



Impact of Providing Food Supplements to Pregnant Women Experiencing Chronic Energy Deficiency within the Sangowo Public Health Center Region

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Abstract. Chronic Energy Deficiency (CED) among pregnant women remains a public health concern because it increases the risk of adverse maternal and fetal outcomes. The Indonesian government implemented the Supplementary Feeding Program (PMT) to improve the nutritional status of vulnerable pregnant women. This study evaluated the effectiveness of PMT in improving nutritional indicators among pregnant women with CED in the Sangowo Primary Health Care coverage area. A pre-experimental single-group pretest–posttest design was used involving 60 pregnant women with CED selected through total sampling. Mid-upper arm circumference (MUAC) and body weight were measured before and after 90 days of nutritional supplementation. Data were analyzed using descriptive statistics and a paired t-test at $\alpha = 0.05$. Mean MUAC increased from 22.34 ± 0.74 cm to 23.68 ± 0.81 cm, while mean body weight increased from 49.82 ± 5.28 kg to 52.11 ± 5.36 kg. The paired t-test showed a statistically significant improvement in nutritional indicators ($p < 0.001$). PMT significantly improved nutritional indicators among pregnant women with CED. Continued implementation should include nutrition education, adherence monitoring, and clinical management.

Keywords: Chronic Energy Deficiency; Maternal Nutrition; Nutritional Status; Pregnant Women; Supplementary Feeding Program.

1. Background

Chronic Energy Deficiency (CED) among expectant mothers poses a persistent public health challenge across low- and middle-income countries, including Indonesia. This metabolic-nutritional state arises from long-term insufficiency in dietary energy and protein consumption, ultimately impairing maternal health throughout gestation. In clinical practice, screening relies heavily on Mid-Upper Arm Circumference (MUAC) metrics, with values falling below 23.5 cm serving as a key diagnostic threshold for maternal undernutrition. The adverse effects of CED reach far beyond maternal well-being, directly hindering fetal growth and escalating the risk of premature birth, low birth weight, intrauterine growth limitation, as well as infant and maternal complications. As a result, controlling CED forms a core pillar of maternal health initiatives in Indonesia (Kementerian Kesehatan Republik Indonesia, 2023; World Health Organization [WHO], 2023).

Pregnancy entails heightened physiological requirements for essential nutrients—including energy, protein, and micronutrients—to sustain fetal growth while preserving maternal bodily function. Inadequate intake during this period can induce undernutrition, detrimentally impacting both immediate reproductive health and long-term health trajectories for future generations. CED stems from a complex interplay of determinants, such as socioeconomic standing, maternal education, household food security, nutritional awareness, underlying medical conditions, and adherence to recommended dietary habits. These interconnected factors indicate that addressing CED requires comprehensive and multi-faceted intervention frameworks (Black et al., 2013; WHO, 2023).

As a strategic measure against maternal malnutrition, Indonesia established targeted nutrition programs, primarily the Supplementary Feeding Program (PMT), to assist pregnant women diagnosed with CED. The scheme delivers nutrient-dense food supplements rich in protein, calories, and key vitamins to enhance overall maternal nutritional standing. Channelled through primary health centers during routine prenatal visits, PMT is designed to support adequate weight accumulation, optimize health profiles, and prevent maternal-fetal complications. However, real-world program performance is strongly influenced by maternal

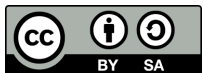
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compliance, healthcare provider engagement, and regional cultural behaviors regarding food consumption (Kementerian Kesehatan Republik Indonesia, 2023; UNICEF, 2023).

Prior literature confirms that supplementary feeding programs can positively alter maternal nutritional profiles. Regional investigations across Indonesia report measurable gains in maternal weight, arm circumference, and hemoglobin concentrations post-intervention. Internationally, trials in developing regions show that balanced energy-protein supplementation lowers the incidence of low birth weight while supporting better overall pregnancy outcomes. Nonetheless, the magnitude of improvement varies across studies due to differences in participant characteristics, compliance, composition of supplementary foods, and varying levels of implementation quality across healthcare settings (Ota et al., 2015; Imdad & Bhutta, 2012).

Despite growing empirical support, most existing studies have focused on urban centers or areas with well-resourced healthcare infrastructure. Furthermore, past research often evaluates general nutritional changes without analyzing how PMT performs within primary healthcare facilities that serve geographically isolated populations. Consequently, current evidence fails to adequately represent PMT outcomes in remote or island communities where access to healthcare services is constrained. This underscores the necessity of localized, context-driven research that accounts for regional geography and clinical service environments when assessing program delivery (Rahman et al., 2021; Kementerian Kesehatan Republik Indonesia, 2023).

