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Detection Of Giardiasis Among Malnourished Children Under Five Years Old

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ABSTRACT

Childhood malnutrition remains a major public health issue globally, particularly in low-income countries, where it is exacerbated by parasitic infections such as Giardia lamblia. Malnutrition in children under five years of age not only affects physical growth and cognitive development but also reflects and reinforces broader socioeconomic, cultural, and environmental challenges. This study aimed to assess the nutritional status of children under five years of age and determine the prevalence of Giardia lamblia infection among malnourished individuals, while exploring associations with demographic and environmental factors.

Anthropometric measurements—including weight, height, and mid-upper arm circumference—were collected to classify the degree of malnutrition (mild, moderate, severe) in children under five. Demographic data such as age, sex, socioeconomic status, dietary habits, and residency were recorded. Stool samples were analyzed to detect G. lamblia infection using standard microscopic techniques.

The study identified a significant prevalence of G. lamblia infection among malnourished children, particularly in those from lower socioeconomic backgrounds and rural areas. A strong interdependence was observed between malnutrition and infection, with G. lamblia contributing to nutrient malabsorption, growth stunting, and developmental delays. Additionally, the prevalence of co-infections and poor dietary practices were linked to more severe forms of malnutrition.

The findings underscore the synergistic relationship between malnutrition and parasitic infection, particularly G. lamblia, in children under five years old. Addressing malnutrition in such populations requires integrated health strategies that combine nutritional rehabilitation, parasite control, and public health education, especially in low-resource settings..

Keywords: *Malnutrition, Giardia lamblia, Children under five, Parasitic infection, Nutritional status, Low-income countries, Public health*

1. INTRODUCTION

Childhood nutrition is linked to health, economic, social, and political development. Child malnutrition under 5 affects cultural, social, economic, and community dietary patterns. [1]. One of the most frequent intestinal protozoan flagellates in humans is Giardia (syn. G. intestinalis, G. lamblia), which causes Giardiasis. Giardia species have a straightforward life cycle with two active trophozoites and cystic forms[2]. Direct or indirect fecal-oral intake of infected cysts transmits this parasite. After eating cysts, incubation lasts 9–15 days. [2] Parasites like giardiasis afflict children and adults worldwide. Underdeveloped countries have more Giardia infections. More than 200 million giardiasis cases occur annually worldwide. The WHO has included Giardia in its neglected illnesses strategy since 2004. [3]

Infection and malnutrition are harmfully interdependent. Malnutrition increases infection severity and death. Infection alters substrate utilisation, nutritional intake, and tissue breakdown [4]. Infection and malnutrition are common in resource-poor, impoverished, and elderly communities, as well as hospitalised patients. A history of weight loss indicates macronutrient deficiency. Protein deficiency and wasting are indicated by BMI and mid-upper arm circumference. Blood tests are difficult to interpret during an acute-phase response, but more complex body composition methods are available [5]. Infection inhibits energy, protein, and amino acid use, therefore acute nutrition support should meet but not exceed needs. Recovery from infection often involves intense anabolism, which may raise nutritional needs [6].

Multiple pathogen co-infections are widespread in low-income nations [1]. Recently, cross-sectional studies from several regions have linked G. lambilae 2,3,4]. Both organisms colonise the gastrointestinal system of their human hosts nearby and infect youngsters at a high incidence in low-income countries [5,6,7]. The protozoan parasite G. intestinalis (syn. G. lamblia,

G. duodenalis) causes giardiasis in several animals, including humans. An estimated 280 million people contract giardiasis annually [8]. It causes diarrhoea, bloating, flatulence, and malnutrition in children in low-income countries, stunting growth and cognitive impairment [9,10]. SymptomaticGiardia coinfections are common [11]. This study measured weight, height, and mid-upper arm circumference to identify mild, moderate, and severe malnutrition in children under 5 and distributed cases by demographic data: age, sex, socioeconomic level, dietary habits, and residency. Detect G.lamblia infection in malnourished children under 5 years old.

