Parental Misperceptions on Child Nutrition in India*

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November 14, 2025

Abstract

Nearly half of all children under age five in India are undernourished, yet parents often fail to recognize malnutrition in their children. I examine a potential explanation using a field experiment with 1,527 mother–child pairs in the state of Telangana. I show that parents frequently *normalize* malnutrition, benchmarking growth against local peers rather than global standards. While nearly 40% of children were stunted at baseline, 84% of their mothers described their height as "normal" or "tall", with misclassification especially pronounced in high-malnutrition communities. Randomly selected mothers received personalized feedback on their child's growth percentiles based on WHO standards, along with height and weight reference values at different percentile ranks to recalibrate benchmarks for healthy growth. The intervention shifted beliefs, raised growth aspirations, and improved child diets. Within six months, treated children gained 0.10–0.19 standard deviations in anthropometric z-scores, with a 13–35% reduction in malnutrition rates. Treatment effects were strongest for undernourished children in high-malnutrition areas—precisely where peers are shortest and misperceptions largest. These findings highlight distorted parental beliefs arising from downward-biased local growth norms as a key barrier to nutrition investment and show that targeted belief-correction offers a scalable and highly cost-effective approach to meaningfully improve child health.

*I am deeply grateful to my advisors, Jeffrey Weaver, Vittorio Bassi, John Strauss, and Matthew Kahn, for their invaluable guidance and support throughout this project. I also thank Augustin Bergeron, Silvia Barcellos, Neeraj Sood, Daniel Bennett, Paulina Oliva, Zachary Wagner, Simon Quach, Joseph Cummins, Robert Metcalfe, S. K. Ritadhi, Simone Schaner, Meera Mahadevan, Sumeet Patil, Rasmi Avula, Shilpa Aggarwal, Sabareesh Ramachandran, and Deivy Houeix, for immensely helpful comments and discussions. I am grateful to Jagadish Krishnappa, Sivaprasad Narra, Sridevi Harathi, and my outstanding field team of nearly 50 people at Median, for their exceptional effort in survey implementation and data collection. This study would not have been possible without the collaboration and support of officials from the Department of Women Development and Child Welfare (DWDCW), Government of Telangana, particularly Divya Devarajan IAS, Nirmala Kanthi Wesley IAS, Shivalkar Reddy, Narasimha Rao, Pradeep Kumar, Ravi Nunna, and colleagues at TG Foods. I am especially thankful to A. R. Anuradha IPS, former Principal Secretary, WD&CW Department, Government of Andhra Pradesh, whose encouragement and introductions to officials in Telangana were instrumental in making this collaboration possible. I appreciate the support of Gurman Bhatia, Divya Ribeiro, and Rashi Shah at Revisual Labs for their excellent work in developing visual aids for this study. I gratefully acknowledge funding from the Center for Effective Global Action (CEGA) through the Spring 2024 Development Economics Challenge, and from the Weiss Fund for Research in Development Economics (2024). This study has human subjects approval from the University of Southern California IRB (UP-24-00580) and is pre-registered with the AEA (ID: 0011806). All errors are my own.

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1 Introduction

Beliefs play a central role in shaping household decisions, and inaccurate beliefs can lead to suboptimal choices across various settings. This raises a key question: *how are beliefs formed, and under what conditions do they give rise to systematic misperceptions?* Existing work largely focuses on misperceptions that arise from unobserved information about others (e.g., Bursztyn and Yang (2022)) or from gaps in knowledge, where relevant information is difficult to access or understand (e.g., Jensen (2010), Fitzsimons et al. (2016), Dizon-Ross (2019)). However, misperceptions may also emerge because individuals form beliefs based on peers around them, who may not be representative of the broader population. Failing to account for this selection can bias self-perceptions and ultimately distort choices.

I study this mechanism in the critical context of child malnutrition in India. Nearly half of all children under age five in India are malnourished (IIPS and ICF (2021)), yet parents often fail to recognize malnutrition in their children. For instance, in my study setting, 84% of mothers of stunted children[1] described their height as "normal" or "tall". This could be explained by parents evaluating their children's growth relative to local peers, rather than against global standards. In high-malnutrition settings, local reference points for growth may be systematically downward-biased, causing parents to overestimate their child's nutritional status, set low benchmarks for "ideal" growth, and fail to recognize nutritional deficits. Left uncorrected, such misperceptions can suppress demand for improved nutrition and sustain a self-reinforcing low-nutrition equilibrium where widespread malnutrition becomes *normalized* and parents see little need for additional nutritional investment.

This paper investigates this channel and provides causal evidence on how reference-dependent beliefs about child nutrition shape parental investment decisions, and whether correcting these beliefs can shift behaviors and growth outcomes. I conducted an individual-level field experiment with 1,527 mother–child pairs across 168 government childcare centers (Anganwadi Centers, AWCs) in the Indian state of Telangana. Eligible children were 7–24 months old at baseline, an age when growth faltering is acute (Behrman (2015)). Randomly selected mothers received personalized feedback on their child's growth percentiles relative to WHO growth standards, along with reference values for height and weight at different percentile ranks based on WHO standards to recalibrate benchmarks for "normal" growth.

The intervention substantially reduced misperceptions, improved feeding practices and utilization of nutrition services, and led to measurable gains in child growth, reducing malnutrition rates by 10–25% within six months. Heterogeneity analyses provide key causal evidence on the reference-point mechanism: it is precisely where misperceptions were largest and peers shortest that information had the biggest impact.

[1] Stunting is defined as a height-for-age z-score below −2 standard deviations from the WHO Child Growth Standards median, indicating chronic undernutrition.

Telangana provides an especially relevant setting for studying belief formation in nutrition. It has a population of about 40 million—roughly the size of Uganda—and faces child malnutrition rates comparable to many countries in Sub-Saharan Africa despite considerably higher income levels. 33.1% of children under age five in the state are stunted, 31.8% are underweight, and 21.7% are wasted[2]. Diet quality is especially poor: only 9.2% of children aged 6–23 months receive an adequate diet, and diets remain heavily cereal-based with limited protein intake[2]. The government provides generous supplementary nutrition through AWCs, including 16 eggs and a 2.5-kilogram packet of *Balamrutham* (a fortified, ready-to-eat therapeutic food) each month, providing roughly 40% of the recommended calorie intake and the full monthly protein requirement for a 16- to 20-month-old child. While nearly all mothers reported receiving these rations at baseline, fewer than half said their child regularly consumed them—pointing to demand-side, rather than supply-side, constraints.

Government administrative growth monitoring records from the Department of Women Development and Child Welfare were used as the sampling frame, providing detailed monthly information on child growth outcomes at the AWC-level. Centers were classified into "high-nutrition" and "low-nutrition" groups based on average child anthropometric z-scores, allowing me to examine how beliefs and treatment effects vary across different nutrition environments. Within each center, children were randomly assigned to control and treatment groups, stratified by sex and malnutrition status.

The baseline survey was implemented in September–October 2024. The information was delivered immediately after the baseline survey, with reinforcement messages sent via Whatsapp three months later. Endline data were collected six months after baseline, allowing for analysis of short-run impacts on outcomes across three domains: (i) parental beliefs, (ii) feeding practices and nutritional investments, and (iii) child growth and health.

Baseline data show large distortions in parental beliefs. On average, mothers believed their children were at the 47th percentile for height and 37th for weight, when true values were 14 and 13, respectively. They reported nearly identical rankings between global and local comparisons, implicitly viewing local children as representative of children worldwide. Perceived percentiles more closely tracked true values in local comparisons. Mothers' perceptions of "ideal" height was well below global norms, corresponding to an average height-for-age z-score of -1.83. Despite 38% of the children being stunted, 84% of mothers described their height as "normal" or "tall", and 74% believed their child was of average or above-average height.

Importantly, these misperceptions were not random. They were systematically larger in villages where the average child was shorter. Mothers in low-nutrition centers held more optimistic views of their children's growth, reported lower benchmarks for ideal height, and

[2]National Family Health Survey (NFHS-5, 2019–20). (IIPS and ICF, 2021)

were more likely to describe malnourished children as normal. A one standard deviation increase in mean AWC HAZ is associated with an 8.7-point smaller gap between perceived and true percentiles—evidence consistent with local reference bias. In centers with the lowest average nutrition levels, reported ideal height even fell below the stunting threshold of –2 HAZ. This highlights the key paradox: parents in areas with the highest malnutrition rates are also the least likely to recognize it.

The intervention shifted beliefs and improved feeding practices. In the treatment group, the gap between perceived and true percentiles narrowed sharply—by nearly 30 points (height) and 22 points (weight). Mothers raised their aspirations: reported ideal height increased by 1.92 SD (WHO height-for-age z-score). Recognition of malnutrition increased by about 63 percentage points (pp), roughly a four-fold improvement among stunted children. While these changes are substantial, belief updating alone need not guarantee dietary improvement: intra-household bargaining dynamics and tight household budgets could constrain the translation of corrected beliefs into higher nutritional intake.

In this setting, however, these belief shifts translated into meaningful dietary improvements. Mothers in the treatment group reported greater diet adequacy, increased protein consumption, and higher utilization of government supplementary food. They also displayed a stronger revealed preference for nutritional quality: their willingness to pay for protein-rich foods, elicited using an incentivized multiple price list strategy, nearly doubled.

Treated children consumed 5.6 grams more protein (a 71% increase), as measured using a 24-hour diet recall module; monthly recall data corroborate these patterns, indicating sustained increases in consumption. This was driven by higher consumption of government-provided Balamrutham and eggs, rather than an increase in total household food expenditures. Mothers' weight and meal frequency were unaffected, and treatment effects on diet indicators were similar for children with and without siblings, suggesting that the improvements were not driven by diverting food away from mothers or other children. The additional consumption likely reflects reduced wastage of Balamrutham and a modest reallocation of eggs from adults to children—changes that imply only negligible reductions in adult diets but large nutritional gains for children in terms of protein and calorie shares.

Finally, and most importantly, belief and behavior shifts produced measurable improvements in child growth within the six-month follow-up period. Treated children gained 0.08 SD in height-for-age z-scores (HAZ) ($p < 0.1$), 0.15 SD in weight-for-age z-scores (WAZ), and 0.14 SD in weight-for-height z-scores (WHZ) ($p < 0.01$). The fraction of underweight children fell by 6 pp (a 25% reduction). Stunting and wasting rates were also 10% and 22% lower, though not statistically significant at conventional levels. Impacts were concentrated among the most undernourished children at baseline, with the largest gains in height and weight observed in the lowest quintiles of the distributions.

To test for complementarities—specifically, whether providing richer nutrition advice adds anything beyond reference-point feedback—I included a second treatment arm that augmented percentile feedback with information targeting complementary misperceptions about the returns to early-life nutrition and the effectiveness of different foods in promoting child growth. This additional information improved mothers' knowledge and produced somewhat larger and more precisely estimated effects on child diets and growth, but did not generate statistically significant gains beyond those from percentile feedback alone, suggesting limited complementarities. The similar magnitudes of effect sizes in the two treatment arms suggest that most of the behavioral response operates through the correction of distorted reference points—that is, by closing the gap between parents' perceived and actual assessments of their child's nutritional status—rather than through changes in perceived returns or nutrition knowledge.

To further examine mechanisms, I examine heterogeneity in pooled treatment effects along three dimensions. First, I compare mothers with high versus low baseline misperceptions, defined in terms of the gap between perceived and true height percentiles. Second, I exploit variation in the average nutritional environment across AWCs, comparing outcomes for children in high- versus low-nutrition centers based on mean baseline child HAZ. Finally, I examine malnourished children specifically, comparing those in high- versus low-nutrition centers. These heterogeneity results provide the key causal evidence on the reference-point mechanism: *it is precisely where peers were shortest and misperceptions largest that information had the biggest impacts*, suggesting that belief distortions were a binding constraint on nutrition investment.

Pooled across the two treatment arms, the intervention increased anthropometric z-scores by 0.10-0.19 SD, alongside a 13–35% reduction in malnutrition rates. The magnitudes of these effects are striking, with belief correction alone producing improvements in child growth comparable to those achieved by far more resource-intensive nutrition supplementation and cash transfer programs (e.g., Ahmed et al. (2025)). Using a costing exercise based on the J-PAL ingredients method, I estimate a total program cost of about USD $12.20 per child, but this would fall below USD $1 if scaled and integrated into existing public programs. With an estimated cost of USD 116 per 1 SD improvement in HAZ and USD 226 per stunting case averted, it is far more cost-effective than typical nutrition and cash transfer interventions (∼USD 900-8,000 per case). Because belief distortions are most severe in the poorest growth environments and among the most malnourished children, it is also inherently progressive.

Using NFHS-5 microdata and these treatment estimates, a back-of-the-envelope calculation suggests that a national-scale belief-correction intervention could close roughly 8% of India's national height deficit among children under age three relative to healthy reference children, and 13% and 22% of the national deficits in weight-for-age and weight-for-height, respectively. A more conservative approach targeting roll-out only in low-nutrition areas—where roughly two-thirds of India's under-three children live—could still close 5-15%

of these gaps.

This paper contributes to three strands of literature. First, it contributes to the growing literature on how beliefs shape household decisions, particularly in human capital investment (Fitzsimons et al. (2016), Jensen (2010), Dizon-Ross (2019), Madajewicz et al. (2007)) and more broadly to evidence on how information and social-comparison nudges influence behavior (Bursztyn et al. (2020), Costa and Kahn (2013)). While most prior work has focused on misperceptions arising from inaccessible or costly-to-acquire information, this study instead highlights how the *source* of information—specifically *who* individuals get information signals from—can itself generate systematic misperceptions. Local environments which do not provide representative information can generate belief distortions in ways consistent with a "frog-pond" effect. While the frog-pond mechanism has been explored mainly in education (Marsh (1987), Kinsler and Pavan (2021), Elsner and Isphording (2017)), this study provides a novel application to health and nutrition, and, by leveraging experimental variation, provides stronger causal identification of the reference-point mechanism than prior observational and quasi-experimental studies.

