Article

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Abstract

Background: Central Asia Stunting Initiative (CASI) is a program to overcome the challenge of malnutrition in the Badakhshan province of Afghanistan. The region faces significant nutritional challenges, particularly among women of reproductive age and children under five. **Methods:** A pre-post experimental design was used to assess the impact of CASI interventions. Cross-sectional surveys were conducted to collect data from women aged 15–49 and children under five using two-stage stratified random sampling. Data collection included anthropometric measurements and hemoglobin assessments. **Results:** The results demonstrated improvements in the health indicators. Among children, dietary diversity improved from 7.5% to 20.7% while exclusive breastfeeding rose from 64.0% to 80.9%. The percentage of households having access to safe drinking water and sanitation improved, while food insecurity worsened from 94.7% to 30.5%. Despite these results, stunting declined from 52.3% to 37.3% ($p = 0.001$, Cohen's $h = 0.30$), and a reduction in the prevalence of anemia was also observed. In conclusion, the CASI intervention demonstrated measurable success in decreasing child stunting and improving dietary practices, highlighting the importance of integrated, community-based nutrition programs in enhancing maternal and child health outcomes, particularly in vulnerable areas. **Conclusion:** This initiative has significantly improved maternal and child nutrition in Afghanistan, resulting in notable reductions in malnutrition indicators. Policymakers should focus on scaling up effective interventions, ensuring continuous monitoring to improve nutrition outcomes for women and children in Afghanistan.

Keywords: nutritious supplementation; stunting; Anaemia; women & children; Afghanistan

Introduction

Malnutrition and micronutrient deficiencies are not just health issues but significant public health crises in developing countries, particularly in Afghanistan [1,2]. These challenges are particularly severe for women of reproductive age and children under five [1,2]. The complex interplay of socioeconomic vulnerabilities, food insecurity, and limited healthcare access perpetuates

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the burden of malnutrition [3,4]. Research indicates that undernutrition, poor dietary habits, and insufficient healthcare during pregnancy and lactation create a vicious cycle, adversely affecting women's health and the health and nutrition of children [6–8].

Afghanistan is grappling with one of the highest child malnutrition rates globally, with almost 41% of children under five suffering from stunting and 9.5% affected by wasting [9]. Stunting, a chronic form of malnutrition, is predominantly driven by food insecurity, poverty, maternal malnutrition, and inadequate healthcare access [3]. It has long-lasting effects on children's cognitive and physical development, ultimately influencing future productivity and socioeconomic success [10]. Additionally, anemia, the most prevalent micronutrient deficiency, is widespread among Afghan children, affecting nearly 45% of those under five [11]. Iron deficiency, exacerbated by poor dietary intake, parasitic infections, and inadequate absorption, linked to chronic illnesses, is the leading cause [12]. Anemia poses serious risks to child health, leading to delayed development, reduced immunity, and increased morbidity [13].

Women of reproductive age in Afghanistan experience a dual burden of malnutrition, marked by undernutrition and a growing prevalence of overweight and obesity. Almost 20% of women are underweight, with notable regional differences [14]. Maternal malnutrition is closely tied to adverse birth outcomes, such as low birth weight and neonatal mortality [15–17]. In contrast, the increasing rates of overweight and obesity among urban women accentuate the necessity for comprehensive nutritional strategies that address both sides of the malnutrition spectrum [16]. Like children, about 40% of Afghan women of reproductive age suffer from anemia, attributable mainly to iron deficiency, low dietary diversity, and high fertility rates [11]. Pregnant women are especially at risk, as anemia enhances the likelihood of maternal mortality and adverse pregnancy outcomes [4].