2. MATERIALS AND METHODS

2.1 Study population

The study was conducted on 100 clinically suspected patients in the period from November 2024 to February 2025 in Baghdad, Iraq. It was carried out on patients under 5 years old (children <5yrs), that were clinically suspected to have gastrointestinal disorder and malnourished

2.2 Sampling methods

Hundred participants provided stool samples. Same individuals completed 100 questions. Patients should empty stool into a plastic cup with a tight cover. For Giardia lamblia testing, 20–40 grammes of formed faeces or 5–6 spoonfuls of watery stools were collected. Collect stool samples in clean containers. Samples can be refrigerated (2-8ºC) for 1-2 days before testing. To store specimens for up to one year, keep them frozen at -20ºC. For testing, the sample will be completely frozen and brought to room temperature. Stool sample should be homogenised before processing. All samples were labelled with patient name, age, sex, and collection date.

2.3 Parasitological methods

2.3.1 Giardia lamblia kit Assay

CerTest Crypto+Giardia detects Cryptosporidium and Giardia in stool samples using a qualitative immunochromatographic technique. Strip A is a nitrocellulose membrane pre-coated with mouse monoclonal antibodies against Cryptosporidium on the test line (T) in the results window and rabbit polyclonal antibodies against a particular protein on the control line (C). The label/sample absorbent pad is sprayed with test label solution (mouse monoclonal antibodies anti-Cryptosporidium) conjugated to red polystyrene latex and control label solution (specific binding protein) conjugated to green, generating coloured conjugate complexes. Strip B is a nitrocellulose membrane pre-coated with mouse monoclonal antibodies against Giardia on the test line (T) in the results window and rabbit polyclonal antibodies against a particular protein on the control line (C). Test label solution (mouse monoclonal antibodies anti-Giardia) and control label solution (specific binding protein) are sprayed on the label/sample absorbent pad to generate coloured conjugate complexes. If the sample is Cryptosporidium positive, the diluted sample's antigens react with the red-colored conjugate complex (anti-Cryptosporidium monoclonal antibodies-red polystyrene microspheres) in strip A, and if it's Giardia positive, strip B, which were pre-dried on the absorbent pad.

The mixture rises on the membrane by capillary action. As the sample passes over the test membrane, binding conjugate complexes move. The red line will be evident in both strips because the anti-Cryptospodirium and anti-Giardia antibodies on strip A and strip B catch the coloured conjugate. The outcome is interpreted using these bands. If the sample is negative, Cryptosporidium and Giardia are absent, although the antigens may be present at concentrations below the detection limit values, preventing the reaction with a red conjugate complex. Anti-Cryptosporidium and antiGiardia antibodies on membranes (test lines) will not capture the antigen-red-colored conjugate complex (not produced), hence red lines will not show. Both strips allow the mixture to traverse the membranes to the immobilised particular antibodies in the control lines regardless of the sample. Both membranes' anti-specific protein antibodies capture control green-conjugate complex, therefore both control lines always appear. These green lines ensure proper volume, flow, and reagent control.

2.4 Data collection

The primary data were collected by using questionnaire to obtain information that of help to the study. Variables included in the questionnaire were: age, resident rural, Weight, height, ,mid upper arm circumference ,type of feeding ,if they are any other diseases such as asthma or chronic diseases, family economic stuation,the purity of water they drink and if they have been take I.V fluids or any antibiotics

2.5 Data analysis

The results obtained were analyzed by computerized program of statistical package for social science (SPSS version 26) by using frequency, mean, and chi-squire test. Then data were presented in figures and tables.

3. RESULTS AND DISCUSSIONS

3.1. Demographic characteristics of study population

Table.1 shows malnourished children under-five's demographics. The age distribution showed that 56% of the children were under one year old and 44% were older (p = 0.024). Significant weight differences were seen between children under one year and those over one year, with a mean of 6.21 ± 1.33 kg for the former and 12.04 ± 1.28 kg for the latter (p = 0.030). Height differed considerably between age groups, with children under one year averaging 53.11 ± 0.95 cm and those over one year 85.47 ± 1.03 cm (p = 0.046). The difference in breastfeeding status was statistically significant (p = 0.012), with 21% of children nursed and 79% not. These findings indicate that age, weight, height, and nursing practices are linked to childhood malnutrition.