To my knowledge, this is the first study to document how parents form implicit benchmarks for what constitutes "ideal" or "normal" child growth based on local references, and parental perceptions on how malnutrition in childhood affects later-life outcomes. Although a wide literature has long documented the effects of early-life nutrition on health, education, and earnings[3], there is little evidence on what parents themselves believe about these returns. This paper provides new empirical evidence on belief formation, complementing the primarily theoretical insights of Wang et al. (2024), who model reference-dependent preferences in nutritional choices but do not directly measure parental beliefs. In doing so, it adds to a broader literature that underscores the need for structural models of human capital investment to explicitly incorporate belief formation (e.g., Cunha et al. (2013)), since frameworks focused only on income, access, or environmental constraints risk missing a central mechanism driving household underinvestment.

Second, it contributes to research on interventions to improve child nutrition by introducing a novel information-based approach that differs from standard behavior change and growth monitoring programs (Fink et al. (2017), Taylor et al. (2023), Ashworth et al. (2008), Premand and Barry (2022), Lassi et al. (2020), Menon et al. (2016)). While most behavior change interventions emphasize *what to do*—such as exclusive breastfeeding or complementary feeding—this study focuses on *why to do it*, delivering information in a form that is easily interpretable and salient for parents. It provides a continuous measure of growth, helps set incremental and attainable goals (e.g., moving from the 5th to the 10th percentile), and

[3]See for example: Strauss and Thomas (2007), Alderman et al. (2006), Hoddinott et al. (2008), Hoddinott et al. (2013), Maluccio et al. (2009), Glewwe et al. (2001), Galasso and Wagstaff (2019), Case and Paxson (2008), Deshpande and Ramachandran (2022), Victora et al. (2008)

motivates greater nutritional investment even for children above conventional malnutrition thresholds, who are often overlooked under binary classifications. Importantly, it offers a scalable and low-cost complement to existing programs, delivering comparable gains in child growth at a fraction of the cost of traditional supplementation or cash-transfer interventions.

Third, the paper offers a new perspective on what is often called the "Indian nutrition puzzle". Two empirical patterns make this puzzle especially stark: children in India are, on average, shorter than children in many poorer African countries, and increases in income or GDP per capita have translated only weakly, if at all, into improvements in child height[4]. Prior explanations have emphasized factors like sanitation, first child and son preference, social identity and caste, and historical scarcity (Spears (2013), Spears et al. (2019), Jayachandran and Pande (2017), Chambers and Von Medeazza (2013), Deshpande and Ramachandran (2024), Coffey et al. (2019), Luke et al. (2021)). This study highlights a complementary behavioral mechanism, offering a belief-based explanation for why rising incomes, improved sanitation, and expanded nutrition services have not translated into proportional gains in child growth.

Beyond its academic contributions, this study offers direct policy relevance. India, and many other low- and middle-income countries, already operate large-scale public nutrition programs providing free food and growth monitoring services, yet malnutrition rates remain high. The findings suggest that demand-side constraints, rooted in parental misperceptions of child growth, may mute the impact of these programs. Embedding belief-correction into frontline nutrition platforms could offer a scalable and cost-effective approach to strengthen demand for improved nutrition, increase utilization of existing services, and ultimately improve child health.

The rest of the paper proceeds as follows. Section 2 presents the conceptual framework. Section 3 describes the experimental design, data, and measurement. Section 4 reports the main results. Section 6 analyzes the cost-effectiveness of the intervention and benchmarks it against other nutrition programs. Section 5 presents results on heterogeneity and mechanisms. Section 7 concludes.

2 Conceptual Framework

In this section, I introduce a simple model of parental decision-making on child nutrition, building on frameworks of reference-dependent preferences (Wang et al., 2024), misperceived health production function (Fitzsimons et al., 2016), and misperceived returns to human capital (Jensen, 2010).

Parents face a fundamental choice problem: how much to allocate household resources toward child nutrition versus competing demands on adult consumption and other expen-

[4] See for example: Deaton and Drèze (2009), Jayachandran and Pande (2017)

ditures. When parents make choices about investments, they do so not only based on constraints of income and access, but also on perceptions of their child's current status, the expected returns to further investment, and the production function linking specific nutrition inputs to outcomes. Distortions in any of these beliefs can shift demand for nutrition downward, even when resources are sufficient and nutritious foods are accessible.

2.1 Parental Beliefs and the Choice Problem

Parents allocate household income across adult consumption A, and two child nutrition inputs C_1 and C_2.

Let C_1 denote high-protein, high-nutrient foods such as eggs, meat, or pulses, and C_2 denote staples such as rice or bananas. Child health, proxied by height-for-age H, is produced according to the true health production function:

$$H = C_1^{\delta} C_2^{\theta} \quad with\ \delta > \theta$$

where protein-rich foods (C_1) have higher marginal returns than staples (C_2) (Fitzsimons et al., 2016)[5]. Parents derive utility from current adult consumption A, their child's immediate health H, and the child's future outcomes W, such as schooling or earnings, which depend positively on health:

$$W = aH^{\phi}$$

Additionally, parents may care about their child's health relative to an "ideal" benchmark H^* (Wang et al., 2024). Falling below this benchmark generates disutility, either because parents internalize social comparisons or because they aspire for their children to reach what they view as "normal" growth.

The household utility function is given by:

$$U = A^{\alpha}[H^{\gamma} + \lambda W^{\rho} - \psi. \max(0, H^* - H - \epsilon)^{\eta}]$$

where $\alpha, \gamma, \lambda, \rho, \psi, \epsilon, \eta$ are preference parameters, as follows:

- α: weight on adult consumption
- γ: weight on child health (direct value)
- λ, ρ: strength and curvature of future wage utility

[5]Experimental evidence from the INCAP study in Guatemala shows that children receiving a protein-rich supplement experienced large and lasting gains in height and human capital relative to those receiving a low-protein drink (Martorell (1995)). Consistent patterns are found elsewhere, with animal-source and pulse-based foods yielding greater growth returns than calorie-equivalent staples (e.g., Headey et al. (2017)).

- ϵ: tolerance threshold (small deviations from ideal health benchmark ignored)
- ψ, η: weight on disutility from deviation falling below ideal health benchmark and penalty curvature

subject to the household budget constraint:

$$Y = p_A A + p_1 C_1 + p_2 C_2$$

This structure reflects that: (i) parents value child health intrinsically, (ii) they value future returns to child health through education or labor market outcomes, and (iii) they are motivated by comparisons to an "ideal" standard of growth.

2.2 Three Dimensions of Misperceptions

Parents may have distorted beliefs along three dimensions:

1. Reference-point misperception. Parents set an "ideal" growth benchmark H^* by comparing their child's height to that of other children they routinely observe around them. In practice, this benchmark reflects the local average H_{AWC} within the Anganwadi center. In high-malnutrition settings, where average height-for-age is well below global standards, H^* is systematically downward-biased. As a result, children who are objectively stunted relative to WHO references may still be seen as "healthy enough".

2. Misperceived long-run returns. Parents may underestimate the extent to which early-life nutrition affects future outcomes such as schooling, adult earnings, and later-life health conditions. Formally, if true wages are $W = aH^{\phi}$, parents perceive $\phi^p < \phi$. With lower perceived long-run returns, they discount the benefits of today's nutritional investments.

3. Misperceived health production technology. Parents may also underestimate the return to protein-rich foods, believing that staples are equally or more effective for growth. This can be represented as $\delta^p \leq \delta$ and $\theta^p \geq \theta$. Misperceptions of this form induce misallocation—overinvestment in C_2 and underinvestment in C_1—even when budgets permit higher protein consumption.

The utility function reflecting these misperceptions then becomes:

$$U = A^{\alpha}[(H^p)^{\gamma} + \lambda(a(H^p)^{\phi^p})^{\rho} - \psi. \max(0, H^* - H^p - \epsilon)^{\eta}]$$

with $H^* = H_{AWC}$ and perceived health, $H^p = C_1^{\delta^p} C_2^{\theta^p}$

Parents choose allocations of C_1, C_2, and adult consumption A to maximize a utility function that places weight on current consumption, child health, and (perceived) future child outcomes. Critically, the utility specification includes a disutility term for falling short of the reference point H^*. This creates a kinked behavioral response, where only large enough perceived gaps between ideal and perceived health trigger behavioral change. When perceived health H_p exceeds or is close enough to this local benchmark, parents see no need to adjust behavior. When it falls below, they may respond—though their adjustments may be constrained by distorted beliefs on the returns to C_1 and the long-run returns to health on economic outcomes.

2.3 Misperceptions and Low-Nutrition Equilibria

Define the marginal value of perceived health, κ, as the multiplier on the marginal product of nutrition inputs $\partial H^p / \partial C_j$, with $j = \{1, 2\}$; ($\kappa \equiv dV(H^p)/dH^p$):

$$\kappa(H^p, H^*, \phi^p) \equiv \underbrace{\gamma\,(H^p)^{\gamma-1}}_{\text{direct value}} + \underbrace{\lambda\,\rho\,a^\rho\,\phi^p\,(H^p)^{\rho\phi^p-1}}_{\text{long-run return}} + \underbrace{\psi\,\eta\,\mathbf{1}\{H^p < H^* - \epsilon\}\,(H^* - H^p - \epsilon)^{\eta-1}}_{\text{reference shortfall}}.$$

When perceived health H^p falls below the reference benchmark H^*, the shortfall term is active and κ is strictly larger. This raises the marginal utility of improving health.

In high-malnutrition settings, however, the benchmark H^* itself is low because it is set relative to local averages. When the community reference point is downward-biased, most children are seen as "close enough" to normal. The shortfall penalty is rarely triggered, κ remains small, and incentives to invest in better diets are muted. Complementary misperceptions—undervaluing nutritious foods or long-run returns—further dampen demand for nutritional improvement.

Together, these misperceptions can generate an endogenous "low-nutrition equilibrium": low benchmarks keep perceived health gaps small, which in turn sustains underinvestment and low child growth. Parents conclude that their children are healthy enough, even if they are malnourished by international standards. As a result, children continue to receive inadequate diets, reinforcing the low local average. Over time, this feedback loop makes malnutrition appear "normal", stabilizing a self-reinforcing equilibrium with persistently low child health.

Information interventions can break this cycle by shifting perceptions. When information raises benchmarks for healthy growth, parents perceive a larger gap between their child's current and ideal status, increasing demand for nutritional inputs. When parents learn about nutrition technology, they may substitute toward nutrient- and protein-rich foods. And when they understand the long-run consequences of malnutrition, they may assign greater value to investing in early-life nutrition. Together, these shifts in beliefs can raise household investments in child nutrition, and over time, improve community averages, reset norms, and help break out of the low-nutrition trap. Absent such corrections, the equilibrium remains stuck at low levels of H, sustained by biased perceptions.

2.4 Testable Predictions

The theoretical framework above delivers concrete, testable predictions about how distorted beliefs shape parental investments in child nutrition. In particular, the model emphasizes the role of downward-biased reference points in suppressing the perceived marginal value of health, thereby muting parental demand for nutrition inputs. Two central predictions emerge.

Prediction 1. *Belief distortions vary systematically with the local nutrition environment.* In high-malnutrition communities where the local reference point H^* is relatively low, the shortfall penalty term in the marginal utility function rarely activates, keeping the perceived marginal value of health low. Accordingly, in "low-nutrition" AWCs—where local averages are farthest below WHO standards—parental misperceptions will be most severe.

Estimation. To test this prediction, I compare mothers' baseline beliefs across AWCs with high and low average child HAZ. If belief distortions are systematically tied to local benchmarks, we should observe that mothers in AWCs where children are shorter on average report higher perceived percentiles for their children, conditional on true WHO-referenced percentiles. A positive bias in beliefs that covaries with the local nutrition environment would be evidence consistent with the model.

Prediction 2. *Information treatments should have stronger effects for mothers with larger baseline misperceptions.* The model predicts that providing accurate percentile feedback effectively increases the gap between H^* and H^p, activating the shortfall penalty term in κ and increasing the perceived marginal value of health. Mothers who initially overestimated their child's status by the greatest margin should therefore show the largest treatment responses, as the intervention most strongly shifts their perceived benchmark relative to their child's true health.

Estimation. To test this prediction, I exploit experimental variation in the provision of percentile-based feedback. I estimate heterogeneous treatment effects by baseline misperceptions—measured as the gap between a child's true WHO-referenced percentile and the mother's perceived percentile. A positive gradient of treatment effects with respect to this misperception gap would confirm the model's prediction that beliefs constrain parental investment.

Identification Note. Without experimental variation, heterogeneous responses by baseline misperceptions could simply reflect omitted variables. For instance, mothers who overestimate their child's status might differ in unobserved traits such as optimism or preferences, which could also drive different responses to new information. The experiment resolves this concern by exogenously shifting mothers' benchmarks, holding constant all other determinants of investment. If heterogeneous effects by baseline misperceptions are observed, this can only occur because information moved mothers closer to or further from the true WHO benchmark, consistent with the theoretical mechanism. In other words, treatment heterogeneity provides a causal test that distorted beliefs constrain behavior, rather than merely correlating with unobserved preferences.

The remainder of the paper presents empirical evidence on parental belief distortions and tests these predictions, leveraging a randomized experiment that generates exogenous variation in beliefs along the three dimensions described above.