Studies have demonstrated that nutrition interventions based on the 1000-day approach and supplementation strategies have significantly improved nutrition indicators among women and children [18,19] and promise a healthier future generation. The first 1000 days, from conception to a child's second birthday, is a critical window for growth and development, and nutrition interventions during this window have lasting benefits on health and nutrition [18]. It has also been recognized that adequate maternal nutrition through iron and folic acid supplementation lowers the risk of maternal anemia and low birth weight. At the same time, early initiation of breastfeeding and exclusive breastfeeding contribute to improved child survival and development [13]. Similarly, Vitamin A supplementation, ready-to-use therapeutic foods (RUTF), and micronutrient powders have reduced childhood wasting, stunting, morbidity, and mortality [13]. Evidence suggests that children getting optimal nutrition during this period exhibit better cognitive development, immune function, and long-term health outcomes [4]. Community-based programs implementing this approach, such as those in South Asia and sub-Saharan Africa, have successfully lowered malnutrition rates and improved maternal and child health [19–21].

Recognizing the urgency of addressing malnutrition, several organizations have implemented targeted interventions to improve maternal and child nutrition outcomes in Afghanistan. One such initiative is the Central Asia Stunting Initiative (CASI), led by the Aga Khan Foundation (AKF) in collaboration with key stakeholders. The CASI project aims to reduce stunting and improve maternal and child health through community-based interventions focused on women of reproductive age and children under five, particularly those under two years of age (Table 1). This initiative is being implemented in Badakhshan, a province chosen for its high stunting rates (58%) and undernutrition (26.1%), making it a crucial location for this study [22]. This study aims to assess the impact of nutritional interventions in reducing the prevalence of stunting and anaemia among Afghan women and children in Badakhshan.

Methodology

The Aga Khan Development Network (AKDN) and its local partners, such as the World Food Program and UNICEF, were pivotal in delivering the intervention package. The details of the

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intervention package are outlined in Table 1. An independent team of researchers from Aga Khan University, Pakistan, evaluated the interventions.

Table 1. Interventions Implemented Under the Central Asia Stunting Initiative (CASI).

Target Group	Key Interventions
Pregnancy and Lactating Women	ي Antenatal and postnatal care and nutritional assessment ي Provision of energy-dense nutritious foods (LNS) ي Iron and folic acid supplementation ي Intensive nutrition counselling and behavioural change communication ي - Follow-ups
Birth to 6 months	ي Helping Baby Breathe ي Helping Baby Survive ي Promotion of exclusive breastfeeding ي Immunization ي Behavioural change communication (IYCF practices, care practices, hygiene, and sanitation) ي - Follow-ups
Children (6–23 months)	ي Promotion of continued breastfeeding ي Immunization ي Promotion of Infant and Young Child Feeding (IYCF) practices ي Provision of LNS and iron supplementation ي Growth monitoring ي Vitamin A supplementation ي Treatment of acute malnutrition (SAM and MAM) ي Behavioural change communication (healthy diets, food demonstrations, care practices, hygiene, and sanitation)
Children (24–59 months)	ي Growth monitoring ي Improved hygiene and sanitation practices ي Treatment of acute malnutrition (SAM and MAM) with LNS and RUTF ي - Follow-ups- Behavioural change communication (healthy diets, care practices, hygiene, and sanitation)

Since CASI interventions were administered to a large population in Badakhshan Province of Afghanistan, and due to the nature of the intervention, no population segment can be excluded from benefiting; therefore, our study lacks a control group. Given this challenge, we employed a Single-Group Pre-Post Test Design [24] to evaluate the effectiveness of the CASI intervention package [24]. In our study, the participants serve as their own controls, with baseline (pre-intervention) data compared to mid-intervention data to assess changes in nutritional indicators.

The survey's evaluation focused on two key groups: women of reproductive age (15-49 years) and children aged 0-59 months. Using the prevalence (41%) of stunting among children under five years, we estimated a sample size of 350 children to achieve the primary objective of reducing stunting. We utilized a 95% confidence level and a margin of error of 5%, incorporating a 20% non-response rate to achieve this sample size [25].

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We employed a two-stage stratified sampling design, treating villages as primary sampling units (PSUs) and households within those villages as secondary sampling units (SSUs). Villages were selected using proportional probability sampling (PPS), while households were chosen through systematic random sampling. A new household listing was conducted to ensure accurate selection, prioritizing households with children under five.