Table 1: Demographic characteristic of study samples among children < 5 years of age suffering from malnutrition

Parameters		**Frequency (%)**	**Mean +- SD**	**P value**
age	<1 yer	56(56%)		
	>1 yer	44(44%)		0.024
weight(kg)	<1 yer		6.21 +- 1.33	
	>1 yer		12.04 +- 1.28	0.03
height(cm)	<1 yer		53.11 +- 0.95	
	>1 yer		85.47 +- 1.03	0.046
breast milk	Yes	21(21%)		
	No	79(79%)		0.012
	P < 0.05			

Nutrition is crucial to early childhood growth, explaining Table.1's statistical significance. The increased incidence of malnourished children under one year old (56%) implies that suboptimal nursing and weaning habits make this age group vulnerable. Malnutrition delays or stunts physical growth in children under one year old, as shown by their weight and height inequalities [12]. These data show chronic undernutrition in this community. Only 21% of children were nursed, highlighting the importance of breastfeeding in reducing malnutrition. Breast milk offers critical nutrients and immunological protection, especially in the first year, therefore its absence may cause nutritional deficiencies [12]. Thus, suboptimal feeding behaviours, especially not breastfeeding, and insufficient nutrition in the first years of life contribute to malnutrition and growth retardation in children under five.

Malnutrition is more common and severe in younger children, especially those under one year old, due to their increased nutritional needs and greater vulnerability to feeding deficits and infections. Infants eat mostly breast milk or formula in the early months [13]. Malnutrition can occur from inadequate breastfeeding or poor-quality supplemental foods supplied too early or late [14]. Younger children have underdeveloped immune systems, leaving them more susceptible to infections like diarrhoea and respiratory ailments, which deplete nutrients and stunt growth [15]. Figure 1.

Children over one year old eat more variety. Malnutrition can cause chronic diseases like stunting if it continues after infancy. Age is both a risk factor and a factor in malnutrition type and severity [15]. If early nutritional needs are not satisfied, older children may develop chronic malnutrition, whereas younger infants are more likely to develop acute malnutrition. Weight, height, and malnutrition are crucial in measuring children's nutritional condition, especially under-fives. Acute and chronic malnutrition influence weight and height differently [16]. Underweight suggests general malnutrition, which can be caused by sudden weight loss or chronic development failure. Low weight for height (wasting) indicates acute malnutrition, often caused by illness or famine. Stunting, on the other hand, implies persistent malnutrition that has slowed a child's linear growth [17].

Malnourished children usually have a combination of these disorders, and growth indicators like weight and height help diagnose severity and duration [18]. This study's significant weight and height differences between age groups suggest that malnutrition is affecting growth patterns, with younger children likely showing signs of acute malnutrition (wasting) and older children possibly stunting due to prolonged deficiencies. Therefore, weight and height monitoring is essential for early detection, intervention, and prevention of malnutrition's long-term effects.

Breastfeeding and malnutrition are strongly linked, especially in children under five. Breastfeeding prevents malnutrition, especially in the first six months when breast milk is the only source of nutrition. It contains all the nutrients, antibodies, and enzymes needed for good growth, immunological development, and protection against diarrhoea and pneumonia, which cause malnutrition [19].

Children who are not nursed or inadequately breastfed are more likely to become malnourished [20]. During rapid growth and high nutritional demand, not nursing deprives newborns of important proteins, lipids, vitamins, and minerals. Improper replacement feeding (using filthy water or diluted formula) can cause infections and poor nutrient absorption, increasing malnutrition risk [21]. The data shows a statistically significant link between loss of breastfeeding and malnutrition ($p = 0.012$). Poor breastfeeding practices lead to malnutrition, as 79% of children are not breastfed. For optimal child development and to prevent malnutrition, exclusive breastfeeding for six months followed by proper complementary eating is essential (Figure 1).

