,6) | 4 (57,1) |
| **p-value** | | 0,008** | | | 0,027*# | | | 0,067* | |
| **r** | | 0,352 | | | 0,299 | | | 0,248 | |
| WASH practice % mean score (min-max) | 82,34±17,89 (52,38-100) | 91,84±10,34 (52,38-100) | 97,14±4,01 (90,48-100) | 81,46±17,95 (52,38-100) | 92,98±11,04 (52,38-100) | 95,83±4,56 (85,71-100) | 87,30±12,14 (61,91-95,24) | 85,28±16,14 (52,38-100) | 95,83±4,88 (85,71-100) |
| **p-value** | | 0,000*# | | | 0,000*# | | | 0,000*# | |
| **r** | | 0,504 | | | 0,455 | | | 0,334 | |

*p significant
#rank spearman test

by covering food, improving drainage, and safely disposing of garbage into a waste receptacle or protected pit; clean key surfaces, e.g., latrines, basins, and kitchen floors and surfaces with soap and water; use of a hygienic toilet by all; safely removing and treat fecal waste; and use of diapers/nappies and safe disposal of fecal matter into toilets and safe washing of diapers.

## DISCUSSION

The bivariate analysis shows that household food security was significantly associated with WAZ and HAZ but not WHZ. The results of this study are similar to previous research, which showed an association between household food insecurity and WAZ and HAZ but was not associated with WHZ. Based on this research, the household food insecurity score is significantly associated with a decrease in WAZ and HAZ, which are respectively associated with an increased risk of stunting and underweight. Based on the research results in Ethiopia, household food insecurity does not correlate with wasting (WHZ index), and the factors that cause wasting themselves are influenced by exclusive breastfeeding, antenatal care visits, birth spacing, and the incidence of diarrhea [10]. Based on the research results, the association between household food security and WHZ nutritional status is insignificant because most have similar characteristics related to food fulfillment and varied food consumption among household members.

The results of this study are similar to those of previous research, which showed that the higher the level of household food security, the better the z-score of WAZ and HAZ. The ease of obtaining food sources affects household food security, affecting the family's nutritional fulfillment, including children under five. If the family's diet is good and there is no reduction in food quality, quantity, or diversity, there is no disease or infection. The family's level of nutritional fulfillment will also be good. The occurrence of this condition will improve the nutritional status of the family, especially for toddlers [14].

Household food security is closely related to food supply, which is one of the factors that influences children's nutritional status. This is because the better household food security, the greater the family's ability to provide food to meet the nutritional needs of family members, including children. A household can be categorized as having good access to food if the household can access food that is available economically, physically, and socially. Household food insecurity will make it difficult for toddlers to fulfill their nutritional requirements. Thus, access to household food indirectly affects the nutritional status of toddlers [15-18].

The bivariate analysis shows that WASH practices are significantly associated with WAZ, HAZ, and WHZ. The results of this study are similar to those of previous research, which showed an association between water, sanitation, and hygiene (WASH) scores with WAZ and HAZ. Based on this research, WASH practices are positively related to WAZ and HAZ, which means that the higher the WASH practices, the higher the WAZ and HAZ z-scores [19]. Based on research, poor hygiene and sanitation, especially the habit of not washing hands after defecating, causes fecal contamination in the home environment, which can cause enteropathy and ultimately cause wasting in toddlers. Likewise, contaminated water increases the risk of toddlers directly ingesting feces [20,21].

A study also proves that WASH (water, sanitation, and hygiene) interventions are significantly associated with increased average HAZ in toddlers. Based on this study, improving the quality of drinking water, reducing fecal-oral contamination both directly and indirectly, and promoting the habit of washing hands after defecation or before touching food has proven

effective in improving the nutritional status of children [22]. Poor environmental hygiene and sanitation will result in the process of absorbing nutrients not being optimal, which will result in a decrease in children's nutritional status. Poor hygiene practices can cause repeated infections with infectious diseases with clinical symptoms of nausea, vomiting, loss of appetite, or diarrhea. This condition will result in the toddler's dietary intake not being fulfilled, negatively impacting the child's linear growth [17,18].

The results showed that the percentage of children with good/normal nutritional status, according to WAZ calculations, was 27.28%, HAZ was 30.9%, and WHZ was 52.73%. These results show a change in nutritional status from the initial information, where previously, the child was recorded as undernourished by the local health center. After several months of data collection, he became well-nourished. This shows that efforts to improve nutrition in the local area have been optimal. However, there are still quite a lot of children suffering from undernutrition and lacking food security. Even though changing nutritional status takes a long time, improving several aspects, including HFS and WASH practices, is necessary.

It requires seriousness and a focus on certain aspects that need attention. The role of the Family Assistance Team and Community Health Centers is important in achieving the target of reducing undernutrition. The focus on monitoring with a one size for approach sometimes becomes an obstacle to program success. This is because the running programs are average for the entire community rather than emphasizing the needs of certain communities. This condition needs to be paid attention to by regional and local health stakeholders.

This study was small and intended to look at patterns in low-middle-income areas. Further research was possibly carried out for a wider number of areas. Even small, it can still provide a strong recommendation for improving the program in the local area.