3 Methods

3.1 Setting

The study is set in Telangana, a southern Indian state with total estimated population of 38 million as of 2025, with 3.9 million children under the age of 6 years[6]. Child malnutrition rates are comparable to national averages. 33.1% of children under age 5 are stunted, 31.8% are underweight, and 21.7% are wasted. Child anemia is also high at 70.0%. Only 9.2% of children aged 6–23 months in Telangana receive an adequate diet, and diets remain heavily cereal-based with limited protein consumption (IIPS and ICF, 2021). Despite extensive sanitation expansion (a rise in toilet coverage from 52.3% in 2015–16 to 76.2% in 2019–20 (IIPS and ICF, 2021), and a 75.5% increase in per capita income between 2014-2024[7] (a compounded average annual growth rate of 5.8%), child malnutrition rates have remained persistently high.

[6] Telangana State Profile, Government of Telangana (2024)

[7] (Directorate of Economics and Statistics, Government of Telangana, 2024)

The sample is drawn from two districts: Asifabad and Mancherial. Asifabad is one of the districts with the highest child malnutrition rates in Telangana[8], while the neighboring district of Mancherial has more moderate levels of malnutrition[9].

3.1.1 The Integrated Child Development Services Program

Telangana implements the Indian government's Integrated Child Development Services (ICDS) program through a network of 35,700 Anganwadi centers (AWCs), which collectively serve about 1.8 million children under six across the state. Each AWC is staffed by an Anganwadi worker (AWW), who is responsible for growth monitoring of children and delivering supplementary nutrition services, as well as related health and early childhood education services. For children under age 3, the government provides 16 eggs and a 2.5-kilogram packet of a ready-to-eat protein-fortified therapeutic food called Balamrutham every month as take-home ration. This is a substantial monthly transfer, equivalent to 11,470 kilocalories and 371 grams of protein, providing roughly 40% of the recommended calorie intake and the full monthly protein requirement for a 16- to 20-month-old child. However, consumption remains a challenge: prior work documents low and irregular take-up of ICDS services across India (Trivedi (2023), Abraham and Fraker (2014), Malik (2016)). Consistent with this, baseline self-reports from my study setting indicate that fewer than half of the children regularly consumed the provided rations.

3.2 Sampling

3.2.1 Sampling Frame and AWC Selection

The sampling frame was constructed from August 2024 administrative growth monitoring records in the two largest mandals (sub-districts) of each district. To ensure that children would be within the eligible age range at baseline, the sampling frame was restricted to children who would be 7–24 months old by September 2024. Children with missing anthropometric z-scores were excluded. In addition, children with HAZ, WAZ, and WHZ all above zero (the WHO reference median) were dropped (approximately 6% of the sampling frame), as the interventions were designed to target children at lower nutrition levels. Then, AWCs with fewer than 10 eligible children were excluded to ensure sufficient sample size per center.

The remaining AWCs were stratified into "low-nutrition" and "high-nutrition" groups based on whether their average child height- and weight-for-age z-scores fell below or above

[8] According to the 2023 KPI survey (independent survey commissioned by the Government of Telangana), 58.1% of children in Asifabad were stunted, 41.4% underweight, and 16.7% wasted. These data are not publicly available and were obtained from the Department of Women Development and Child Welfare, Telangana.

[9] According to the same 2023 KPI survey, 33.9% of children in Mancherial were stunted, 22.8% underweight, and 16.8% wasted.

the median. Within each stratus, 75 AWCs were randomly selected, with an additional 10 sampled as "buffer" centers in case of shortfalls due to unavailability of respondents during the survey dates or ineligibility/exclusions. The 170 total sampled AWCs were randomly assigned to high treatment intensity (118 centers) or low treatment intensity (52 centers). The final analysis sample includes respondents from 168 AWCs, evenly split between 84 low-nutrition and 84 high-nutrition centers.

3.2.2 Sampling of Children within AWCs

Within each selected AWC, I sampled 10 children, stratifying by child sex and malnutrition status, and randomly assigned them to one of the three treatment arms. In high-intensity AWCs, approximately 75% of sampled children were assigned to one of the two treatment arms; in low-intensity AWCs, approximately 40% were assigned to treatment, with the remainder assigned to the control group.

To account for potential non-availability during survey days, a list of replacement children was also drawn for each AWC, matched by sex, malnutrition status, and the closest height-for-age z-score. If an originally sampled child was unavailable, he or she was replaced from this list, retaining the same treatment assignment. This procedure ensured that the replacement process preserved both the original stratification and randomization.

3.2.3 Final Sample and Participation

The final study sample comprises 1,527 mother–child dyads across 168 AWCs, with 504 assigned to Treatment 1, 506 to Treatment 2, and 517 to Control. At baseline, 1,533 respondents were interviewed; 1,527 were successfully followed at endline, yielding an attrition rate of less than 1%. Attrition did not differ by treatment status. Approximately 13% of the baseline sample consisted of replacement children[10].

3.3 Experimental Design

Figure 1 presents the experimental design and the final sample sizes. This study employs an individual-level randomized controlled trial to causally identify the effects of correcting parental misperceptions about child nutrition. The central focus is on the role of reference-point distortions, which arise when parents in high-malnutrition settings compare their child's growth to downward-biased local norms, leading to overestimation of nutritional

[10]Replacements were used when originally sampled respondents were unavailable during survey days (9.4%), declined consent (1.2%), the child was outside the required 7–24 month age range (1.0%), the child had chronic medical conditions or special needs (0.3%), or the respondent did not understand the Telugu language (0.9%). Replacement children were matched by sex and closest HAZ from a pre-specified reserve list, maintaining stratification and treatment assignment.

status and underinvestment in improved diets. The primary intervention, Treatment 1 (T1), directly targets these distortions.

While the main focus of the experiment is the effect of T1, the second treatment arm (T2) was included to examine two additional belief channels—misperceptions about the returns to protein-rich foods and about the long-term consequences of early-life malnutrition—to understand how reference-dependent misperceptions interact with these other distortions to shape household investment decisions. This second arm is used later in the analysis to disentangle whether observed behavioral responses arise primarily from reference-point correction or from changes in broader nutrition beliefs.

Randomization was conducted at the level of the child within Anganwadi centers (AWCs), the local administrative unit for child nutrition services. Individual-level assignment was chosen over cluster randomization to maximize statistical power, as spillovers were expected to be minimal: information was delivered privately to mothers in their homes, and the core reference-point feedback was personalized to each child. As an additional check for potential spillovers, treatment intensity was varied experimentally at the AWC level, with some centers assigned a higher proportion of treated children. This design allows for the estimation of individual-level treatment effects, while also providing flexibility to examine whether information given to a subset of mothers within an AWC influences the beliefs and behaviors of others[11].

3.3.1 The Interventions

The interventions were designed to causally identify the effects of correcting parental misperceptions about child nutrition. The primary focus is on reference-point misperceptions—if parents misperceive their child's relative nutritional status comparing against locally short peers rather than objective standards, they may underestimate growth shortfalls and underinvest in high-nutrient foods. The primary intervention, Treatment 1 (belief-correction), directly targets this channel by providing clear, personalized feedback that re-anchors parents' perceptions to global benchmarks of healthy child development. The second arm, Treatment 2 (knowledge), extends this design to probe additional mechanisms—whether providing information on the health returns to protein-rich foods and the long-run consequences of malnutrition further reinforces behavioral change.

Treatment Arm 1: Belief-Correction Intervention

T1 was designed to highlight gaps between perceived and actual child growth and to shift parental benchmarks for healthy child development, by raising mothers' reference points for

[11] I do not observe consistent evidence of spillover effects to control households. These results are presented in Appendix D.

growth (H^*) and increasing the perceived shortfall between the reference and perceived health levels ($H^* - H^p$).

Mothers were provided with personalized feedback on their child's height- and weight-for-age percentiles relative to WHO growth standards. Enumerators used picture cards (see Figure A5) to illustrate the child's true height- and weight-for-age percentile rank and compared it to the mother's perceived percentile ranks elicited earlier during the survey, emphasizing any over- or underestimation. They also provided reference values for height and weight at various percentile ranks (1st, 5th, 10th, 25th, 40th, 50th, 60th, 75th, 90th, and 100th) to help mothers contextualize their child's growth relative to healthy children globally, and to encourage them to form specific goals for their child's future growth. The script highlighted that child malnutrition in the study villages is higher than in other developed regions, making reference-point distortions salient by showing how comparisons only to local children can understate deficits in growth.

For ethical reasons, mothers also provided brief general advice: an overview of locally available protein-rich foods and encouragement to track child growth every month at the AWC. This information was given to avoid delivering "bad news" about a child's nutritional status without offering at least some minimal advice on how to improve it. This was highly general advice—comparable to what mothers could already obtain from Anganwadi workers—and was not intended as the main focus of the treatment. Nevertheless, as a robustness test, I examine whether treatment effects in T1 operate primarily through the reference-point channel or also partly through this additional advice.

Treatment Arm 2: Knowledge Intervention

T2 built on the reference-point intervention by providing mothers with more substantive information on the effectiveness of protein-rich foods in improving child growth, along with information on the long-term consequences of early-life malnutrition. By design, T2 was expected to shift mothers' reference points for growth (H^*), increase perceived returns to protein-rich foods (δ^p), and strengthen beliefs about the long-term returns to child nutrition (ϕ^p).

In addition to the T1 information, mothers in T2 were shown a five-minute animated video that contrasted the life trajectories of a well-nourished and a malnourished child (Figure A6). The video highlighted higher risks of mortality, impaired cognition, lower test scores, reduced schooling, diminished adult earnings, and elevated risk of cardiometabolic disease among malnourished children, drawing on global evidence including the INCAP study in Guatemala, the Young Lives and Cebu longitudinal surveys, and syntheses from review articles and the WHO[12].

[12]Sources: Pelletier et al. (1995), Kirolos et al. (2021), Maluccio et al. (2009), Hoddinott et al. (2013), Deshpande and Ramachandran (2022), Woldehanna et al. (2017), López Boo (2009), Spears (2012),

Enumerators were trained to guide mothers through the video content, explain key messages, and answer follow-up questions. Following the video, enumerators reiterated the importance of increasing children's intake of protein-rich foods—such as eggs, dairy, lentils, chickpeas, peanuts, Balamrutham, and meat—and explained how these are more effective at improving growth than staple foods like rice and wheat. Mothers were also offered practical, context-appropriate suggestions on how to improve feeding practices, such as introducing eggs or Balamrutham early in the day when a child's appetite is high and gradually increasing food thickness to improve calorie and nutrient density per serving.

Both interventions were delivered in-person to mothers by trained enumerators during home visits, using a structured script and standardized visual materials. All intervention materials were pre-tested during a pilot to ensure that the content was accessible and easily understood. The information treatments were delivered immediately after the baseline survey and lasted approximately 15–30 minutes.

Together, these two treatment arms allow me to estimate the causal impact of shifting mothers' reference points for child growth, and test whether supplemental information on the returns to protein-rich foods and the long-term consequences of malnutrition strengthens or alters these effects.

3.3.2 Experiment Timeline

The baseline survey was conducted between September-October 2024. For each household, the baseline survey, information treatment (for mothers in T1 and T2), and an incentivized willingness-to-pay exercise (described in the Outcomes section) were administered on the same day, with the data collection rolled out over 18 days across all the households. In January 2025, approximately three months after baseline, mothers in the treatment groups received a reinforcement message via WhatsApp summarizing the key content of the information interventions; for Treatment 2, the animated video was also shared digitally. The endline survey was conducted between March-April 2025, roughly six months after baseline. On average, the time between treatment delivery and endline measurement was ∼180 days, providing a short-run exposure window in which to detect changes in feeding practices and growth outcomes.

3.3.3 Outcomes and Measurement

I examine outcomes across three primary domains: (i) parental beliefs about child nutrition, (ii) feeding practices and nutritional investments, and (iii) child growth and health outcomes.

Galasso and Wagstaff (2019), Grey et al. (2021), WHO (b), WHO (a)

The full set of outcomes, and their construction details, are provided in the Appendix.

Beliefs. To measure parents' beliefs about their child's nutritional status, I compare mothers' perceived height- and weight-for-age percentiles with their child's true percentiles based on WHO growth standards. Belief elicitation was incentivized with small cash rewards to encourage truthful reporting: mothers received Rs. 30 (USD 0.34) if their percentile estimate was within ten points of the true value, and zero otherwise. This incentive structure was intended to reduce noise and minimize experimenter demand effects.

In addition, mothers were asked to use a measuring tape indicate what they considered the "ideal" height for their child's age; this reported height (in centimeters) was converted into a WHO height-for-age z-score based on the child's sex and age.

Beliefs about the long-term consequences of child malnutrition were measured using a knowledge index based on Likert-scale responses to questions on whether malnutrition before the age of 3 has any effects on (1) years of education, (2) school test scores, (3) likelihood of early death, (4) adult height, (5) likelihood of cardiometabolic diseases in adulthood, (6) and earnings in adulthood.

Finally, mothers' knowledge about the effectiveness of different foods for child growth was elicited using a vignette exercise in which picture cards of 11 foods were shown and mothers were asked to rank them in order of perceived effectiveness. From these rankings, I construct a dummy variable equal to one if the average rank of protein-rich foods is lower (i.e., perceived as more effective) than the average rank of staple foods.

Feeding practices and nutritional investments. Child feeding was measured using WHO indicators of dietary diversity, minimum meal frequency, and minimum diet adequacy, based on a detailed 24-hour diet recall module. This approach, standard in the nutrition literature, allows the construction of both binary indicators (e.g., minimum dietary diversity) and continuous measures (e.g., dietary diversity score, protein intake).

The survey recorded whether the child had consumed Balamrutham in the previous 24 hours and measured both the quantity consumed during the previous day (in standardized bowls) and over the past calendar month. The monthly measure for Balamrutham is calculated as a fraction of the 2.5 kg packet provided by the government to each child (grams = fraction x 2500g). Finally, the number of eggs consumed in the previous 24 hours and over the past month, was recorded, reflecting another key component of the government's supplementary food program.