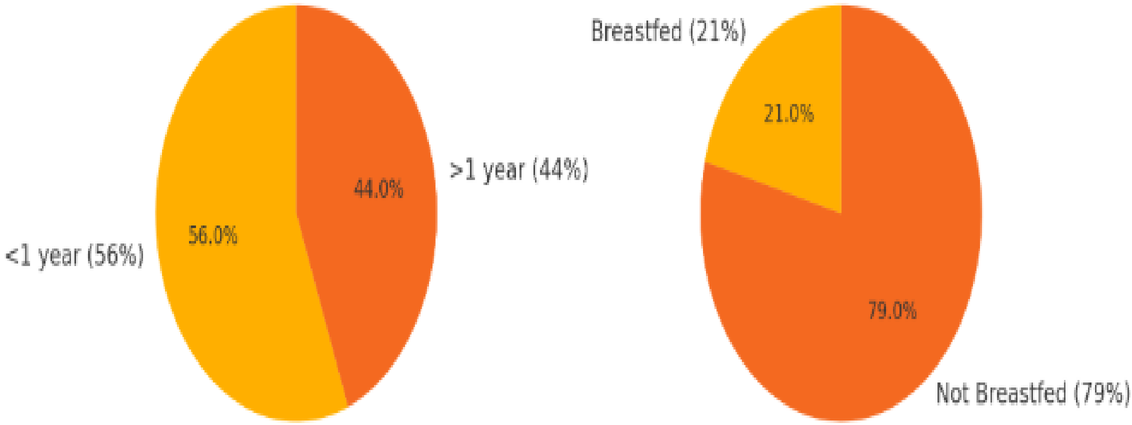


Figure (1): Demographic characteristic of study samples

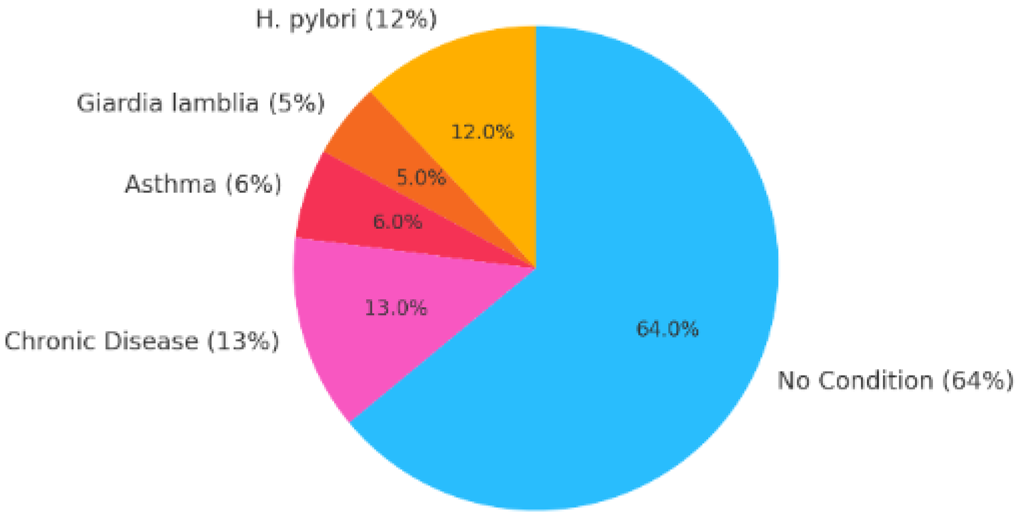
3.2 Various infections and chronic conditions among malnutrition children under five years

Table 2 shows the prevalence and statistical significance of infections and chronic illnesses in malnourished children under five. Malnutrition was related with Giardia lamblia, a parasite infection that causes diarrhoea and malabsorption, in 5% of 100 children ($p = 0.011$). A substantial link between malnutrition and asthma in 6% of children ($p = 0.029$) may be attributed to increased metabolic demands and low appetite during respiratory distress. Chronic diseases were observed in 13% of children, with a p-value of 0.034, demonstrating a relationship between inadequate nutrition and long-term health. These data show that infections and chronic illnesses are strongly linked to malnutrition in early children, emphasising the need for combined medical and nutritional rehabilitation.