The operational area of Sangowo Public Health Center features distinct geographical and socioeconomic dynamics that contrast sharply with urban centers. Factors such as food availability, healthcare access, transport infrastructure, and community nutritional literacy directly influence how effectively PMT functions among local pregnant women with CED. Furthermore, systematic evaluation of maternal health changes in this region remains limited, leaving a knowledge gap regarding the true impact of supplementary feeding on local health outcomes. Such localized data is vital for tailoring primary healthcare delivery and driving evidence-based decision-making.

A review of current literature highlights a clear research gap regarding PMT efficacy among pregnant women with CED within the Sangowo Primary Health Care catchment area. Most prior work has centered on broad associations between nutritional status and birth outcomes or focused merely on descriptive coverage figures. Direct empirical studies analyzing the specific impact of PMT interventions on nutritional indicators within primary care settings remain sparse, and few account for local community dynamics as key determinants of intervention success. These gaps reinforce the importance of conducting location-specific studies to generate actionable evidence.

What sets this research apart is its focused evaluation of the Supplementary Feeding Program (PMT) among pregnant women affected by CED within the specific operational setting of the Sangowo Public Health Center. Diverging from previous literature, this study concurrently accounts for local geographic constraints, participant compliance levels, and post-intervention anthropometric changes. Beyond providing solid empirical insights, the resulting evidence yields actionable strategies to optimize PMT administration, especially across remote and island territories where healthcare access faces significant logistical challenges.

The significance of this study aligns with national goals to reduce maternal CED as part of broader efforts to accelerate stunting reduction and enhance maternal-child health metrics. Assessing PMT outcomes is essential to verify that state resources allocated toward maternal nutrition programs yield maximum benefit. The generated evidence is expected to guide policymakers and healthcare professionals in refining distribution networks, strengthening nutritional education, improving clinical monitoring systems, and ultimately driving better maternal and neonatal health outcomes (WHO, 2023; Kementerian Kesehatan Republik Indonesia, 2023).

Addressing these critical needs, this study evaluates the impact of the Supplementary Feeding Program (PMT) on restoring the nutritional health of CED-diagnosed expectant mothers in the Sangowo Primary Health Care coverage area. The inquiry specifically measures changes in maternal anthropometric metrics following the intervention period, assesses operational performance, and proposes actionable strategies to strengthen community-based nutritional interventions. These insights provide strategic guidance for regional policymakers and healthcare providers seeking to optimize targeted nutrition support for vulnerable pregnant women, thereby curbing CED incidence and advancing maternal and child health.

2. Theoretical Review

Maternal Chronic Energy Deficiency (CED) during gestation represents a metabolic-nutritional disorder caused by a sustained deficit in energy reserves and vital nutrients, rendering the body incapable of satisfying the elevated physiological demands of pregnancy. Operationally, expectant mothers are diagnosed with CED when their Mid-Upper Arm Circumference (MUAC) falls below 23.5 cm. This clinical state significantly escalates the risk of negative maternal-fetal outcomes, such as maternal anemia, premature birth, low birth weight (LBW), intrauterine growth restriction, as well as heightened maternal and neonatal morbidity and mortality rates. The etiology of CED stems from an interplay of determinants, including deficient dietary energy and protein intake, poor socioeconomic background, limited educational attainment, systemic infections, short birth spacing, and varying quality of routine antenatal care (World Health Organization [WHO], 2023; Kementerian Kesehatan Republik Indonesia, 2023).

In Indonesia, the Supplementary Feeding Program (Program Pemberian Makanan Tambahan/PMT) functions as a key nutrition-specific initiative designed to address Chronic Energy Deficiency (CED) among pregnant women. By distributing specialized food supplements packed with macronutrients and vital micronutrients, the program aims to facilitate suitable weight gain during pregnancy, improve maternal nutritional health, and prevent impaired fetal growth. However, achieving maximum therapeutic benefits depends not merely on the nutritional formula of the food items, but equally on pregnant mothers' adherence, continuous nutritional counseling and tracking by healthcare providers, and active domestic support throughout gestation (Kementerian Kesehatan Republik Indonesia, 2023; UNICEF, 2023).