To estimate total protein intake, quantities of broad food categories (e.g., pulses, meat) were measured using standardized bowls and converted into approximate grams of protein using nutritional guidelines from the National Institute of Nutrition. Because quantities were measured at the level of food groups rather than specific items (e.g., types of dal or meat), these protein estimates should be interpreted as rough approximations rather than precise measures of daily intake.

Finally, mothers' willingness-to-pay for protein-rich foods was elicited using an incentive-compatible multiple price list strategy with real stakes: mothers made binding choices between food bundles and randomly drawn cash amounts, with implementation determined by lottery. This design ensured that truthful reporting of preferences was the optimal strategy.

Child growth and health outcomes. Anthropometric outcomes include height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) z-scores, mid-upper arm circumference (MUAC), as well as binary indicators for stunting (HAZ $<$ –2), underweight (WAZ $<$ –2), and wasting (WHZ $<$ –2). These were measured directly during the baseline and endline surveys following WHO guidelines. Monthly height and weight data will also be collected from Anganwadi center administrative records for one year after the endline survey to capture longer-term growth changes.

Secondary outcomes. Secondary health outcomes include a binary indicator for any reported illness in the past 14 days, and a cognition z-score calculated from the Caregiver-Reported Early Development Instruments (CREDI) Short Form, which has been validated across diverse settings and is widely used in early childhood development research. The CREDI measure is based on mothers' reports of whether their child can perform a set of age-appropriate cognitive, motor, and socio-emotional tasks. Information on food and non-food expenditures in the past month was also collected at the household level, along with the share of monthly income devoted to food.

3.4 Empirical Strategy

To estimate the causal effects of the information interventions, I employ an analysis of covariance (ANCOVA) specification, the preferred approach in randomized controlled trials with baseline and endline data (McKenzie (2012)). The specification conditions on the baseline value of the outcome to improve precision.

The primary specification focuses on the belief-correction intervention (Treatment 1) and compares outcomes between mothers assigned to T1 and those in the control group:

$$Y_{i1} = \beta_0 + \beta_1 (T1)_i + \beta_2 Y_{i0} + \beta_3 \mathbf{X}_i + \epsilon_i \tag{1}$$

where Y_{i1} is the outcome for child i at endline, and Y_{i0} is the baseline measure of the same outcome. $(T1)_i$ is the indicator for assignment to Treatment Group 1. The coefficient β_1 captures the treatment effect of belief-correction relative to the control group. $\mathbf{X}_i$ is a vector of pre-specified control variables, including child characteristics (age dummies, sex, birth order, HAZ, WAZ, WHZ), mother characteristics (education, height), and household characteristics (caste category, household size, household poverty probability index)[13].

The primary specification presented in the paper uses standard errors clustered at the AWC level to allow for arbitrary within-AWC correlation in outcomes. Specifications with non-clustered robust standard errors (as pre-specified) are reported in the appendix and yield substantively identical estimates.

To examine whether the additional information provided in the knowledge intervention (Treatment 2) yields different effects, I also estimate a two-arm specification that includes both treatment indicators:

$$Y_{i1} = \beta_0 + \beta_1(T1)_i + \beta_2(T2)_i + \beta_3 Y_{i0} + \beta_4 \mathbf{X}_i + \epsilon_i \quad (2)$$

where β_1 identifies the effect of the belief-correction intervention, and β_2 identifies the combined effect of the belief-correction and knowledge interventions, each relative to the control group. The comparison of β_1 and β_2 serves as a mechanism test, assessing whether providing additional information on the returns to protein-rich foods and the long-term consequences of malnutrition amplifies the behavioral and growth responses induced by reference-point correction.

As a secondary approach, I also estimate a difference-in-differences (DID) model that exploits the panel structure of the data and compares changes in outcomes from baseline to endline across treatment and control groups. The DID estimates are presented in the appendix.

4 Results

4.1 Summary Statistics and Balance

Table A1 presents summary statistics for the full sample and tests for balance across the three experimental arms based on a range of pre-treatment characteristics. The sample comprises 1,527 mother-child dyads. The average child in the sample was 16 months old at baseline, approximately half are female, and mean birth order is 1.7. Mothers were, on average, 26 years old and had 11 years of education, with 78% having completed secondary education or higher. Households had an average of 5.2 members and a per capita monthly

[13] When HAZ, WAZ, or WHZ serve as dependent variables, the corresponding baseline z-score appears twice as regressors (once as Y_{i0} and once in the control vector $\mathbf{X}_i$). In these cases, the duplicate regressor is automatically omitted.

income of $54 USD. About 91% of the households had a toilet, and a majority belonged to Scheduled Castes (19%) or Other Backward Classes (62%).

Consistent with the targeting strategy, over half of the children in the sample were malnourished: mean height-for-age, weight-for-age, and weight-for-height z-scores were -1.66, -1.57, and -0.99 respectively, with 38% of children stunted, 33% underweight, and 21% wasted. 31% of the mothers had short stature (height below 150cm), a widely used marker of elevated child health risk.

Feeding indicators underscore the low quality of children's diets. Although children consume an average of 3.3 meals per day, fewer than half meet the WHO minimum diet diversity and adequacy criteria. Reported protein intake is modest, averaging 8.8 grams per day.

The treatment and control groups were well-balanced at baseline, with no systematic differences in beliefs about nutrition, child anthropometrics, feeding behaviors, or socioeconomic status across the three groups. Differences between treatment and control means are small and not statistically significant at conventional levels, with the exception of household size, which is slightly higher in Treatment 1 than in Treatment 2 ($p = 0.017$). The joint F-test of equality across all three groups across all measures yields p-values above 0.60, confirming that randomization produced balanced samples across a wide range of child, mother, household, and anthropometric characteristics.

4.2 Baseline Beliefs about Child Nutrition

Following the conceptual framework, I document mothers' baseline beliefs along three dimensions: (i) their child's nutritional status, (ii) the long-run consequences of malnutrition, and (iii) the relative effectiveness of different foods for promoting child growth. Table 1 presents a summary of these beliefs. Several patterns are immediately apparent, pointing to systematic distortions in how mothers perceive their children's growth arising from local reference points.

(i) Misperceptions of child nutritional status

First, mothers substantially overestimate their child's height and weight when benchmarked against WHO growth standards (Figure 2). On average, mothers believed that their child was at the 47th percentile for height and the 37th percentile for weight, relative to a reference group of healthy children of the same age and sex from around the world based on WHO growth reference study. These perceived percentiles are considerably higher than the true percentiles, which were, on average, 14 for height and 13 for weight. 90% of mothers overestimated their child's height-for-age percentile, and 87% overestimated their weight-for-age percentile.

When asked to compare their child to other children within their own sub-district (mandal), the magnitude of misperception was smaller: the average gap between perceived and true height-for-age percentiles dropped from 33 points (relative to WHO) to 13 points (relative to peers within mandal), and for weight, from 24 points to just 5 points. While mothers overestimate their child's height and weight percentiles even when using local reference groups, these results suggest that they are more accurate when evaluating their child's nutritional status relative to peers in their immediate environment than when making comparisons to global standards.

Second, mothers' perceptions of the reference group reveal an important distortion. The average difference between the percentiles reported by mothers relative to children in their mandal and relative to WHO standards is only 1.9 points for height and 2.3 points for weight, implying that mothers' reported rankings of their child are nearly identical regardless of the reference group. In other words, mothers' assessments of their child's relative standing are nearly identical regardless of whether they are asked to compare to local peers or to a global reference. This suggests that they implicitly view local children as broadly representative of children around the world. Figure 3 illustrates this. Strikingly, although the average child HAZ in the sampled villages was –1.42 (well below the WHO median), 61% of mothers believed that children in their village were about the same height or taller than children in developed countries such as the United States and the United Kingdom.

Third, mothers' perceptions of "ideal" height for their child's age were also anchored at low levels, well below global norms (Figure A2). On average, the reported ideal height translated to a HAZ of -1.83. These results suggest that benchmarks for healthy growth are systematically downward-biased.

Despite 38% of the children in the sample being stunted, 84% of the mothers classified their child's height as "normal" or "tall" (Figure 4), and 74% believed their child's height was "average" or "above average" compared to other children of the same age. Similarly, although 36% of children were underweight or wasted, 53% of mothers described their child's weight as "normal," and 56% believed it was "average" or "above average" relative to age-matched peers. Only 9% reported being "unsatisfied" with their child's current diet, further highlighting muted demand for nutritional improvement.

(ii) Misperceptions on the consequences of child malnutrition

Mothers' baseline beliefs also revealed limited knowledge about the long-term consequences of child malnutrition and weak perceived associations of height with health, educational, and economic outcomes (Figure A7). Only 17% of mothers believed that taller children generally complete more years of education than shorter children, and 15% believed that they perform better in school exams. Even fewer mothers associated adult height with labor market or health outcomes—only 11% believed that taller individuals earn higher wages, and 8% believed that taller individuals have a lower risk of cardiometabolic health conditions like heart disease, high blood pressure, obesity, and diabetes. Less than 40% of the mothers believed that child malnutrition before age 3 may have an effect on years of education (37%), test scores in high school (38%), or earnings in the labor market (34%), and only 12% believed it may have an effect on the likelihood of developing adverse health conditions in adulthood. These findings are consistent with the hypothesis that mothers may undervalue the long-term returns to child nutrition on education, labor market, and health outcomes.

(iii) Misperceptions of nutrition technology

Finally, when asked to rank different foods by their effectiveness in promoting child growth, less than half of the mothers (43%) ranked non-dairy protein-rich foods (eggs, meat and seafood, nuts and legumes) higher than staple foods (rice, millets, banana). A majority of mothers appear to underestimate the value of protein-rich foods and overestimate the effectiveness of staples.

Baseline beliefs were statistically similar across groups: no systematic differences appear in perceived percentiles, ideal height, concern about low growth, or knowledge about long-term consequences. Joint F-tests confirm overall balance.

Taken together, these findings establish that mothers in this setting substantially overestimate their children's growth relative to WHO standards, anchor their benchmarks for ideal growth at levels well below global norms, and underestimate both the long-run consequences of malnutrition and the relative effectiveness of protein-rich foods. These baseline misperceptions underscore the scope for the information interventions described above.

4.3 Local Reference Bias in Perceptions of Child Growth

Next, I examine whether mothers' beliefs about their children's growth are systematically related to their local growth environment. To capture variation in local child growth, I use the mean HAZ of children within each AWC. Since mothers regularly observe other children in their AWC, these peer comparisons may form an implicit benchmark for assessing what constitutes healthy growth.

Overall, I find that mothers in lower-nutrition environments hold systematically more optimistic beliefs about their own child's height and lower aspirations for growth. The first column in Figure 5 illustrates these patterns, plotting maternal beliefs against AWC mean HAZ. In Panel A, the negative slope of the linear fit line shows that the gap between mothers' perceived and true height-for-age percentiles is larger in centers where average child height is lower, indicating greater overestimation of their own child's nutritional status. Panel B shows that mothers in low-nutrition centers report more downward-biased perceptions of ideal height for their children. Panel C shows that mothers of stunted children are more likely to describe their child's height as "normal" or "tall" when local average HAZ is low.

Table 2 reports the regression estimates of the association between mothers' beliefs and AWC mean HAZ, with and without controls for child, mother, household, and AWC-level characteristics. Columns 1–2 examine the gap between perceived and true height percentiles. Across specifications, higher average HAZ in the AWC is strongly associated with smaller misperception gaps. In the fully controlled model (Column 2), a one standard deviation increase in AWC mean HAZ corresponds to an 8.7 point reduction in the height percentile gap ($p < 0.01$). This indicates that in environments where children are shorter on average, mothers' perceived percentiles are more misaligned with the children's true percentiles.

Columns 3–4 shift focus to mothers' perceptions of "ideal" height for their child's age. A one standard deviation increase in AWC mean HAZ is associated with an increase of roughly 0.55 SD in reported ideal height z-scores ($p < 0.05$). Mothers in higher-nutrition environments report higher ideal child height, even after controlling for child, maternal, household, and AWC-level characteristics. This finding reinforces the idea that local growth norms shape mothers' beliefs about what constitutes "ideal" height for a given age and what they consider a healthy target for growth.

Finally, Columns 5–6 focus on stunted children. Higher AWC mean HAZ is associated with a lower probability that a stunted child is perceived as "normal" or "tall". In the fully controlled model, a one standard deviation increase in local mean HAZ reduces this probability by 8.1 percentage points ($p < 0.1$). This suggests that in contexts where stunting is widespread, mothers are more likely to normalize it and less likely to recognize undernutrition in their own children.

Together, these results highlight the salience of local reference points in shaping maternal beliefs: in high-malnutrition settings, mothers systematically underestimate what healthy growth should look like, resulting in downward-biased ideals and smaller perceived gaps between current and target health. As a result, they are less likely to recognize undernutrition in their own children. When parents do not recognize deficits in their children's growth, their demand for improved nutrition may be reduced, lowering the likelihood that they adjust feeding practices or invest in dietary improvements. These findings provide direct evidence of the reference-point distortion hypothesized in the conceptual framework and establish the empirical foundation for testing whether information interventions that shift benchmarks for healthy growth can correct misperceptions and improve child growth outcomes.

4.4 Other Correlates of Parental Misperceptions

I next examine whether misperceptions vary systematically across child, mother, and household characteristics. Regression results (Appendix Table A2) and subgroup comparisons reveal some consistent patterns. Misperceptions are more pronounced for malnourished and older children. Mothers of stunted children had significantly larger gaps between believed and true height percentiles and reported lower benchmarks for ideal height. Similarly, mothers of children aged 16–24 months overestimated their child's percentiles by larger magnitudes and reported lower ideal height relative to mothers of younger children.

Gender differences also emerge, with stronger misperceptions for boys. By contrast, birth order shows no systematic association with misperceptions. Household socioeconomic characteristics (household size, per capita income, and PPI score) show weaker associations, though gaps between perceived and true percentiles were slightly larger among lower-SES households, while reported ideals for child height were somewhat higher in higher-SES households.