The selection of respondents adhered to specific criteria. Household heads or knowledgeable members aged 18 years and older provided data on demographics, socioeconomic conditions, and food security. Eligible women in selected households were surveyed for reproductive health and dietary data. Data on children aged 0-59 months were collected from mothers or caretakers, including anthropometric measurements and hemoglobin (Hb) tests on a randomly selected child (6-59 months) per household. In children over two years, we calculated height-for-age z scores (HAZ); for children under two years old, we used length instead of height to calculate length-for-age z scores (LAZ). We also computed body Mass Index (BMI) using height and weight for mothers. Children were categorized as stunted, and mothers were classified as underweight, overweight, or obese, all by the WHO classification, ensuring our survey's alignment with global standards [26]. Hemoglobin concentration was also adjusted for altitudes of more than 1000 meters using the WHO-recommended altitude formula [27].

The research and evaluation team of Aga Khan University developed and reviewed a detailed survey protocol. Data collection tools were designed, translated, and pre-tested to ensure accuracy. The survey was conducted by independent Aga Khan University teams trained in data collection, anthropometry, and Hb testing. Survey quality was monitored at multiple levels. Field-based supervision involved team leaders reviewing data collection, anthropometry, and Hb testing. AKU's data management unit (DMU) provided real-time dashboard tracking and data validation. Regular feedback was given to supervisors to address inconsistencies and enhance data quality.

Data collection utilized Computer-Assisted Personal Interviews (CAPI) via handheld tablets. Paper-based personal interviews (PAPI) were conducted in security-sensitive areas, with data later transcribed into the system. Data entry was performed using a customized Android application with built-in validation checks, and a web-based dashboard allowed real-time monitoring. Data security was ensured through encryption and restricted access. Analysis was conducted using STATA. Stunting (height/length-for-age z-score of < -2) and anemia (< 11 gm/dL) were considered outcome variables among children under five, while undernutrition (BMI <18.5, underweight), overweight, obesity (BMI 25–34.99), and anemia (< 12 gm/dL) were considered outcome variables among mothers. Statistical tests such as chi-square tests for categorical variables and t-tests for continuous variables were used to analyze the pre-and post-intervention differences. The significance of differences was determined using p-values ($p < 0.05$) to assess statistical significance. The effect size was measured using Cohen's h [28], which quantifies the magnitude of change between proportions.

The study was approved by Aga Khan University's Ethical Review Committee, ERC #: 2019-1582-4219. And from the Institutional Review Board of the Afghanistan National Public Health Institute IRB Code: IRB.C.0519.0029. Informed consent was obtained from all respondents to ensure confidentiality. Children identified with severe malnutrition or illnesses were referred to health facilities for treatment.

Results

Our Results in Table 2 show the baseline sociodemographic and health indicators for the baseline and midline surveys. The findings show significant improvements in socioeconomic conditions, with increased access to safe drinking water (80.9% to 90.7%) and sanitation facilities (37.4% to 88.3%). Food security improved markedly, with severe food insecurity dropping from 94.7% to 30.5%. The data show that most mothers fall within the 20–34 age group, with little change between baseline (74.2%) and midline (73.5%). Literacy among mothers improved from 63.2% to 69.8%, while their employment slightly decreased (9.5% to 6.8%). Fathers' literacy remained high but slightly declined

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from 76.7% to 74.8%. These trends reflect a modest improvement in maternal education but a reduction in maternal employment over the survey period.

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Table 2. Sociodemographic and Health Indicators, Baseline and Midline Surveys.