Table 2: Parasitological infections and other diseases among children < 5 years of age suffering from malnutrition

Parameters	**Frequency (%)**	**P Value**
Giardia lambalie positive samples	5(5%)	0.011
Asthma positive samples	6(6%)	0.029
Chronic disease positive samples	13(13%)	0.034
	$P < 0.05$	

The data presented in Table .2 reflects the significant association between malnutrition and various infections and chronic health conditions among children under five years of age. The high prevalence of *Giardia lamblia* in 5% of the cases ($p = 0.011$) indicates that parasitic infections, often linked to poor hygiene and sanitation, contribute to malnutrition through chronic diarrhea and nutrient loss. Asthma, found in 6% of the children ($p = 0.029$), may lead to increased metabolic demands and reduced appetite, especially during flare-ups, further compromising nutritional intake. Additionally, 13% of the children were diagnosed with chronic diseases ($p = 0.034$), which are known to interfere with nutrient absorption, increase energy requirements, and reduce overall food intake. These statistically significant findings highlight the multifactorial nature of malnutrition, where infections and chronic health issues not only coexist with but actively contribute to poor nutritional outcomes. Addressing malnutrition in early childhood, therefore, requires an integrated healthcare approach that treats underlying infections and chronic conditions while providing appropriate nutritional support Figure (2)



Figure(2):Parasitological infections and other diseases in children suffering from malnutrition

It is bidirectional and synergistic that parasitological diseases and starvation can worsen each other [22]. Because malnourished children lack proteins, vitamins A and C, and minerals zinc and iron, their immune systems are weakened and more prone to parasitological infections [23]. Parasitological infections, such as Giardia lamblia, can decrease nutrient absorption, induce chronic inflammation, and cause diarrhoea, vomiting, and lack of appetite [24]. These consequences deplete the body's nutrients, perpetuating infection and starvation. Giardia lamblia, a protozoan, damages gut lining and nutrient absorption. Malnutrition and poor sanitation and hygiene increase exposure risks to these illnesses in low-income settings [25]. Parasitological illnesses cause and result in malnutrition, therefore proper intervention must involve nutritional rehabilitation and infection prevention and treatment [26].

Childhood asthma and hunger are complex and often reciprocal. Multiple ways asthma, a chronic inflammatory airway condition, can cause malnutrition [27]. In asthma flare-ups, children may have trouble breathing, exhaustion, and a diminished appetite, which can affect food intake [28]. Regular asthma attacks and chronic inflammation raise metabolic demands, so the youngster needs more energy and nutrients to stay healthy. Weight loss, poor growth, and undernutrition can arise from unmet demands, especially in food-insecure contexts [29].

Long-term corticosteroid medication can also impair food metabolism, appetite, and gastrointestinal function in children with moderate to severe asthma. However, malnourished children have compromised immune systems, making them more prone to respiratory infections and asthma symptoms. They may also have less muscular mass, including respiratory muscles, affecting lung function [30].

Thus, asthma and starvation can worsen each other, affecting physical development and health. In malnourished children, asthma management must include respiratory care and nutritional support to disrupt this interdependent relationship [28]. In children, chronic diseases and malnutrition are intimately linked and often reinforce each other [31]. Chronic ailments such congenital heart defects, kidney disease, cystic fibrosis, neurological disorders, and gastrointestinal conditions can impact appetite, digestion, absorption, and metabolism, causing malnutrition [32]. Due to weariness, pain, or frequent hospitalisations, children with chronic illnesses may have feeding difficulties or dietary restrictions that limit their food intake [33]. Due to continual inflammation, repair, or altered metabolism, these disorders often increase nutritional needs. For growth and immunological function, children with persistent infections or inflammatory disorders may need more protein and energy. Failure to meet these demands causes growth failure, weight loss, or stunting [34]. Malnutrition weakens the immune system, reduces therapeutic efficacy, and slows recovery from chronic disorders. Malnourished children may have slower wound healing, higher infection risk, and lengthier sickness recovery. Chronic disease causes malnutrition, which worsens the disease and slows development [35]. Managing chronic diseases in children must be closely integrated with nutritional assessment and support because increasing nutritional status improves health outcomes and quality of life.