Finally, maternal education is positively associated with reported ideal height and broader knowledge outcomes. Both continuous years of schooling and secondary-school completion predict higher scores on the knowledge index about the long-term consequences of malnutrition, as well as a greater likelihood of ranking protein-rich foods above staple foods in vignette exercises.

These results suggest that misperceptions are not uniformly distributed: they are stronger among parents of malnourished children, and they are attenuated for better-educated mothers.

4.5 Impacts of the Information Intervention on Beliefs, Behaviors, and Child Growth

The previous sections documented systematic parental misperceptions of child nutrition, shaped in part by local reference environments: mothers in lower-nutrition settings were more likely to overestimate their own child's growth and to report lower benchmarks for "ideal" height. I now turn to the central question of whether providing targeted belief-correction information can shift these beliefs and, in turn, improve feeding behaviors and child growth outcomes.

The results below focus on the comparison between Treatment 1 (T1) and the control group, which identifies the causal effects of correcting reference-point misperceptions. I group outcomes into three domains: (i) parental beliefs on child nutrition, (ii) feeding practices and nutritional investments, and (iii) child growth and health outcomes. Overall, the intervention led to meaningful shifts in parental beliefs, and improvements in reported feeding practices and child growth. In addition, I examine secondary outcomes related to household food versus non-food expenditures and child cognitive development, where I do not find significant treatment effects.

(i) Treatment effects on parental beliefs on child nutrition

I first examine whether the intervention corrected parental misperceptions about child nutrition. Table 3 reports treatment effects on belief outcomes, organized around three dimensions: (i) mothers' beliefs about their own child's height percentile, (ii) their benchmarks for "ideal" height, and (iii) their ability to correctly identify stunting among undernourished children. Outcomes related to weight are reported in Table A3.

The personalized percentile feedback led to large and statistically significant corrections in mothers' perceptions of their children's relative growth. On average, the gap between perceived and true percentiles fell by nearly 30 points for height and 21 points for weight. These effects are large given baseline gaps of roughly 33 points (height) and 23 points (weight) in the control group. Consistent with the theory, mothers also updated their aspirations upward: reported ideal height increased significantly by 1.92 SD relative to the control group (WHO height-for-age z-score). These shifts imply that mothers not only revised their perceptions of current deficits but also raised their benchmarks for what constitutes healthy growth. Panel B in Figure 5 illustrates this, showing that the linear fit line of perceived ideal height on AWC mean HAZ shifts up and becomes flatter in the treatment group relative to control, indicating both higher reference points and reduced sensitivity to local undernutrition.

The intervention also reduced the likelihood that mothers misclassified undernourished children as "normal." Among stunted children—defined using endline height status—the probability that mothers described their child's height as "normal" or "tall" fell by more than 63 pp relative to the control group mean of 80%. Because this outcome is meant to capture mothers' recognition of current malnutrition, stunting status is measured at endline; however, using post-treatment status may introduce compositional differences since treatment itself affects who is classified as stunted. Panel C in Figure 5 therefore complements this analysis by illustrating misclassification of stunted children at both baseline and endline, using each child's stunting status at the corresponding survey round to account for potential compositional changes. Similarly, for underweight or wasted children, the probability of being described as normal weight declined by more than half. These results indicate that personalized percentile feedback was effective in correcting reference-point misperceptions and improving mothers' ability to recognize undernutrition.

(ii) Treatment effects on feeding practices and nutritional investments

Tables 4 and A3 presents treatment effects on household feeding practices and nutritional investments. The intervention led to improvements in children's diets across multiple measures.

In comparison to the control group, children in treated households were more likely to meet minimum diet diversity and diet adequacy standards, and showed significant increases in protein intake. Relative to a control mean of 34%, treated children were 20 pp more likely to meet the minimum dietary adequacy criteria (a 59% increase). Total protein consumption over the previous 24 hours rose by 5.6 grams ($p < 0.01$), a 71% increase relative to the control group's mean of 7.8 grams.

This increase is largely driven by higher consumption of government-provided supplementary foods. The fraction of children who consumed Balamrutham in the last 24 hours rose by 25 pp (49%). The quantity consumed also increased: treated children consumed an additional 0.20 bowls the previous day and 219 grams over the last month (a 19% increase relative to 1,181 grams in the control group). Egg consumption also rose both in daily and monthly terms. Relative to a control mean of 41%, the share of children consuming any eggs in the past 24 hours rose by 20 pp. Quantities consumed increased by 0.26 eggs over the previous day and 1.7 eggs over the last calendar month.

Consistent with these revealed feeding practices, willingness-to-pay for a bundle of protein-rich foods was significantly higher in the treatment arm relative to the control group. The treatment effect implies an increase of Rs. 1,105, nearly double the control mean of Rs. 1,331 ($p < 0.01$). By contrast, household food expenditures did not significantly differ between treatment and control groups, suggesting that gains in dietary diversity and protein intake were achieved either through reallocation within the household budget or by reducing wastage, rather than through higher overall spending.

(iii) Treatment effects on child growth and health

The intervention produced measurable improvements in children's anthropometric outcomes within the short six-month follow-up period. Table 5 shows that the treatment increased anthropometric z-scores. Relative to a control group mean of –1.52 for HAZ, treated children experienced a 0.09 SD gain ($p < 0.1$). The effects are larger for weight: WAZ increased by 0.15 SD, while WHZ improved by 0.14 SD ($p < 0.01$). These magnitudes are consistent with short-run growth responses documented in prior nutrition interventions, where weight tends to respond more quickly than height.

Binary indicators of malnutrition status also reflect these improvements. As reported in Columns (4)–(6), the fraction of underweight children fell by 6 pp, relative to a control mean of 24% ($p < 0.01$). Stunting declined by about 3 pp (a 10% decrease) and wasting by 2 pp (a 22% decrease), though these estimates are not statistically significant at conventional levels. There were also gains in mid-upper arm circumference (MUAC), which increased by 0.20 cm ($p < 0.01$). These results point to substantial improvements in nutritional status within a relatively short follow-up window.

Health outcomes also improved. Column (8) in Table A3 shows that the likelihood of illness in the two weeks prior to survey declined by 9 pp, relative to a control mean of 64% ($p < 0.01$). Cognitive development, measured using the CREDI z-score (Column 9), shows positive but statistically insignificant effects. Given the time frame of six months, the absence of detectable impacts on cognition is not unexpected; such outcomes may require longer follow-up to materialize.

Taken together, these findings demonstrate that a relatively light-touch, information-based intervention not only shifted parental beliefs and feeding practices but also translated into meaningful improvements in child nutrition and health outcomes over the short run.

5 Mechanisms

The preceding sections demonstrated that the belief-correction intervention (Treatment 1) led to substantial improvements in parental perceptions, feeding practices, and child nutrition outcomes. In this section, I explore the mechanisms underlying these effects. Specifically, I assess whether the observed gains stem primarily from the correction of reference-point misperceptions, or whether other channels—such as general information exposure or changes in nutritional knowledge—also play a role.

I conduct a series of complementary analyses:

(1) Cross-arm comparisons (T1 vs. T2 vs. Control): To test whether the effects are driven by the common information provided in both arms—the belief-correction component—I compare treatment estimates across the two arms. Similar magnitudes for T1 and T2 would indicate that most behavioral and growth responses arise from reference-point correction rather than the additional knowledge content in T2.

(2) Heterogeneity by baseline misperceptions and local reference points: I test whether treatment effects are stronger among mothers who initially had the largest misperceptions about child growth, defined as the gap between perceived and true HAZ percentiles at baseline. I also examine heterogeneity by the average nutritional environment across AWCs (mean baseline child HAZ) and among malnourished children in high- versus low-nutrition AWCs, controlling for correlated factors such as child malnutrition status and maternal education. This analysis directly links behavioral updating to the initial anchoring of beliefs to local peer reference points.

(3) Role of protein-effectiveness information: Since Treatment 1 also modestly improved mothers' ranking of protein-rich foods over staple foods in terms of effectiveness in promoting child growth (Table 6), I assess heterogeneity in T1 effects by mothers' baseline protein knowledge to assess the extent to which the general nutrition advice drives the observed improvements in feeding practices and nutrition outcomes.

(4) Within-household food allocation and spillovers: I examine treatment effects on mothers' weight, meal frequency, and household food security, as well as heterogeneity by the presence of siblings, to examine if dietary improvements reflect reallocation of food from mothers or other children versus other household members, or efficiency gains from reduced food wastage.

(5) Distributional effects: I examine whether treatment effects differ across the baseline distribution of child nutritional status. Since belief updating should primarily occur among mothers of more undernourished children, whose growth was most severely overestimated at baseline, I test effects across quintiles of baseline HAZ, WAZ, and WHZ to assess whether the gains in child growth are indeed concentrated among those most likely to update their beliefs.

5.1 Cross-arm comparisons (T1 vs. T2 vs. Control)

Recall that the experiment featured three arms: a control group that received no information; Treatment 1 (T1), in which mothers received personalized feedback on their child's height- and weight-for-age percentiles relative to WHO standards, along with height and weight reference values at various percentile ranks to recalibrate benchmarks for heathy growth; and Treatment 2 (T2), which added to T1 a more detailed module emphasizing the effectiveness of protein-rich foods and information on the long-term consequences of early-life malnutrition.

While T1 primarily targeted reference-point misperceptions, mothers were also provided some general advice, including an overview of locally available protein-rich foods, encouragement to track child growth regularly at the AWC, and brief emphasis on the importance of nutrition before age three. This information was given to avoid delivering "bad news" about a child's nutritional status without offering at least some minimal advice on how to improve it. This was highly general advice—comparable to what mothers could already obtain from Anganwadi workers—and was not intended as the main focus of the treatment. As a robustness test, I now examine whether treatment effects in T1 operate primarily through the reference-point channel or also partly through this additional advice.

T2 built directly on this foundation by emphasizing these additional components more strongly, providing mothers with richer information on the effectiveness of protein-rich foods in improving child growth, along with information on the long-term consequences of early-life malnutrition. Comparing treatment estimates across the two arms allows me to assess whether the behavioral and growth responses are driven mainly by the shared belief-correction information or whether the additional content in T2 generates incremental effects. In particular, the T1–T2 comparison tests whether providing richer nutrition advice adds anything beyond the reference-point feedback itself—thereby revealing whether the brief, general advice included in T1 meaningfully contributed to the observed impacts.

Tables 6-7, A4-A5 and Figure 6 present these results. The effects on parental beliefs about child growth are identical across T1 and T2. Turning to knowledge of nutrition technology and the long-term consequences of malnutrition, however, meaningful differences emerge. While both treatments improved mothers' ranking of protein-rich foods relative to staples, the effect in T2 is roughly twice as large. Only T2 significantly increased mothers' knowledge of the long-term consequences of malnutrition. These patterns are consistent with the experimental design: the common reference-point feedback primarily explains the large belief corrections, while the incremental informational content in T2 strengthened understanding of nutrition technology and returns.

T2 also produced slightly larger and more precisely estimated impacts on dietary and growth outcomes—particularly on egg consumption and protein intake—but the differences between the two arms are not statistically significant across several measures. Because these statistically significant incremental effects are concentrated in the diet domain, this suggests that the knowledge component meaningfully reinforced behavioral responses specifically related to protein-rich foods. This is consistent with the stronger emphasis on the importance of consuming protein-rich foods in the T2 intervention.

The similarity in overall treatment effects across the two arms suggests that belief correction is the dominant mechanism driving improvements in feeding practices and child growth. The additional informational components in T2 appear to reinforce but not fundamentally alter behavioral responses, underscoring that correcting misperceptions about children's relative growth was the key behavioral lever in this context.

5.2 Heterogeneity by Baseline Misperceptions and Local Reference Points

Since treatment effects are statistically similar for T1 and T2 across most outcomes, the results point to belief correction as the central channel through which the interventions affected behavior and child growth. I examine this further by testing if treatment effects vary by the extent of baseline misperceptions on children's nutritional status and by the local peer environment, as proxied by the average child HAZ across AWCs.

I first measure the gap between perceived and true height percentiles at baseline (the "HAZ percentile gap"). If belief distortions are a binding constraint on investment, effects should be larger among mothers who substantially overestimated their child's growth status. A stronger response in this group would support the interpretation that belief correction, rather than generic exposure to information, drives behavioral change.

Consistent with this prediction, pooled treatment effects on both child feeding and growth outcomes are stronger for children whose mothers had larger baseline gaps (Table 8, Figures 7-8, A3). The heterogeneity gradients by baseline height-percentile gap are statistically significant for weight-for-age (WAZ) and broadly for weight-for-height (WHZ), while for height-for-age (HAZ) the gradient is positive but imprecisely estimated. These patterns are robust when controlling for a range of potential correlates of misperceptions and their interactions with treatment status (Table A6). Across all three z-scores, the estimated gradients by baseline height percentile gap remain broadly stable in magnitude and direction when each correlate is included individually, whether related to child characteristics (sex, age, baseline malnutrition), maternal characteristics (education), Anganwadi Worker attributes (education and growth-monitoring information), or the local nutrition environment. In all cases, treatment effects appear to be strongest among children whose mothers had the largest initial misperceptions. These results indicate that the heterogeneous responses are not driven by observable characteristics correlated with belief accuracy, but instead reflect growth changes following the correction of distorted reference points.

To further test the reference-point mechanism, I exploit cross-sectional variation in the average child nutrition levels across AWCs, as defined by mean child HAZ. Treatment effects are larger in low-nutrition AWCs—where peers are shorter on average and local reference points are more downward-biased—than in high-nutrition AWCs (Panel B, Figure 8). Finally, focusing on malnourished children, the largest gains in growth occur among those in low-nutrition centers, precisely where local norms most distort perceptions of healthy growth (Panel C, Figure 8).