The conceptual groundwork of this study is anchored in the maternal nutrition framework, which posits that maternal nutritional capacity prior to and during pregnancy operates as a decisive factor in fetal growth and development. Sufficient energy and protein intake fortifies maternal physiological reserves, supporting healthy placental development, fetal tissue formation, and necessary metabolic adaptations. Conversely, sustained nutritional shortfalls compel metabolic trade-offs that can restrict fetal development and trigger adverse pregnancy complications. Under this conceptual model, supplementary feeding interventions like PMT are designed to restore maternal energy equilibrium and improve overall nutritional profiles throughout pregnancy (Black et al., 2013).

Prior empirical research consistently underscores the positive impact of supplementary feeding programs on maternal health metrics. A systematic review by Ota et al. (2015) highlighted that balanced energy and protein supplementation during gestation correlates with increased maternal weight gain and a reduced prevalence of low birth weight newborns. Similarly, regional studies across Indonesia indicate measurable post-intervention increases in maternal MUAC, hemoglobin levels, and a reduction in overall CED prevalence following PMT implementation. Nonetheless, the extent of nutritional improvement varies considerably between regions, reflecting variations in demographic profiles, distribution logistics, and local healthcare execution.

Despite these favorable observations, the real-world performance of PMT exhibits variability across different operational settings. Variations in program success are often linked to differences in maternal adherence, intervention duration, supplement formulations, household economic status, and physical accessibility to healthcare facilities. Furthermore, the majority of earlier studies were conducted in urban centers or regions with robust health infrastructure, generating a gap in scientific evidence regarding PMT performance in geographically distinct or under-resourced areas, such as the Sangowo Public Health Center catchment region. This limitation emphasizes the need for localized studies that account for community-specific demographics, socioeconomic conditions, and primary healthcare environments.

Grounded in these theoretical models and empirical insights, this study operates on the premise that structured supplementary food delivery for pregnant women with CED can successfully improve maternal nutritional parameters throughout gestation. Consequently, this investigation assesses the effect of the Supplementary Feeding Program on the nutritional status of pregnant women diagnosed with CED in the Sangowo Public Health Center service area. The resulting insights aim to deliver scientific evidence to support evidence-based recommendations, strengthen maternal nutrition services, and elevate the quality of primary antenatal care.

3. Research Methods

A quantitative pre-experimental model incorporating a one-group pretest–posttest framework was executed to assess the influence of the Supplementary Feeding Program (PMT) on restoring the nutritional status of CED-diagnosed expectant mothers. By contrasting anthropometric metrics measured before and after intervention delivery, this design accurately captured changes directly resulting from the program. Fieldwork was carried out within the Sangowo Primary Health Care service area during the 2026 operational cycle.

The study population included all expectant mothers identified with CED through standardized antenatal screenings at the Sangowo Primary Health Care center. Sampling was executed via a total sampling technique, enrolling every eligible participant who met the predetermined inclusion criteria while excluding non-eligible cases. Eligibility required pregnant women to present with a Mid-Upper Arm Circumference (MUAC) under 23.5 cm, provide consent for full study participation, and receive PMT in accordance with national delivery protocols. Conversely, individuals who developed severe obstetric complications or dropped out before completing the intervention duration were excluded from final data synthesis.

The independent variable examined in this study was participation in the Supplementary Feeding Program, while the dependent variable was maternal nutritional status among CED-affected pregnant women. Anthropometric parameters—specifically MUAC measurements and maternal body weight—were evaluated pre- and post-intervention to reflect nutritional status. Additionally, demographic and clinical profiles, encompassing maternal age, gestational stage, educational background, employment status, and parity, were documented to contextualize the study cohort and support data interpretation.

Data gathering involved physical anthropometric measurements, direct observation, and clinical record audits. Research instruments comprised structured demographic questionnaires, PMT delivery monitoring forms, and calibrated anthropometric devices standard to maternal healthcare settings, such as digital weighing scales and MUAC measuring tapes. Expert reviewers in maternal nutrition and public health verified the content validity of all data collection tools prior to deployment. Reliability testing confirmed strong internal consistency, yielding Cronbach's alpha values above 0.70 across instruments.

Univariate statistics were calculated initially to summarize sample characteristics using counts, percentages, averages, and standard deviations. Data distributions were subsequently tested for normality to determine the appropriate inferential test. For normally distributed variables, pre- and post-intervention differences in nutritional indicators were evaluated using a paired t-test. If normality assumptions were violated, the non-parametric Wilcoxon signed-rank test was utilized. Statistical significance was declared at an alpha threshold of $\alpha = 0.05$. Analytical protocols adhered to established biostatistical methodologies outlined by Dahlan (2020) and Ghazali (2021); thus, explicit mathematical formulas are omitted from this text.