## CONCLUSION

Household food security is significantly associated with WAZ and HAZ but is unrelated to WHZ in children with a history of undernutrition aged 6–23 months. WASH (water, sanitation, and hygiene) practices are significantly associated with the nutritional status of children with a history of undernutrition aged 6–23 months. Household food security (HFS) and WASH practices are factors that influence the nutritional status of toddlers. The occurrence of household food insecurity and poor feeding hygiene practices will cause inadequate food intake and have an impact on reducing the child's z-score. Therefore, parents need to pay attention to the condition of household food security and hygiene practices when feeding their children. It requires seriousness and a focus on certain aspects that need attention, especially from regional and local health stakeholders.

## REFERENCES


1. Perdana HM, Darmawansyih D, Faradilla A. Gambaran faktor risiko malnutrisi pada anak balita di wilayah Kecamatan Tamalanrea Kota Makassar tahun 2019. UMI Medical Journal. 2020 Jun 30;5(1):50–6.
2. World Health Organization. 2021 [cited 2023 Sep 28]. Malnutrition. Available from: [Website]
3. UNICEF. Child malnutrition [Internet]. 2023 [cited 2023 Sep 28]. Available from: [Website]
4. Kementerian Kesehatan Republik Indonesia. Hasil Survei Status Gizi Indonesia (SSGI) 2022. 2023.
5. Likhar A, Patil MS. Importance of maternal nutrition in the first 1,000 days of life and its effects on child development: a narrative review. Cureus. 2022 Oct 9;14(10):1–6.
6. UNICEF. Guide for practical joint actions nutrition - Water, Sanitation, and Hygiene (WASH) Nutrition - WASH Toolkit. 2016. Available from: [Website]
7. World Health Organization. Malnutrition in children [Internet]. 2019 [cited 2023 Sep 28]. Available from: [Website]
8. Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2020 tentang standar antopometri anak. 2020. Available from: [Website]
9. Shrestha SK, Vicendese D, Erbas B. Water, sanitation and hygiene practices associated with improved height-for-age, weight-for-height and weight-for-age z-scores among under-five children in Nepal. BMC Pediatric. 2020 Mar 23;20(1):1–10.
10. Sreeramareddy CT, Ramakrishnareddy N, Subramaniam M. Association between household food access insecurity and nutritional status indicators among children aged <5 years in Nepal: A national, cross-sectional household survey results. Vol. 18, Public Health Nutrition. Cambridge University Press; 2015. p. 2906–14.
11. Saaka M, Osman SM. Does Household Food Insecurity Affect the Nutritional Status of Preschool Children Aged 6–36 Months? International Journal of Population Research. 2018 Jul 1;2013:1–12.
12. Bekele T, Rahman B, Rawstorne P. The Effect of Access to Water, Sanitation and Handwashing

Facilities on Child Growth Indicators: Evidence from the Ethiopia Demographic and Health Survey 2016. PLoS One. 2020 Sep 22;15(9):e0239313.
13. Ashari CR, Khomsan A, Baliwati YF. Validasi HFIAS (Household Food Insecurity Access Scale) dalam mengukur ketahanan pangan: kasus pada rumah tangga perkotaan dan perdesaan di Sulawesi Selatan. The Journal of Nutrition and Food Research. 2019 Nov 5;42(1):11–20.
14. Safitri AM, Pangestuti DR, Aruben R. Hubungan ketahanan pangan keluarga dengan status gizi balita (studi di Desa Palasari dan Puskesmas Kecamatan Legok, Kabupaten Tangerang). Jurnal Kesehatan Masyarakat. 2017;5(3):120–8.
15. Morales ME, Berkowitz SA. The relationship between food insecurity, dietary patterns, and obesity. Current Nutrition Reports. 2016 Mar 25;5(1):54–60.
16. Arlius A, Sudargo T, Subejo S. Hubungan ketahanan pangan keluarga dengan status gizi balita (studi di Desa Palasari dan Puskesmas Kecamatan Legok, Kabupaten Tangerang). Jurnal Ketahanan Nasional. 2017 Dec 7;23(3):359.
17. Jubayer A, Islam MH, Nayan MM. Child-sensitive water, sanitation, and hygiene composite score and its association with child nutritional outcomes in St. Martin's Island, Bangladesh. SAGE Open Medicine. 2022;10:1–12.
18. Cunningham K, Headey D, Singh A, Karmacharya C, Rana PP. Maternal and child nutrition in Nepal: examining drivers of progress from the mid-1990s to 2010s. Global Food Security. 2017 Jun;13:30–7.
19. Raihan MJ, Farzana FD, Sultana S, Haque MA, Rahman AS, Waid JL, et al. Examining the relationship between socio-economic status, WASH practices, and wasting. PLoS One. 2017 Mar 9;12(3):e0172134.
20. Jayadipraja EA, Prasetya F, Azlimin A, Mando WOSY. Family Clean and Healthy Living Behavior and Its Determinant Factors in the Village of Labunia, Regency of Muna, Southeast Sulawesi Province of Indonesia. Public Health of Indonesia. 2018 Mar 25;4(1):39–45.
21. Mia H, Sukmawati S, Abidin U wusqa A. Hubungan hygiene dan sanitasi lingkungan terhadap kejadian stunting pada balita di Desa Kurma. Journal Perguruan: Conference Series. 2021 Dec 1;3(2):494.
22. Mauliza, Harvina S, Desti MR. Hubungan pola asuh ibu dengan status gizi balita 12-59 bulan di Kecamatan Banda Sakti. Jurnal Ilmiah Manusia Dan Kesehatan. 2023 Jan 10;6(1):109–22.