Together, these results provide strong causal evidence for the reference-point mechanism proposed in the conceptual framework. The intervention's effects effects were strongest for malnourished children in low-nutrition areas—precisely where local peers are shortest and parental misperceptions are largest—consistent with parents anchoring their assessments of child growth to local rather than global reference distributions. In other words, belief distortions arising from downward-biased local benchmarks were a binding constraint on nutrition investment, and correcting these distortions shifted parents' reference points upward, leading to improved feeding practices and measurable gains in child growth.

5.3 Role of Protein-effectiveness Information

Next, I assess whether the effects of Treatment 1—intended primarily to shift reference points for child growth—could instead be attributed to the brief, general advice on the relative effectiveness of protein-rich foods. Although T1 produced a small but statistically significant increase in the share of mothers ranking protein-rich foods above staples in terms of their effectiveness in promoting child growth (Table 6), this improvement was modest compared to the larger knowledge gains observed in T2.

To test whether this limited advice nonetheless played a meaningful role, I exploit heterogeneity in mothers' baseline knowledge of protein effectiveness. If the protein advice were driving the effects, impacts should be concentrated among mothers with low baseline knowledge. However, I find that treatment effects are statistically indistinguishable across high- and low-knowledge groups (Figures 9, A4), with point estimates that are, if anything, slightly larger for the high-knowledge group. This pattern suggests that the improvements in feeding practices and growth are unlikely to operate through closing a knowledge gap and instead likely operate through the reference-point channel.

5.4 Within-household Food Allocation and Spillovers

Table A4 showed that the information interventions led to substantial improvements in children's feeding outcomes and protein intake, without any increase in total household food expenditures. This pattern implies some degree of food reallocation within households, raising the question of whether these gains came at the expense of other household members.

I first test for potential unintended consequences among other children by comparing treatment effects for children with and without siblings (Table 9). The results show no meaningful differences across groups: improvements in diet adequacy, protein intake, and anthropometric outcomes are statistically similar for only children and for those with siblings. Since each child under age six receives an individual entitlement from the Anganwadi Centre, and treated children were consuming a larger—though still not the entire—share of their allocation at endline, these findings suggest that the observed gains reflect more complete use of each child's own entitlement, rather than transfers from siblings.

Next, I examine treatment effects on mothers and household-level outcomes (Table 10). There are no detectable changes in maternal weight, meal frequency, or reported household food security, indicating that the improvements in child nutrition did not come from reducing mothers' own food intake. Columns (5)–(6) indicate that even after the intervention, some degree of within-household sharing and unutilized capacity in children's food entitlements remain, reflecting the typical pattern of partial consumption of supplementary foods among children.

Overall, the intervention increased the share of government-provided food that children actually consumed: treated children ate about two more eggs and 240 grams more Balamrutham per month than control children—making fuller use of their monthly entitlements of 16 eggs and 2.5 kilograms of Balamrutham distributed through Anganwadi Centres. The additional consumption likely comes from reduced wastage of Balamrutham (an infant food rarely eaten by adults) and a modest reallocation of eggs from adults to children. Any such reallocation would represent only a negligible reduction in adult diets but a large nutritional gain for the child in percentage terms of protein and calories. Together, these results suggest that the intervention enhanced the efficiency of intra-household food allocation without imposing large costs on other household members.

5.5 Distributional Effects

I now turn to distributional effects, asking whether the impacts of the interventions differed across the baseline distribution of child nutritional status. To examine this, I estimate pooled treatment effects across quintiles of the baseline anthropometric distribution, separately for HAZ, WAZ, and WHZ. Figure 10 plots treatment effects on these outcomes by baseline quintile, with 95% confidence intervals.

The results show clear distributional patterns. For height and weight, treatment effects are largest for children in the lowest baseline quintiles. For example, children in the bottom HAZ quintile gained approximately 0.25 SD in HAZ relative to the control group, while effects in the top quintile are small and not statistically distinguishable from zero. A similar gradient appears for WAZ, with largest gains for children in the lowest quintiles and effects tapering off in higher quintiles. For WHZ, the pattern is less monotonic: while impacts are still stronger among children in the lowest quintiles, estimates are noisier and confidence intervals wider, reflecting greater short-run variability in weight-for-height measures.

Consistent with the conceptual framework, children who were furthest below healthy growth benchmarks were also those whose mothers most strongly misperceived their nutritional status at baseline, and thus responded most when given accurate percentile information. Importantly, this pattern also rules out the possibility that treatment effects are driven only by children who were already close to normal growth thresholds. Instead, belief correction appears to relax a binding constraint precisely for those children who faced the largest growth deficits and for whom misperceptions were most severe, producing disproportionate improvements for the most undernourished children.

6 Cost-effectiveness

To assess the economic efficiency of the belief-correction intervention, I conduct a costing exercise using the ingredients approach following J-PAL guidelines. I estimate a total program cost of about USD $12.20 per child as implemented in the randomized evaluation. This figure includes all direct program expenses such as enumerator training, salaries, materials, travel, accommodation, and monitoring, as well as administrative overheads. For the cost-effectiveness calculations, I use Treatment 2 (T2) estimates, which show slightly larger and more precise improvements in child growth outcomes. Since both T1 and T2 entail the same delivery costs, this provides a reasonable benchmark for the intervention's potential when implemented at scale. The key difference between the two arms is a short, five-minute animated video shown to mothers in T2; because it is played on the same tablet during the same household visit, it does not raise marginal delivery costs.

The intervention's cost-effectiveness is roughly USD \$116 per 1 SD improvement in HAZ and USD \$226 per stunting case averted, placing it well below the cost of most nutrition interventions evaluated in low- and middle-income countries. Moreover, because the intervention leverages India's existing public nutrition infrastructure (ICDS)—where Anganwadi Workers already conduct home visits and monthly growth monitoring—the per-child delivery cost would fall to USD \$0.44-0.53 if scaled at the state or national levels, implying a cost of USD \$8–10 per stunting case averted.

Figure 11 benchmarks these cost-effectiveness estimates against other interventions in the literature. Compared to cash or food transfers—which typically cost USD \$4,000–8,000 per stunting case averted—and even relative to nutrient supplementation (USD \$900–1,000), the belief-correction intervention stands out as a highly cost-effective behavioral approach. Importantly, many studies do not include full programmatic costs—such as administrative overheads, training, and delivery—so for those cases, the reported figures based only on transfer values of cash or food likely represent lower bounds on true program costs. While facility-based interventions represent some of the most efficient supply-side strategies for improving child nutrition, the belief-correction intervention offers a complementary demand-side mechanism, enhancing the effectiveness of existing programs by aligning parental beliefs and behaviors with nutritional goals.

Finally, using pooled treatment effect estimates and NFHS-5 data on national child growth distributions, a back-of-the-envelope calculation suggests that scaling this intervention could close 7.9% of India's national height deficit among children under age three relative to WHO growth standards, with comparable gains of 13.2% and 22.1% of the national gaps in weight-for-age and weight-for-height, respectively. A more conservative, targeted approach—applying these same effects only to children living in low-nutrition environments (mean HAZ < -1), who constitute roughly two-thirds of India's under-three population—yields smaller but still meaningful estimates: belief correction could close about 5% of the national height deficit and 9% and 15% of the WAZ and WHZ gaps, respectively. Correcting widespread parental misperceptions through existing frontline delivery systems thus represents a scalable, low-cost lever for accelerating India's progress in reducing child undernutrition.

7 Conclusion

This paper examines how distorted parental beliefs arising from downward-biased local growth benchmarks shape nutritional investments in children and whether correcting these beliefs can improve health outcomes. Despite large public investments in nutrition services, child malnutrition remains widespread in India, raising questions about demand-side factors that constrain child feeding practices. Using a randomized controlled trial with 1,527 mother–child pairs across 168 Anganwadi Centers in Telangana, I find that parents systematically overestimated their children's growth and set low benchmarks for "normal" height, particularly in areas where peers were shorter on average. This highlights the key paradox: *in contexts where malnutrition is widespread, mothers are more likely to normalize it and less likely to recognize undernutrition in their own children.*

Correcting these distorted benchmarks produced substantial behavioral and growth responses. The intervention substantially reduced misperceptions, raised growth aspirations, and improved recognition of malnutrition. Treated mothers reported greater diet adequacy, increased protein consumption, and higher utilization of government supplementary food. Within six months, these behavioral changes translated into measurable gains in child growth (0.10 SD increase in height-for-age and 0.18-0.19 SD increases in weight-for-age and weight-for-height z-scores), alongside a 13–35% reduction in malnutrition rates. Treatment effects were strongest for malnourished children in low-nutrition areas, precisely where peers are shortest and misperceptions are largest, providing strong causal evidence of the reference-point mechanism: downward-biased local benchmarks are a binding constraint on nutrition investment, and correcting these distortions led to improved feeding practices and measurable gains in child growth.

Scaled nationally, the belief correction intervention could close roughly 8% of India's height deficit and 12-22% of the weight-for-age and weight-for-height deficits among children under three. At a cost of only about USD 12 per child—or less than USD 1 if integrated into existing government programs—it is roughly 5–20 times more cost-effective than typical nutrition supplementation or cash-transfer programs. In line with seminal evidence demonstrating that early parental environments and investments yield high long-term returns (Heckman (2008), Currie and Vogl (2013)), the findings here suggest that correcting misperceptions in the first few years of a child's life can be a cost-effective lever to boost early human capital formation.

At the same time, these are short-run effects of a light-touch intervention, and impacts may fade without reinforcement. Ideally, belief-correction would be integrated into frontline platforms and delivered at regular intervals. Moreover, this is a setting where sanitation coverage is high and nutritious food is readily available through government programs; effects may be smaller in contexts with greater access constraints or environmental risks. Similar evidence is documented by Weaver et al. (2024), who find that cash transfers improved child growth only in areas with low open defecation. The medium- and long-run impacts, and external validity to other contexts, remain important open questions for future research.

The findings have direct policy relevance. The proposed information interventions provide a scalable, low-cost complement to existing public nutrition programs. India—and many other low- and middle-income countries—already operate large-scale programs that provide free supplementary food and routine growth monitoring, yet demand-side constraints rooted in parental misperceptions may mute their impact. Embedding belief-correction into front-line nutrition platforms could strengthen demand for improved diets, increase utilization of supplementary nutrition services, and ultimately improve child health.

A promising direction for future work is to study the longer-term effects of belief-correction as children age. Follow-up surveys could measure whether changes in feeding practices persist, whether growth improvements translate into better school readiness and cognitive development, and whether communities eventually break out of low-nutrition equilibria as average nutrition levels rise. Another area of interest would be to test the scalability and cost-effectiveness of delivering these interventions through government frontline workers. It would also be valuable to examine misperceptions among Anganwadi workers themselves, who are responsible for growth monitoring and for identifying malnourished children, but may hold similar downward-biased perceptions shaped by the same local reference environments. Finally, alternative approaches to shifting reference points—such as photo- or video-based exposure to well-nourished children, or cross-village peer matching—could provide complementary tools to counteract biased local benchmarks and reshape parental perceptions. More broadly, the findings highlight the need for structural models of human capital investment to incorporate belief formation and updating processes, opening new avenues to better understand how beliefs, information, norms, and expectations jointly shape early-life investments and long-run development outcomes.

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8 Tables

Table 1. Baseline Beliefs on Child Nutrition

	Full Sample				Control	T1	T2
	Mean (1)	SD (2)	Min (3)	Max (4)	Mean (5)	Mean (6)	Mean (7)
Beliefs about child's nutrition							
Believed height-for-age percentile, relative to WHO standards	46.80	23.83	1.00	100.00	47.00	47.28	46.12
Believed weight-for-age percentile, relative to WHO standards	36.95	19.19	1.00	100.00	36.97	37.31	36.57
Believed height-for-age percentile, relative to children in their mandal	48.72	23.38	1.00	100.00	49.38	48.30	48.48
Believed weight-for-age percentile, relative to children in their mandal	39.24	19.27	1.00	100.00	39.19	39.46	39.08
Ideal height for child's age, converted to WHO z-score	-1.83	3.28	-11.96	15.97	-1.86	-1.78	-1.85
Ideal weight for child's age, converted to WHO z-score	0.17	1.26	-5.04	4.75	0.17	0.18	0.16
Believes child's height is "normal" or "tall"	0.89	0.31	0.00	1.00	0.91	0.89	0.89
Believes child's weight is "normal"	0.62	0.49	0.00	1.00	0.63	0.61	0.62
Believes child's height is "average" or "above average" compared to other children of the same age	0.81	0.39	0.00	1.00	0.80	0.82	0.82
Believes child's weight is "average" or "above average" compared to other children of the same age	0.68	0.47	0.00	1.00	0.68	0.67	0.69
Is "unsatisfied" with child's current diet	0.09	0.28	0.00	1.00	0.09	0.09	0.08
Gaps between believed and true percentiles							
Believed - True height-for-age percentile, relative to WHO standards	33.05	28.03	-74.00	99.00	33.97	32.88	32.26
Believed percentile higher than true percentile	0.90	0.30	0.00	1.00	0.90	0.90	0.89
Believed - True weight-for-age percentile, relative to WHO standards	23.57	23.46	-75.00	87.00	24.14	23.39	23.17
Believed percentile higher than true percentile	0.87	0.34	0.00	1.00	0.88	0.86	0.86
Believed - True height-for-age percentile, relative to children in their mandal	12.61	30.57	-82.00	96.00	13.38	11.89	12.55
Believed percentile higher than true percentile	0.66	0.48	0.00	1.00	0.66	0.65	0.66
Believed - True weight-for-age percentile, relative to children in their mandal	4.65	28.06	-71.00	87.00	3.69	5.03	5.25
Believed percentile higher than true percentile	0.57	0.50	0.00	1.00	0.55	0.59	0.56
Beliefs about child nutrition in village compared to other regions							
Believes children in their village are about the same height or taller than children in Indian cities like New Delhi, Mumbai, and Hyderabad	0.70	0.46	0.00	1.00	0.71	0.70	0.69
Believes children in their village are about the same height or taller than children in developed countries like the US and UK	0.61	0.49	0.00	1.00	0.62	0.62	0.61
Beliefs about height							
Believes taller children generally complete more years of education than shorter children	0.17	0.37	0.00	1.00	0.16	0.18	0.17
Believes taller children generally score higher marker in school exams than shorter children	0.15	0.35	0.00	1.00	0.13	0.15	0.16
Believes taller individuals generally earn higher wages than shorter individuals	0.11	0.32	0.00	1.00	0.11	0.12	0.12
Believes taller individuals have lower risk of cardiometabolic diseases like heart disease, high blood pressure, and diabetes than shorter individuals	0.08	0.28	0.00	1.00	0.08	0.09	0.09
Beliefs about consequences of child malnutrition							
Believes child malnutrition has an affect on...							
adult height	0.45	0.50	0.00	1.00	0.46	0.47	0.43
number of years of education	0.37	0.48	0.00	1.00	0.34	0.38	0.38
test scores in high school	0.38	0.49	0.00	1.00	0.38	0.37	0.38
likelihood of developing adverse health conditions in adulthood (heart disease, high blood pressure, obesity, diabetes)	0.12	0.32	0.00	1.00	0.11	0.13	0.11
earnings in adulthood	0.34	0.47	0.00	1.00	0.34	0.35	0.33
Beliefs about effectiveness of protein-rich foods vs. staple foods in improving child growth							
Ranks protein-rich foods as being more effective than staple foods in improving child growth	0.43	0.50	0.00	1.00	0.44	0.41	0.43
Sample Sizes	1527				517	504	506