Variable	Baseline (% (95 % CIs))	Midline (% (95 % CIs))
Household level indicators	**N=369**	**N=371**
Household Size; mean (95 % CIs)	8.8 (8.4 - 9.3)	8.4 (8.0 - 8.8)
SES Status		
Poorest	20.3% (16.2% - 24.4%)	18.6% (14.4% - 22.9%)
Poor	19.9% (15.7% - 24.1%)	19.4% (14.9% - 24.0%)
Middle	19.9% (15.6% - 24.3%)	18.2% (13.9% - 22.6%)
Rich	20.0% (15.6% - 24.5%)	19.7% (15.0% - 24.3%)
Richest	19.8% (15.5% - 24.2%)	24.0% (18.4% - 29.6%)
Type of Housing		
Flooring		
Natural	96.1% (94.1% - 98.2%)	74.8% (69.3% - 80.3%)
Rudiment	3.4% (1.5% - 5.3%)	1.2% (0.0% - 2.4%)
Finished	0.5% (0.0% - 1.1%)	24.0% (18.5% - 29.5%)
Roof		
Natural roofing	0.6% (-0.1% - 1.4%)	13.3% (9.6% - 17.0%)
Rudimentary roofing	78.5% (74.3% - 82.7%)	27.4% (22.3% - 32.5%)
Finished roofing	20.9% (16.7% - 25.0%)	59.3% (53.6% - 65.0%)
Walls		
Natural walls	48.2% (42.8% - 53.6%)	32.9% (27.7% - 38.2%)
Rudimentary walls	48.6% (43.3% - 54.0%)	42.1% (36.2% - 47.9%)
Finished walls	3.2% (1.4% - 5.0%)	24.6% (19.0% - 30.2%)
Other	-	0.4% (0.0% - 1.1%)
Access to Safe Drinking Water (Improved sources of water)	80.9% (77.0% - 84.9%)	90.7% (87.8% - 93.6%)
Improved Sanitation Facilities	37.4% (32.2% - 42.6%)	88.3% (84.6% - 92.0%)
Food Security Status		
Food Secure	1.5% (0.2% - 2.9%)	9.1% (5.1% - 13.1%)
Milld Food Insecure	0.4% (0.0% - 1.1%)	25.5% (20.3% - 30.8%)
Moderate Food Insecure	3.3% (1.3% - 5.2%)	34.9% (29.2% - 40.6%)
Severely Food Insecure	94.7% (92.3% - 97.2%)	30.5% (25.4% - 35.6%)
Variable	**Baseline (% (95 % CIs))**	**Midline (% (95 % CIs))**
Mothers level indicators	**N=229**	**N=541**
Mother's Age Group		
Less than 20 years	2.4% (0.8% - 4.1%)	2.4% (0.4% - 4.4%)
20-34 years	74.2% (67.9% - 80.5%)	73.5% (69.2% - 77.9%)
35-49 years	23.4% (17.2% - 29.5%)	24.0% (19.9% - 28.2%)
Mother's Education Level		
Illiterate	36.8% (30.1% - 43.6%)	30.2% (25.9% - 34.5%)
Literate	63.2% (56.4% - 69.9%)	69.8% (65.5% - 74.1%)
Employment Status of Mother		
Working	9.5% (5.2% - 13.8%)	6.8% (4.3% - 9.2%)

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Not working	90.5% (86.2% - 94.8%)	93.2% (90.8% - 95.7%)
Father's Education Level	**N=223**	**N=544**
Illiterate	23.3% (17.5% - 29.1%)	25.2% (21.2% - 29.2%)
Literate	76.7% (70.9% - 82.5%)	74.8% (70.8% - 78.8%)
Child level indicators	**N=232**	**N=565**
Child's Sex		
Male	49.1% (42.0% - 56.2%)	48.1% (43.3% - 52.8%)
Female	50.9% (43.8% - 58.0%)	51.9% (47.2% - 56.7%)
Child's Age Group		
0-5 months	9.5% (5.1% - 13.8%)	10.0% (7.0% - 13.0%)
6-11 months	9.4% (5.5% - 13.3%)	8.7% (6.1% - 11.3%)
12-23 months	17.6% (12.2% - 23.0%)	24.2% (20.0% - 28.5%)
24-35 months	25.6% (19.4% - 31.7%)	21.7% (17.9% - 25.6%)
36-47 months	21.0% (15.3% - 26.8%)	16.4% (13.0% - 19.8%)
48-59 months	16.9% (11.6% - 22.1%)	18.9% (15.3% - 22.5%)
Exclusively breastfed:	**N=16**	**N=51**
Children aged 0-5 months	64.0% (36.5% - 91.4%)	80.9% (67.0% - 94.7%)
MDD (6-24 month) IYCF	**N=66**	**N=186**
	7.5% (1.9% - 13.2%)	20.7% (13.6% - 27.8%)
Immunization Status of Child (12-23 months of age)	**N=40**	**N=136**
Not immunized	-	-
Partially immunized	4.4% (0.0% - 10.6%)	10.6% (4.8% - 16.5%)
Fully immunized	95.6% (89.4% - 101.7%)	89.4% (83.5% - 95.2%)