The conceptual framework portrays a direct causal link between the Supplementary Feeding Program as the independent variable (X) and shifts in maternal nutritional status among CED-diagnosed pregnant women as the dependent variable (Y). Variable X encompasses the standard PMT intervention executed under national operational guidelines, whereas variable Y captures measurable gains in maternal nutritional parameters, specifically post-intervention changes in MUAC and weight. Evaluating the interaction between these variables enabled the determination of PMT effectiveness within the Sangowo Public Health Center service area.

4. Results And Discussion

Field activities for this investigation took place in the Sangowo Public Health Center catchment area between January and March 2026. The initial phase involved tight coordination between the investigation team and healthcare officers to identify pregnant women diagnosed with Chronic Energy Deficiency (CED) based on routine antenatal screening logs. Candidate respondents received comprehensive information detailing the study objectives, experimental procedures, and ethical protections prior to submitting written informed consent.

Initial baseline evaluations (pretest) were performed to record the starting nutritional status of respondents using two primary anthropometric metrics: Mid-Upper Arm Circumference (MUAC) and body weight. Once baseline data were documented, all enrolled participants were integrated into the Supplementary Feeding Program (Program Pemberian Makanan Tambahan/PMT), delivered in accordance with the standard clinical guidelines of the Sangowo Primary Health Care center over a 90-day intervention period. At the conclusion of the 90-day supplementation phase, posttest evaluations were carried out using the same

standardized measurement protocols and calibrated equipment to safeguard data consistency. Collected health metrics underwent a structured quality assurance process comprising completeness checks, double-entry verification, variable coding, and preliminary statistical validation prior to main analytical testing. The resulting data were then interpreted to assess how effectively the Supplementary Feeding Program restored key nutritional indicators among CED-affected pregnant women.

Participant Characteristics

The background characteristics of the cohort offer a demographic profile of the pregnant women enrolled in this study. Out of 60 evaluated participants, the vast majority were within the safe reproductive age range (20–35 years), indicating that most respondents were in an optimal biological phase for pregnancy.

Table 1. Respondent Demographics.

Characteristic	Frequency (n)	Percentage (%)
Age		
< 20 years	6	10.0
20–35 years	45	75.0
> 35 years	9	15.0
Educational Attainment		
Primary–Junior High School	18	30.0
Senior High School	30	50.0
Higher Education	12	20.0
Occupation		
Homemaker	39	65.0
Self-employed	12	20.0
Government/Private Employee	9	15.0
Parity		
Primigravida	24	40.0
Multigravida	36	60.0

Source: Primary field data, 2026.

As detailed in Table 1, baseline data highlight that 75.0% of participants fell within the prime reproductive age window of 20–35 years. Half of the cohort (50.0%) had completed senior high school education, while the majority (65.0%) were full-time homemakers. Furthermore, multigravida women represented 60.0% of the total sample.

These background demographics suggest that despite being in a biologically favorable reproductive age bracket, participants remained susceptible to Chronic Energy Deficiency (CED). This pattern indicates that maternal nutritional outcomes during gestation depend not solely on biological age, but rather on an array of interacting factors, including educational level, household economic status, dietary habits, and physical access to maternal healthcare infrastructure. Changes in Nutritional Status Pre- and Post-Intervention.

To assess the efficacy of the Supplementary Feeding Program (PMT), baseline mean measurements of Mid-Upper Arm Circumference (MUAC) and maternal body weight were contrasted with post-treatment outcomes. Variations across these physical metrics provided essential benchmarks for determining the program's impact on restoring adequate nutritional status in CED-diagnosed expectant mothers.

Table 2. Anthropometric Shift in CED Pregnant Women Before and After PMT.

Variable	Pre-PMT (Mean $\pm$ SD)	Post-PMT (Mean $\pm$ SD)	Mean Difference
MUAC (cm)	22.34 $\pm$ 0.74	23.68 $\pm$ 0.81	+1.34
Body Weight (kg)	49.82 $\pm$ 5.28	52.11 $\pm$ 5.36	+2.29

Source: Processed primary data, 2026.