Notes: This table reports summary statistics on baseline beliefs about child nutrition for the study sample (N = 1,527), disaggregated by random assignment to Treatment 1 (T1), Treatment 2 (T2), and the control group (C). "True" height-for-age and weight-for-age percentiles were calculated according to WHO growth standards using directly measured child height, weight, sex, and age in months. Mothers' reported "ideal" height and weight for their child's age were elicited in centimeters using a measuring tape exercise and then converted into WHO-standardized z-scores and percentiles based on the child's sex and age. Gaps between believed and true percentiles were constructed as the difference between the mother's reported percentile rank and the child's actual percentile rank by WHO standards.

Table 2. Local Reference Bias in Perceptions of Child Growth

Dependent Variable:	Height Percentile Gap (1)	Height Percentile Gap (2)	Ideal Child Height (Z) (3)	Ideal Child Height (Z) (4)	Describe child's height as "normal" or "tall" (5)	Describe child's height as "normal" or "tall" (6)
AWC Mean Child HAZ	-7.295***	-8.686***	0.578**	0.551**	-0.074*	-0.081*
	(1.926)	(2.164)	(0.227)	(0.255)	(0.041)	(0.049)
Observations	1,527	1,516	1,527	1,516	578	576
Sample	All children	All children	All children	All children	Stunted children	Stunted children
R-squared	0.009	0.215	0.004	0.065	0.006	0.067
Controls	No	Yes	No	Yes	No	Yes
Y Mean	33.05	33.05	-1.830	-1.830	0.840	0.840

Notes: AWC mean HAZ is from September 2024, just before the start of the baseline survey. Controls include child-level (HAZ, age dummies, sex), mother-level (total number of children, education in years, height), household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score), and Anganwadi-level (average mother's height, average mother's education, average household per capita income, average household PPI score) characteristics. Robust standard errors are reported.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Table 3. Treatment Effects: Beliefs

Dependent Variable:	Height percentile gap (1)	Ideal child height (Z) (2)	Describe child's height as "normal" or "tall" (3)
Treatment 1	-29.500***	1.921***	-0.628***
	(1.373)	(0.095)	(0.048)
Observations	1,021	1,021	312
R-squared	0.380	0.515	0.445
Controls	Yes	Yes	Yes
Sample	All children	All children	Stunted children
Control Mean - EL	33.33	-1.630	0.800
% Change T	-89%		-79%

Notes: This table reports the effects of the belief-correction intervention (Treatment 1) relative to the control group on parental beliefs about child height. Stunting status is defined using endline HAZ to capture mothers' ability to recognize *current* malnutrition; as treatment can influence stunting itself, these estimates may reflect compositional differences. Figure 5 presents misclassification rates using stunting status at both baseline and endline, thereby accounting for such changes. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Table 4. Treatment Effects: Feeding Practices and Nutritional Investments

	24-hour diet recall							
Dependent Variable:	Diet adequacy (1)	Total protein consumed (gms) (2)	Consumed Balamrutham (3)	Quantity of Balamrutham (bowls) (4)	Consumed eggs (5)	Quantity of eggs (number) (6)	Willingness-to-pay for bundle of protein-rich foods (Rs.) (7)	Household food expenditure in last month (Rs.) (8)
Treatment 1	0.202***	5.588***	0.250***	0.198***	0.195***	0.255***	1,104.752***	133.878
	(0.032)	(0.426)	(0.033)	(0.023)	(0.032)	(0.036)	(101.468)	(189.646)
Observations	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,011
R-squared	0.078	0.215	0.103	0.119	0.078	0.100	0.194	0.313
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean - EL	0.340	7.830	0.510	0.250	0.410	0.430	1331	5849
% Change T	59%	71%	49%	79%	48%	59%	83%	2%

Notes: This table reports the effects of the belief-correction intervention (Treatment 1) relative to the control group on child feeding practices and nutritional investments. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means.
$^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$

Table 5. Treatment Effects: Child Growth

	Continuous			Binary		
Dependent Variable:	HAZ (1)	WAZ (2)	WHZ (3)	Stunted (4)	Underweight (5)	Wasted (6)
Treatment 1	0.087*	0.146***	0.144***	-0.031	-0.058***	-0.024
	(0.050)	(0.040)	(0.055)	(0.026)	(0.020)	(0.020)
Observations	1,021	1,021	1,021	1,021	1,021	1,021
R-squared	0.429	0.578	0.354	0.263	0.351	0.162
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean - EL	-1.520	-1.330	-0.770	0.320	0.240	0.110
% Change T				-10%	-24%	-22%

Notes: This table reports the effects of the belief-correction intervention (Treatment 1) relative to the control group on child growth outcomes. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means.
$^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$

Table 6. Cross-arm Treatment Effects: Beliefs

				T2 Components	
Dependent Variable:	Height Percentile Gap (1)	Ideal Child Height (Z) (2)	Describe child's height as "normal" or "tall" (3)	Knowledge score on long-term consequences (4)	Rank protein-rich foods higher than staples (5)
Treatment 1	-29.624***	1.925***	-0.625***	0.063	0.067**
	(1.397)	(0.093)	(0.049)	(0.074)	(0.027)
Treatment 2	-29.189***	1.904***	-0.632***	3.081***	0.132***
	(1.345)	(0.091)	(0.054)	(0.080)	(0.030)
Observations	1,527	1,527	446	1,527	1,527
R-squared	0.370	0.471	0.420	0.620	0.312
Controls	Yes	Yes	Yes	Yes	Yes
Sample	All children	All children	Stunted children	All children	All children
Control Mean - EL	33.33	-1.630	0.800	1.900	0.450
% Change T1	-89%		-78%	3%	15%
% Change T2	-88%		-79%	162%	29%
Pooled Treatment Effect	-29.41***	1.914***	-0.628***		
Pooled SE	(1.278)	(0.075)	(0.046)		
T1 = T2 p-val	0.661	0.847	0.896	0.000	0.0130

Notes: This table reports the effects of the belief-correction intervention (Treatment 1) and the belief-correction + knowledge intervention (Treatment 2) relative to the control group on parental beliefs about child nutrition. Stunting status is defined using endline HAZ to capture mothers' ability to recognize *current* malnutrition. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means.
$^{*}p < 0.1,^{**}p < 0.05,^{***}p < 0.01$

Table 7. Cross-arm Treatment Effects: Child Growth

	Continuous			**Binary**		
Dependent Variable:	HAZ (1)	WAZ (2)	WHZ (3)	Stunted (4)	Underweight (5)	Wasted (6)
Treatment 1	0.084*	0.154***	0.155***	-0.028	-0.061***	-0.024
	(0.050)	(0.040)	(0.055)	(0.027)	(0.020)	(0.020)
Treatment 2	0.105**	0.215***	0.217***	-0.054**	-0.105***	-0.045**
	(0.051)	(0.038)	(0.057)	(0.027)	(0.022)	(0.019)
Observations	1,527	1,527	1,527	1,527	1,527	1,527
R-squared	0.414	0.551	0.323	0.243	0.316	0.135
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean - EL	-1.520	-1.330	-0.770	0.320	0.240	0.110
% Change T1				-9%	-25%	-22%
% Change T2				-17%	-44%	-41%
Pooled Treatment Effect	0.095**	0.184***	0.186***	-0.0410*	-0.083***	-0.035**
Pooled SE	(0.044)	(0.032)	(0.047)	(0.024)	(0.017)	(0.017)
T1 = T2 p-val	0.668	0.161	0.283	0.319	0.0510	0.249

Notes: This table reports the effects of the belief-correction intervention (Treatment 1) and the belief-correction + knowledge intervention (Treatment 2) relative to the control group on child growth outcomes. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means. Tables A4-A5 report cross-arm treatment effects on diet and other health outcomes.

$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Table 8. Heterogeneity in Treatment Effects by Baseline Height Percentile Gap

	Beliefs			Diet						Growth					
Dependent Variable:	Height Percentile Gap (1)	Ideal Child Height (Z) (2)	Describe child's height as "normal" or "tall" (3)	Diet adequacy (4)	Total protein consumed (gm) (5)	Consumed Balamrutham (6)	Quantity of Balamrutham (bowls) (7)	Consumed eggs (8)	Quantity of eggs (number) (9)	HAZ (10)	WAZ (11)	WHZ (12)	Stunted (13)	Underweight (14)	Wasted (15)
Treated	-19.093***	1.414***	-0.558***	0.105*	4.859***	0.220***	0.177***	0.119**	0.217***	0.070	0.065	0.041	-0.009	0.006	0.038
	(3.577)	(0.214)	(0.129)	(0.057)	(0.741)	(0.071)	(0.040)	(0.060)	(0.066)	(0.112)	(0.087)	(0.117)	(0.051)	(0.044)	(0.034)
Medium HAZ Percentile Gap	5.185	0.029	0.004	-0.012	0.267	-0.047	-0.003	0.015	0.013	0.000	-0.002	-0.018	-0.057	-0.044	0.002
	(3.699)	(0.183)	(0.114)	(0.056)	(0.723)	(0.064)	(0.035)	(0.057)	(0.065)	(0.108)	(0.081)	(0.112)	(0.052)	(0.043)	(0.034)
High HAZ Percentile Gap	10.041**	-0.287	0.003	0.062	0.790	-0.016	0.038	0.067	0.066	-0.038	-0.053	-0.052	-0.057	-0.018	-0.014
	(4.764)	(0.204)	(0.117)	(0.067)	(0.774)	(0.068)	(0.039)	(0.069)	(0.077)	(0.108)	(0.095)	(0.124)	(0.056)	(0.052)	(0.040)
Treated#Medium HAZ Percentile Gap	-10.183**	0.402*	-0.086	0.154**	0.786	0.059	0.034	0.122*	0.059	0.004	0.099	0.139	-0.017	-0.078	-0.091**
	(3.909)	(0.230)	(0.131)	(0.065)	(0.879)	(0.079)	(0.047)	(0.069)	(0.075)	(0.126)	(0.097)	(0.133)	(0.061)	(0.050)	(0.039)
Treated#High HAZ Percentile Gap	-17.095***	1.015***	-0.063	0.235***	2.843***	0.078	0.060	0.223***	0.151*	0.082	0.236**	0.252*	-0.084	-0.171***	-0.085*
	(4.013)	(0.262)	(0.144)	(0.077)	(0.963)	(0.081)	(0.052)	(0.079)	(0.085)	(0.126)	(0.103)	(0.147)	(0.060)	(0.057)	(0.044)
Observations	1527	1527	446	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527
R-squared	0.382	0.481	0.421	0.122	0.244	0.113	0.135	0.119	0.12	0.414	0.553	0.325	0.249	0.329	0.143
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All children	All children	Stunted children	All children	All children	All children	All children	All children	All children	All children	All children	All children	All children	All children	All children

Notes: This table reports heterogeneity in treatment effects by mothers' baseline height percentile gap—a measure of the difference between perceived and true child height percentiles at baseline: Low (gap < 10), Medium ($10 \geq$ gap < 50), and High (gap ≥ 50). Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Table 9. Heterogeneity in Treatment Effects by Presence of Siblings

	Diet						Growth					
Dependent Variable:	Diet adequacy (4)	Total protein consumed (gm) (5)	Consumed Balamrutham (6)	Quantity of Balamrutham (bowls) (7)	Consumed eggs (8)	Quantity of eggs (number) (9)	HAZ (10)	WAZ (11)	WHZ (12)	Stunted (13)	Underweight (14)	Wasted (15)
Treated	0.249***	6.552***	0.277***	0.222***	0.273***	0.306***	0.140***	0.177***	0.144**	-0.064**	-0.099***	-0.039*
	(0.036)	(0.461)	(0.038)	(0.026)	(0.034)	(0.038)	(0.054)	(0.039)	(0.058)	(0.029)	(0.022)	(0.020)
Only Child	0.065	0.372	-0.009	-0.005	0.081	0.063	0.074	0.064	0.039	-0.044	-0.029	-0.016
	(0.052)	(0.677)	(0.053)	(0.032)	(0.055)	(0.061)	(0.088)	(0.060)	(0.089)	(0.045)	(0.036)	(0.026)
Treated#Only Child	0.013	-1.338*	-0.013	-0.032	-0.066	-0.041	-0.094	0.010	0.079	0.057	0.048	0.021
	(0.055)	(0.746)	(0.056)	(0.036)	(0.058)	(0.064)	(0.088)	(0.066)	(0.099)	(0.046)	(0.033)	(0.027)
Observations	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527	1527
R-squared	0.084	0.212	0.106	0.110	0.092	0.102	0.403	0.541	0.301	0.234	0.310	0.127
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports heterogeneity in treatment effects by presence or absence of siblings. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