The child-level indicators reflect key changes between baseline and midline surveys. The gender distribution remained balanced, with a slight increase in the proportion of female children (50.9% to 51.9%). Exclusive breastfeeding for children aged 0–5 months significantly improved, rising from 64.0% to 80.9%. Dietary diversity (MDD) for children aged 6–24 months also improved substantially, increasing from 7.5% to 20.7%. While the proportion of fully immunized children aged 12–23 months slightly declined from 95.6% to 89.4%, the rate of partially immunized children increased from 4.4% to 10.6%. These results highlight improvements in breastfeeding and nutrition practices, with some concerns regarding the slight decline in full immunization coverage.

The findings demonstrate significant improvements in children's nutritional status between baseline and midline surveys (Table 2), with notable reductions in malnutrition levels and moderate-to-large effect sizes, as indicated by Cohen's h. The prevalence of underweight children dropped markedly from 35.0% to 15.5%, representing a significant 19.5% reduction ($P < 0.001$, Cohen's $h = 0.46$, moderate effect size). Severe underweight declined significantly from 13.9% to 2.9% (-11.0%, $P < 0.001$, Cohen's $h = 0.42$, moderate effect size). Stunting decreased from 52.3% to 37.3% (-15.0%, $P = 0.001$, Cohen's $h = 0.30$, moderate effect size), while severe stunting fell from 26.9% to 15.5% (-11.4%, $P = 0.002$, Cohen's $h = 0.28$, small-to-moderate effect size). Acute malnutrition (wasting) declined significantly from 11.8% to 3.1% (-8.7%, $P = 0.001$, Cohen's $h = 0.35$, moderate effect size), although the reduction in severe wasting from 4.2% to 1.2% (-3.0%) was not statistically significant ($P = 0.067$, Cohen's $h = 0.19$, small effect size). Concurrent stunting and wasting, a critical indicator of combined chronic and acute malnutrition, dropped substantially from 6.6% to 0.5% (-6.1%, $P = 0.001$, Cohen's $h = 0.38$, moderate effect size).

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Table 2a highlights significant improvements in anemia status among children between the baseline and midline surveys, with notable reductions in moderate anemia and increases in normal hemoglobin levels. Severe anemia (<7 gm/dL) showed a slight, non-significant decrease from 1.1% to 0.8% (-0.3%, P = 0.828, Cohen's h = 0.03), indicating limited progress in addressing the most critical cases. However, moderate anemia (7–10.99 gm/dL) decreased significantly from 59.7% to 41.1%, reflecting an 18.6% reduction (P = 0.001, Cohen's h = 0.37). Furthermore, the proportion of children with normal haemoglobin levels (≥11 gm/dL) increased significantly from 39.2% to 58.1%, representing an 18.9% improvement (P < 0.001, Cohen's h = 0.38).

Table 3 reveals significant changes in the nutritional status of women of reproductive age (WRA) between baseline and midline surveys. The prevalence of underweight women (<18.5 BMI) decreased significantly from 20.0% to 9.4%, reflecting a 10.6% reduction (P < 0.001, Cohen's h = 0.30), indicating notable improvements in nutritional outcomes. Although the proportion of women with a normal BMI (18.5–24.9) increased from 74.1% to 78.3%, this 4.2% rise was not statistically significant (P = 0.139, Cohen's h = 0.10). Meanwhile, the prevalence of overweight women (25.0–29.9 BMI) rose significantly from 5.4% to 10.7%, reflecting a 5.2% increase (P = 0.003, Cohen's h = 0.20), and obesity (>30 BMI) increased from 0.1% to 1.0% (P = 0.028, Cohen's h = 0.14). These trends suggest an emerging concern for overnutrition. The proportion of missing or unknown data increased slightly from 0.3% to 0.7%, but this change was not statistically significant (P = 0.434, Cohen's h = 0.06).