As illustrated in Table 2, the post-intervention results revealed an average increase of 1.34 cm in MUAC and a mean weight gain of 2.29 kg post-PMT implementation. These consistent anthropometric gains reflect positive nutritional progression across the intervention window, suggesting that the PMT initiative successfully improved overall maternal health metrics during the 90-day study Statistical Analysis of Program Efficacy.

Bivariate testing was conducted via a paired t-test, as pre- and post-intervention data satisfied parametric normality assumptions. This inferential procedure was performed to compare baseline and post-treatment metrics and determine if the observed gains were statistically significant.

Table 3. Paired t-Test Outcomes for Maternal Anthropometric Changes.

Metric	t-statistic	p-value	Decision / Interpretation
Mid-Upper Arm Circumference (MUAC)	10.842	< 0.001	Statistically Significant
Body Weight	12.376	< 0.001	Statistically Significant

Source: Derived from statistical analysis of 2026 dataset.

Statistical testing summarized in Table 3 demonstrates p -values below 0.001 across all evaluated parameters (MUAC and weight). Because the observed significance falls well beneath the standard threshold ($\alpha = 0.05$), the null hypothesis was successfully rejected. Based on these statistical outcomes, it is evident that the Supplementary Feeding Program (PMT) intervention successfully restored the nutritional health of CED-diagnosed pregnant women across the Sangowo Primary Health Care operational region.

Discussion

Data derived from this study substantiate that the execution of the Supplementary Feeding Program (Program Pemberian Makanan Tambahan/PMT) yielded a notable enhancement in the nutritional status of expectant mothers experiencing Chronic Energy Deficiency (CED) across the Sangowo Public Health Center service area. This conclusion is reinforced by statistically significant post-treatment advances in both Mid-Upper Arm Circumference (MUAC) and maternal weight. These anthropometric elevations indicate that the additional dietary energy and protein delivered through the intervention effectively replenished maternal nutritional reserves during the gestational period. Grounded in nutritional science, adequate maternal dietary intake is vital to facilitate physiological adaptation, optimize placental development, and foster fetal growth. Consequently, these results highlight the vital role of structured nutrition strategies in safeguarding maternal and child health outcomes (World Health Organization [WHO], 2023; Kementerian Kesehatan Republik Indonesia, 2023).

The post-intervention increase in MUAC highlights a tangible restoration of maternal muscle mass and subcutaneous tissue, establishing MUAC as a dependable anthropometric metric for assessing nutritional risk in pregnancy. Unlike certain gestational indicators that fluctuate rapidly, MUAC remains stable throughout pregnancy, making it an optimal diagnostic tool for maternal undernutrition. According to maternal nutrition concepts, sufficient energy-protein supplementation optimizes tissue synthesis while supporting healthy placental function. The present empirical data indicate that continuous food supplementation improved overall energy balance, though individual gain trajectories were likely influenced by baseline dietary patterns, health status, and strict compliance with the dietary regimen (Black et al., 2013; WHO, 2023).

A concurrent increase in maternal body weight was also recorded following PMT execution. Adequate gestational weight gain serves as a core index of nutritional sufficiency and positive fetal progression. From a physiological perspective, gestational weight

accumulation encompasses fetal mass, placental tissue, amniotic fluid volume, expanded maternal plasma volume, and necessary subcutaneous lipid storage required to meet the metabolic demands of pregnancy. Although the supplemental food directly drove weight gain, heightened nutritional awareness gained through clinical counseling likely fostered healthier household eating habits, thereby compounding the program's overall effectiveness (Institute of Medicine, 2009; Kementerian Kesehatan Republik Indonesia, 2023).

These insights further reveal that the real-world success of PMT extends beyond the chemical composition of the food supplements, relying heavily on the quality of healthcare delivery. Continuous compliance checks, routine counseling by clinical personnel, and participant engagement were central to achieving these positive metrics. This suggests that community-based nutritional interventions yield maximum benefit when paired with active clinical monitoring, behavioral reinforcement, and continuous dietary guidance. Hence, program success reflects both the nutritional quality of the PMT product and the operational efficiency of primary healthcare delivery services.

The results of this study align closely with global empirical evidence supporting balanced energy-protein supplementation during pregnancy. A systematic review by Ota et al. (2015) documented that dietary supplementation enhances maternal nutritional markers while decreasing the incidence of low birth weight newborns. Similarly, Imdad and Bhutta (2012) established that maternal nutritional supplementation generates substantial positive outcomes for both mother and child. The convergence between current results and existing literature reinforces PMT as an evidence-based strategy for mitigating CED. Nevertheless, slight variations in the magnitude of anthropometric gains compared to other studies stem from differences in sample demographics, intervention length, patient compliance, socioeconomic backgrounds, local food security, and healthcare accessibility.