3.3 levels of malnutrition

Table.3 shows questionnaire-based malnutrition rates in children under five, highlighting a major public health issue. Only

6% of children had no malnutrition (p = 0.013), while 94% had varied degrees of nutritional insufficiency. In 15% of children (p = 0.029), weak malnutrition indicated early-stage undernutrition due to poor diet or inconsistent feeding. 4% of the sample had moderate malnutrition (p = 0.012), indicating greater nutritional stress. Most worrying is that 74% of children (p = 0.044) have severe malnutrition, indicating protracted and chronic nutritional deprivation. This extreme malnutrition is commonly linked to poverty, recurring illnesses, poor food, and insufficient healthcare. Statistically significant p-values across all categories demonstrate that these findings are important and not random. This data emphasises the urgent need for comprehensive nutritional interventions, including immediate therapeutic support and long-term strategies to address maternal education, food security, and public health infrastructure to prevent severe early childhood malnutrition.

Table .3: Levels of malnutrition among children < 5 years of age according to questionnaire

Malnutrition Stage	Frequency (%)	P Value
No Malnutrition	6(6%)	0.013
Weak Malnutrition	15(15%)	0.029
Moderate Malnutrition	5(4%)	0.012
Sever Malnutrition	74(74%)	0.044
	P <0.05	

The data in Table.3 reflects a critical and widespread malnutrition crisis among children under five, arising from a complex interplay of socioeconomic, environmental, and healthcare-related factors. The extremely high rate of severe malnutrition (74%) indicates prolonged nutritional deprivation, which is often rooted in poverty, food insecurity, and limited access to quality healthcare. Families facing economic hardship may be unable to provide adequate, nutrient-rich food, while poor sanitation and hygiene contribute to recurrent infections that further compromise nutrient absorption and immune function [36]. The presence of weak (15%) and moderate (4%) malnutrition suggests that many children are experiencing ongoing but less visible nutritional deficits that can escalate if not addressed early. Additionally, low levels of maternal education and awareness about proper infant and young child feeding practices contribute to early weaning, unbalanced diets, and poor nutritional outcomes [37]. The statistically significant differences across all levels of malnutrition underscore that these patterns are not random but reflect deep rooted structural issues. This data highlights the urgent need for integrated and sustained interventions, including therapeutic nutrition programs, public health education, improved sanitation, and policies aimed at reducing poverty and enhancing maternal and child care services [38] Figure (3)

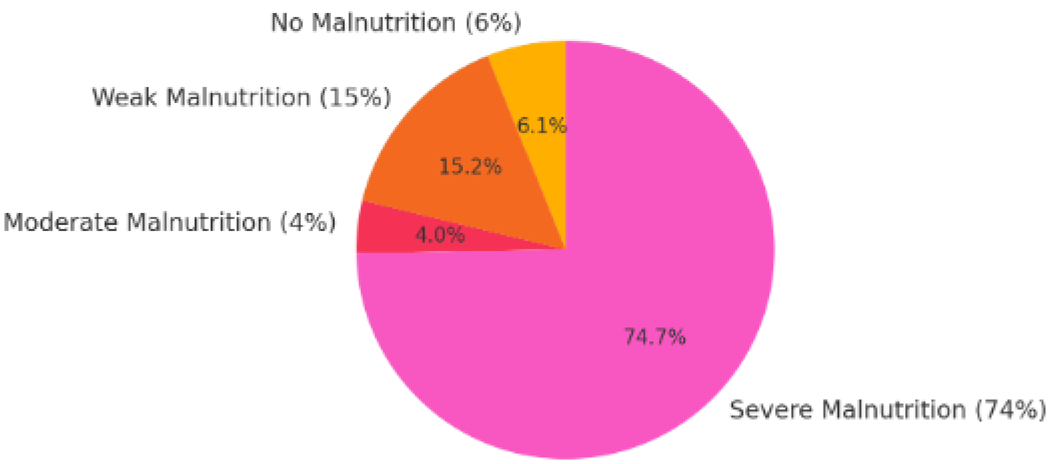


Figure (3): Levels of malnutrition

3.4 Types of supplementary materials used to treat malnutrition among children < 5 years

According to questionnaire responses, Table.4 shows the forms of extra medical therapies used to treat malnutrition in children under five. Malnourished children's impaired immune systems make them susceptible to infections, therefore 57% of them received antibiotics (p = 0.024). To treat or prevent parasitological infections that can affect nutritional status and postpone recovery, antibiotics are often used. Intravenous (I.V.) fluids were also given to 65% of the children (p = 0.028) to treat dehydration caused by diarrhoea, vomiting, or poor oral intake, which is typical in severe malnutrition. The statistically substantial p-values in both scenarios show that these interventions are not random but crucial to malnutrition treatment. These findings emphasise the necessity for a complete malnutrition treatment that involves nutritional rehabilitation and important medical care like infection control and fluid replacement to stabilise the kid and enhance health outcomes.