Table 3. Difference in Nutrition Status among children, P Values, and Effect Size Baseline vs. Midline Surveys.

	Baseline % (95 % CIs)	N	Midline % (95 % CIs)	N	Midline-Baseline (% diff) (95 % CIs)	P value	Effect size (Cohens h)
Nutritional status							
Underweight	35.0% (28.5% - 41.5%)	250	15.5% (11.4% - 19.6%)	494	-19.5% (-27.2% -11.8%)	<0.001	0.46
Severely Underweight	13.9% (9.1% - 18.7%)	250	2.9% (0.8% - 5.0%)	493	-11.0% (-16.3% - -5.8%)	<0.001	0.42
Stunted	52.3% (45.2% - 59.5%)	228	37.3% (32.3% - 42.3%)	491	-15.0% (-23.8% - -6.3%)	0.001	0.30
Severely Stunted	26.9% (20.6% - 33.2%)	228	15.5% (11.8% - 19.3%)	491	-11.4% (-18.7% - -4.1%)	0.002	0.28
Wasted	11.8% (7.3% - 16.4%)	240	3.1% (1.2% - 5.0%)	488	-8.7% (-13.7% - -3.8%)	0.001	0.35
Severely Wasted	4.2% (1.4% - 7.1%)	240	1.2% (-0.2% - 2.7%)	488	-3.0% (-6.2% - 0.2%)	0.067	0.19
Concurrent Stunting & Wasting	6.6% (2.9% - 10.2%)	225	0.5% (-0.2% - 1.1%)	487	-6.1% (-9.8% - -2.4%)	0.001	0.38

Table 4 shows significant changes in haemoglobin levels among participants between baseline and midline surveys, reflecting overall health and nutritional status improvements. The prevalence of severe deficiency (<7 gm/dL) remained unchanged at 0.3%, with no statistically significant difference (P = 0.943, Cohen's h = 0.00). Moderate deficiency (7–11.99 gm/dL) decreased significantly from 32.8% to 22.2%, representing a 10.6% reduction (-10.6%, P = 0.003, Cohen's h = 0.24), indicating a small-to-moderate positive effect of interventions. The proportion of individuals with normal haemoglobin levels (≥12 gm/dL) increased significantly from 66.9% to 77.5%, reflecting a 10.6% improvement (P = 0.003, Cohen's h = 0.24).

Table 4. Difference in Anemia Status among children, P Values, and Effect Size Baseline vs. Midline Surveys.

	Baseline % (95 % CIs)	Midline % (95 % CIs)	Midline-Baseline	P value	Effect size

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			(% diff) (95 % CIs)		(Cohens h)
Anemia	**N=163**	**N=317**			
Severe deficiency (<7 gm/dL)	1.1% (-1.0% - 3.1%)	0.8% (-0.1% - 1.8%)	-0.3% (-2.5% - 2.0%)	0.828	0.03
Moderate deficiency (7 - 10.99 gm/dL)	59.7% (51.4% - 68.1%)	41.1% (34.8% - 47.4%)	-18.6% (-29.1% - -8.1%)	0.001	0.37
Normal (>= 11 gm/dL)	39.2% (30.9% - 47.5%)	58.1% (51.8% - 64.4%)	18.9% (8.4% - 29.3%)	<0.001	0.38

Overall, the results demonstrate the effectiveness of interventions in addressing undernutrition and anemia, mainly through targeted nutritional programs. However, the findings also underscore the need for sustained efforts to tackle severe cases of malnutrition and anemia and to address the growing prevalence of overweight and obesity, emphasizing the importance of balanced and holistic health interventions.