Despite overall positive trends, individual participant responses to the intervention exhibited clear variations. This heterogeneity can be attributed to differences in maternal education, household financial status, gestational stage, baseline dietary quality, adherence to daily PMT intake, and home support systems. Behavioral health models postulate that intervention efficacy is dictated not only by service quality, but also by an individual's readiness, comprehension, and long-term commitment to health-promoting behaviors. Thus, a combination of biological variation and behavioral determinants shaped the varying degrees of success observed across participants (Green & Kreuter, 2005; Notoatmodjo, 2018).

Local environmental contexts also played a crucial role during program delivery. The Sangowo Primary Health Care center operates within a region defined by specific geographic and socioeconomic constraints that directly influence food supply chains and clinical accessibility. Regional transport barriers and limited local availability of nutrient-rich foods can hinder participant compliance and healthcare utilization. From a public health viewpoint, nutritional initiatives yield optimal outcomes when integrated into strong primary care frameworks supported by active community outreach, routine home visits, and structured health education. These considerations emphasize the necessity of multisectoral coordination to ensure long-term program sustainability, particularly in geographically remote regions (UNICEF, 2023; Kementerian Kesehatan Republik Indonesia, 2023).

Inferential evaluation established that the Supplementary Feeding Program (PMT) had a statistically meaningful positive impact on the nutritional status of pregnant women diagnosed with CED. With calculated p falling significantly beneath the standard $\alpha = 0.05$ threshold, the possibility of random variation accounting for the anthropometric gains was effectively eliminated. As a result, the alternative hypothesis was supported, substantiating that engagement in the PMT intervention generates quantifiable enhancements in maternal health. These findings lend robust empirical evidence advocating for PMT execution when paired with standardized delivery protocols and rigorous compliance tracking (Dahlan, 2020; Ghozali, 2021).

Ultimately, this study offers valuable theoretical and practical contributions to maternal health policy. Theoretically, the findings validate the maternal nutrition framework by illustrating how targeted dietary supplementation during pregnancy restores maternal nutritional reserves, thereby improving maternal-fetal health prospects. Practically, the outcomes provide actionable evidence for Sangowo Primary Health Care center and regional health authorities to optimize PMT execution through tailored nutritional education, structured adherence tracking, family-centered support, and routine monitoring. Strengthening these operational pillars will enhance local CED management while aiding national initiatives aimed at stunting prevention and maternal-child health optimization in Indonesia (WHO, 2023; Black et al., 2013).

5. Conclusion

Findings from this inquiry demonstrate that the execution of the Supplementary Feeding Program (PMT) produced a statistically meaningful positive impact on improving the nutritional status of pregnant women with CED in the Sangowo Primary Health Care catchment zone. Quantifiable improvements in essential anthropometric markers—namely Mid-Upper Arm Circumference (MUAC) and maternal weight—confirm that the intervention successfully accomplished its main goal. These outcomes underscore the practical value of pairing targeted food supplementation with ongoing prenatal nutritional monitoring. However, given that this study was restricted to one healthcare facility with distinct demographic and geographical traits, generalizability is constrained, highlighting the need for multi-center validation in diverse operational settings.

Recommendations

Building upon these conclusions, PMT implementation should be fortified by integrating structured dietary education, rigorous participant compliance monitoring, and active involvement from both healthcare workers and family networks throughout pregnancy. Such integrated measures are expected to optimize program efficiency in preventing and mitigating maternal Chronic Energy Deficiency.

Limitations and Future Directions

Several methodological constraints must be noted when interpreting these findings. First, adopting a pre-experimental framework without a control group restricted the capacity to fully isolate confounding variables that might have influenced maternal nutritional gains. Second, conducting the study within a single health center using a relatively small sample size and a short intervention window limits the external validity of the overall findings.

Accordingly, future investigations should consider experimental or quasi-experimental methodologies incorporating control groups to establish more robust evidence regarding PMT efficacy. Expanding sample sizes across multiple primary care facilities and extending the post-intervention observation period will improve external validity. Furthermore, subsequent research should evaluate additional factors—such as daily dietary intake, PMT consumption compliance, household socioeconomic status, physical activity, and birth outcomes to offer a more holistic understanding of determinants governing supplementary feeding success among pregnant women with CED.

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