Table 4: Types of supplementary materials used to treat malnutrition among children < 5 years of age suffering from malnutrition according to questionnaire

Supplementary Materials Types		**Frequency(%)**	**P Value**
Antibiotic	Yes	57(57%)	0.024
	No	43(43%)	
I.V. Fluid	Yes	65(65%)	0.028
	No	35(35%)	
	P<0.05		

The data in Table. 4 highlights the necessity of medical interventions in the treatment of malnutrition among children under five, revealing that malnutrition is frequently accompanied by serious health complications requiring more than just dietary support [39]. The high percentage of children receiving antibiotics (57%, p = 0.024) underscores their vulnerability to infections due to weakened immune systems, a common consequence of nutritional deficiencies. Antibiotics are essential for treating or preventing Parasitological infections that could otherwise worsen the child’s condition or delay nutritional recovery [40]. Similarly, the administration of intravenous (I.V.) fluids to 65% of children (p = 0.028) reflects the widespread issue of dehydration caused by diarrhea, vomiting, or inadequate fluid intake common complications in severely malnourished children. The statistically significant association of both treatments with malnutrition management confirms their clinical importance. This data emphasizes that managing malnutrition effectively requires a comprehensive, integrated approach that combines nutritional rehabilitation with essential medical care, particularly infection control and fluid therapy, to stabilize and support the recovery of malnourished children [41] Figure (4).

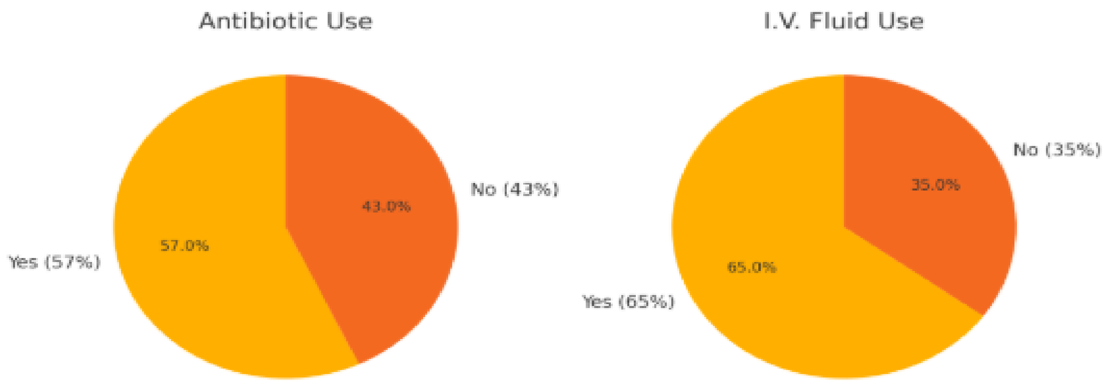


Figure (4): Types of supplementary materials used to treat malnutrition

4. CONCLUSION

The data reveal a severe malnutrition crisis among children under five, with the highest vulnerability seen in those under one year of age due to inadequate breastfeeding and poor weaning practices. Only 21% of children were breastfed, and this was significantly associated with higher malnutrition rates. Significant differences in weight and height between age groups suggest both acute (wasting) and chronic (stunting) malnutrition. The findings also show a strong link between malnutrition and parasitological infections, particularly *Giardia lamblia*, which impairs nutrient absorption and worsens nutritional status. Chronic illnesses, such as asthma and congenital diseases, further contribute to and are exacerbated by malnutrition, forming a vicious cycle that hinders growth and recovery.

Additionally, a high percentage of children required antibiotics and intravenous fluids, indicating frequent infections and dehydration. These statistically significant findings demonstrate that malnutrition is closely tied to medical complications and cannot be addressed by nutrition alone. Comprehensive interventions including medical treatment, breastfeeding support, public health education, and poverty reduction are essential to break the cycle of malnutrition and improve child health outcomes

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