Discussion

The findings of this study demonstrate significant improvements in maternal and child nutrition in Afghanistan following the implementation of CASI. The reduction in stunting, wasting, underweight prevalence, and anemia among children, as well as the improvement in maternal nutritional indicators, highlight the effectiveness of the intervention package. The positive impact of targeted nutrition programs, including dietary supplementation, exclusive breastfeeding promotion, and food security initiatives, aligns with global best practices for addressing malnutrition in resource-limited settings. The substantial decline in severe food insecurity from 94.7% to 30.5% suggests that CASI's interventions effectively addressed food accessibility challenges, particularly in vulnerable communities (4). The improvement in literacy rates among mothers from 63.2% to 69.8% may have contributed to better nutrition practices, as maternal education is a known determinant of child health outcomes (3). Furthermore, the increase in exclusive breastfeeding rates from 64.0% to 80.9% is encouraging, as it is associated with reduced child mortality and improved immune system function (10).

Despite these improvements, specific challenges remain. The decrease in the proportion of fully immunized children from 95.6% to 89.4% raises concerns about the sustainability of immunization efforts and potential setbacks in child health protection. Similarly, while anemia prevalence in children decreased significantly, severe cases remained unchanged, indicating a need for more intensive anemia control measures, such as iron-folic acid supplementation and deworming (12). The potential causal interactions between CASI interventions and observed improvements can be explored through various pathways. Improved maternal nutrition and dietary diversity contribute to better birth outcomes, reducing neonatal morbidity and improving child growth (13). Increased access to fortified foods and dietary supplementation directly improves micronutrient intake, thereby decreasing anemia and supporting cognitive and physical development (WHO, 2022). Community education and awareness programs enhance knowledge on appropriate infant and young child feeding practices, leading to improved exclusive breastfeeding rates and better child nutritional status (UNICEF, 2023). Moreover, improved sanitation and hygiene reduce infection exposure, exacerbating malnutrition (6).

Literature shows that our findings on the positive impact of CASI interventions are consistent with some of the similar programs achieved in neighbouring countries. In Pakistan, the Lady Health Worker (LHW) program and the Benazir Income Support Programme (BISP) for nutritional support have contributed to a reduction in stunting rates from 45% in 2012 to 37.6% in 2019 (29). The success of Pakistan's programs is attributed to integrated maternal and child health initiatives, cash transfers,

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and improved healthcare access [19]. India's Integrated Child Development Services (ICDS) program and the National Nutrition Mission (POSHAN Abhiyaan) have led to significant reductions in child malnutrition [30]. Technology-driven monitoring and maternal health counselling have been crucial in these improvements. Furthermore, micronutrient supplementation programs, including flour fortification with iron and folic acid, have helped reduce the prevalence of anemia among women in many developing countries [31]. Community nutrition education and better access to primary healthcare have also contributed to improving child growth indicators. These comparisons highlight that while Afghanistan has made commendable progress through CASI, sustained efforts and policy reinforcement are necessary to achieve long-term improvements like those observed in neighbouring countries.

While the findings of this study are valuable, several limitations must be acknowledged. The study utilized a single-group pre-post-test design, which limits the ability to establish causality. Without a control group, it is challenging to determine whether the observed improvements are solely due to CASI interventions or external factors. The study evaluates midline results but does not provide insights into the long-term sustainability of these improvements. Follow-up assessments are required to determine whether nutritional gains persist over time. As the data were collected through household surveys, there is a risk of social desirability bias, where respondents may overreport positive health behaviours, such as breastfeeding practices or dietary diversity. The study focuses on Badakhshan province, which may not represent the entire country. Differences in cultural practices, healthcare access, and economic conditions across regions may lead to varied intervention effectiveness. While the study notes an increase in overweight and obesity among women, it does not explore the contributing factors in detail. Future research should investigate dietary patterns, physical activity levels, and metabolic health indicators to develop targeted interventions for addressing the dual burden of malnutrition.

Conclusion

The CASI initiative has significantly improved maternal and child nutrition in Afghanistan, with marked reductions in malnutrition indicators. Policymakers should focus on scaling up effective interventions, strengthening food security measures, and ensuring continuous monitoring to improve nutrition outcomes for women and children in Afghanistan.

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