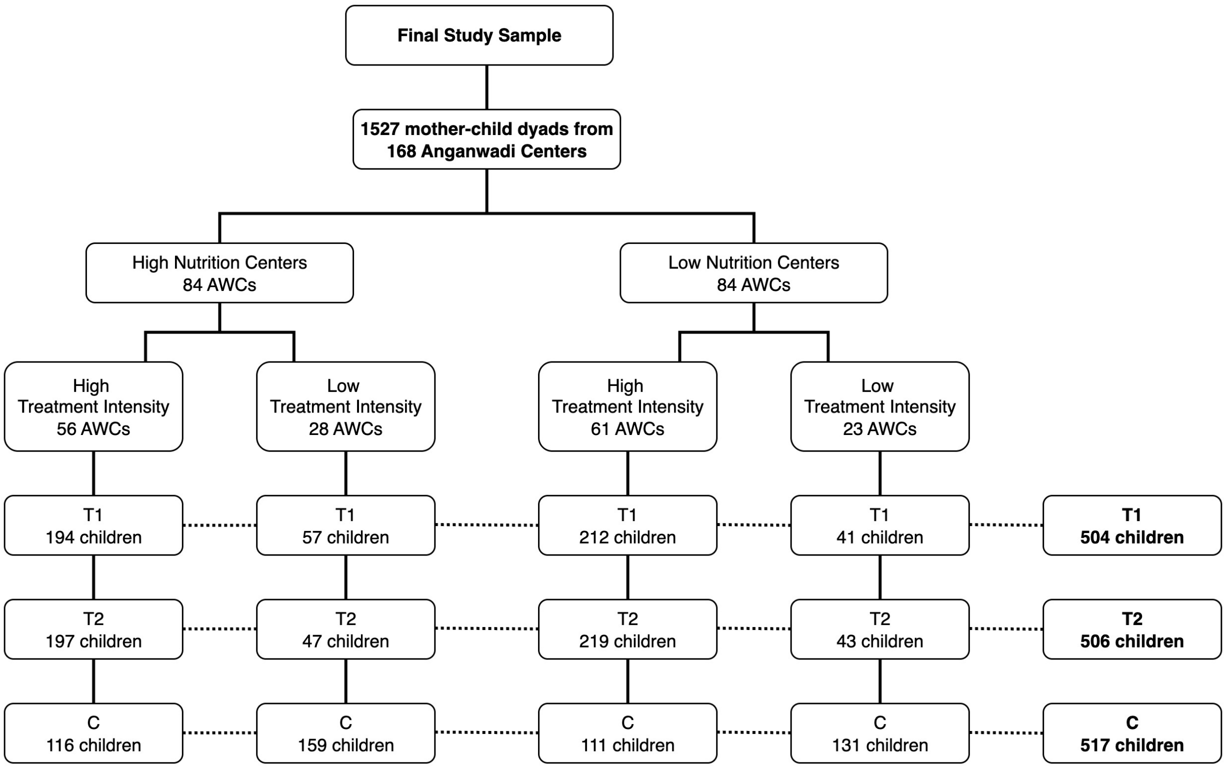
Table 10. Treatment Effects on Mother Outcomes and Intra-Household Food Reallocation

	Mother outcomes		**Household Food Security**	**Child's Consumption of Govt Supplementary Food**	
Dependent Variable:	Weight (kg)	Number of Meals in a Day	Every Household Member Gets Enough Food Everyday	Consumed Balamrutham Entirely	Consumed Eggs Entirely
	(1)	(2)	(3)	(5)	**(6)**
Treatment 1	0.409	0.002	0.003	0.026	0.126***
	(0.350)	(0.022)	(0.008)	(0.023)	(0.029)
Treatment 2	0.344	-0.004	0.005	0.060**	0.110***
	(0.302)	(0.020)	(0.007)	(0.023)	(0.030)
Observations	1,526	1,527	1,527	1,527	1,527
R-squared	0.790	0.029	0.011	0.017	0.035
Controls	Yes	Yes	Yes	Yes	Yes
Control Mean - EL	51.69	2.910	0.990	0.160	0.230
Pooled T Effect	0.377	-0.001	0.004	0.043**	0.118***
Pooled SE	(0.276)	(0.019)	(0.007)	(0.020)	(0.026)
T1 = T2 p-val	0.853	0.790	0.724	0.155	0.575

Notes: This table reports treatment effects of the belief-correction (Treatment 1) and belief-correction + knowledge (Treatment 2) interventions on mothers' nutrition, household food security, and the child's consumption of government-provided supplementary foods (Balamrutham and eggs). Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

9 Figures

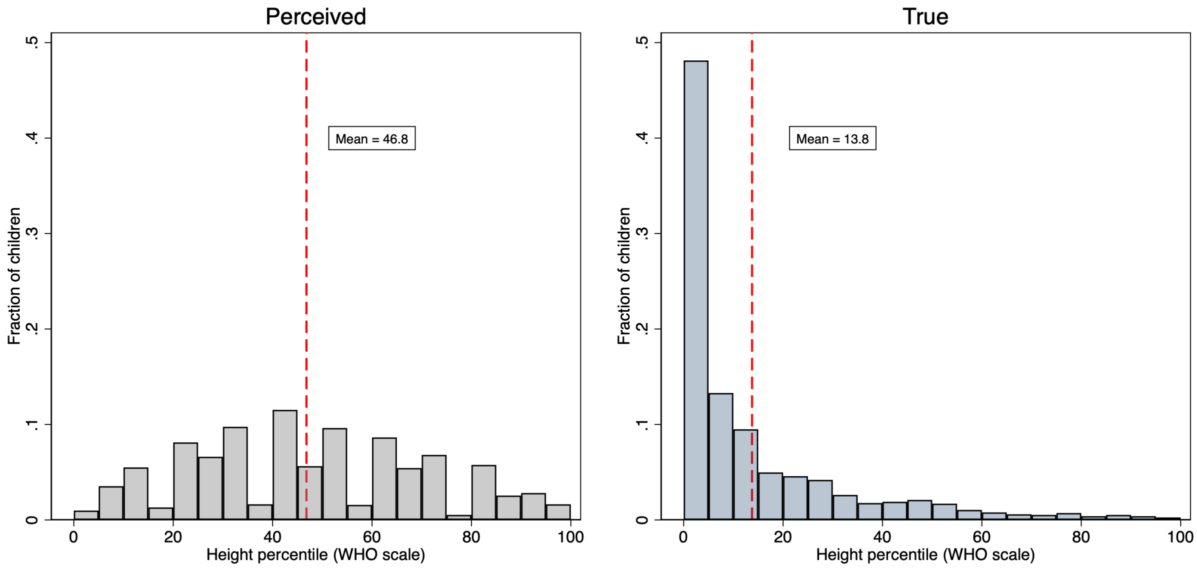
Figure 1. Experimental Design and Sample Size



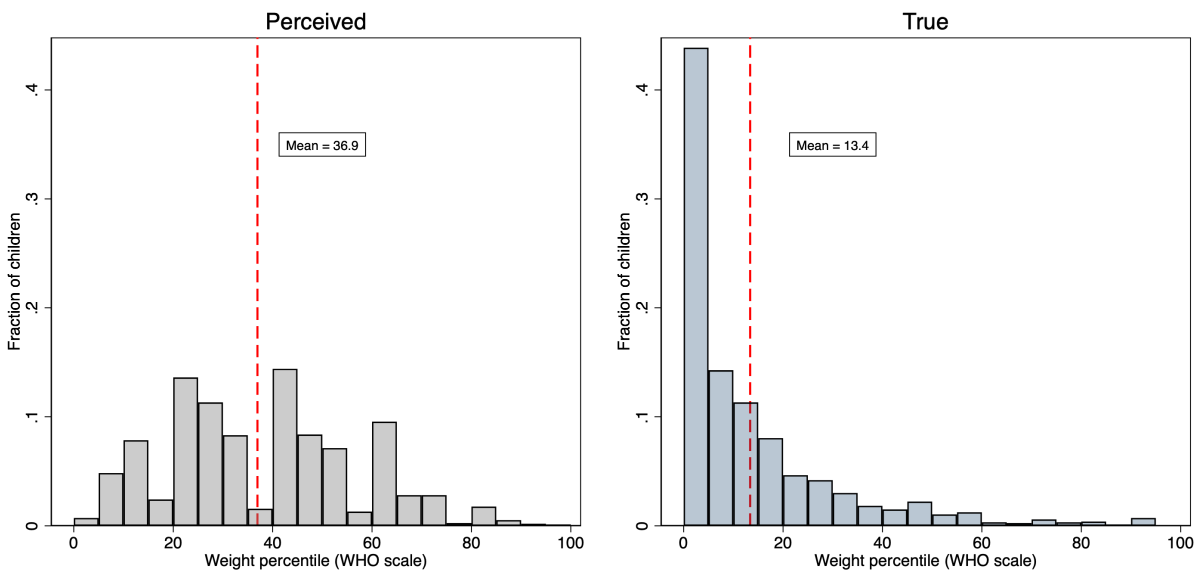
Notes: This figure summarizes the experimental design and sample allocation across the Control, Treatment 1, and Treatment 2 arms. The sample consists of 1,527 mother–child dyads across 168 Anganwadi Centers in Telangana, India. Centers were stratified into "high-nutrition" and "low-nutrition" groups using average child height- and weight-for-age z-scores. Randomization was conducted at the child level within centers, stratified by sex and malnutrition status.

Figure 2. Perceived vs. True Height Percentiles at Baseline

(a) Height

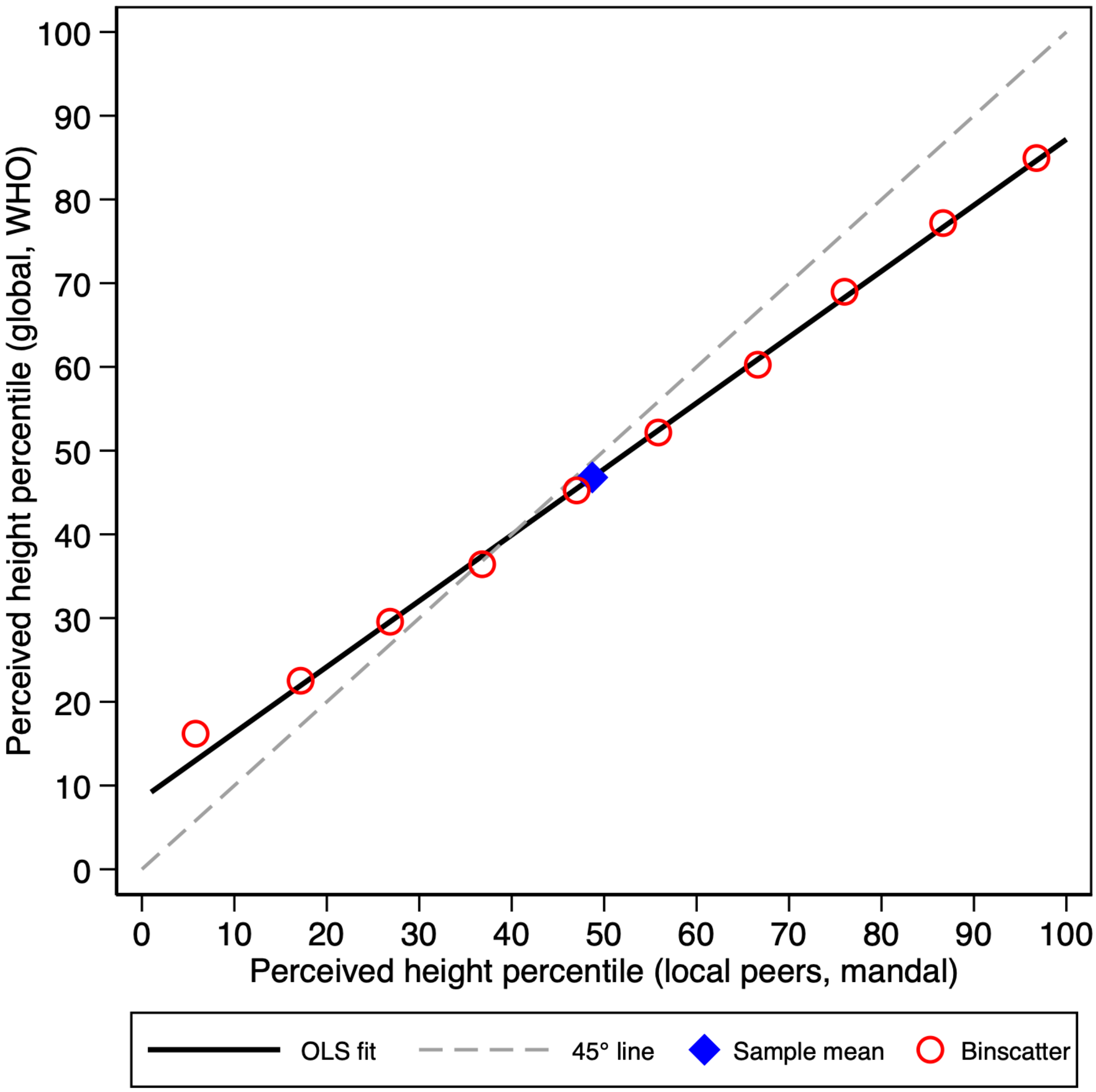


(b) Weight



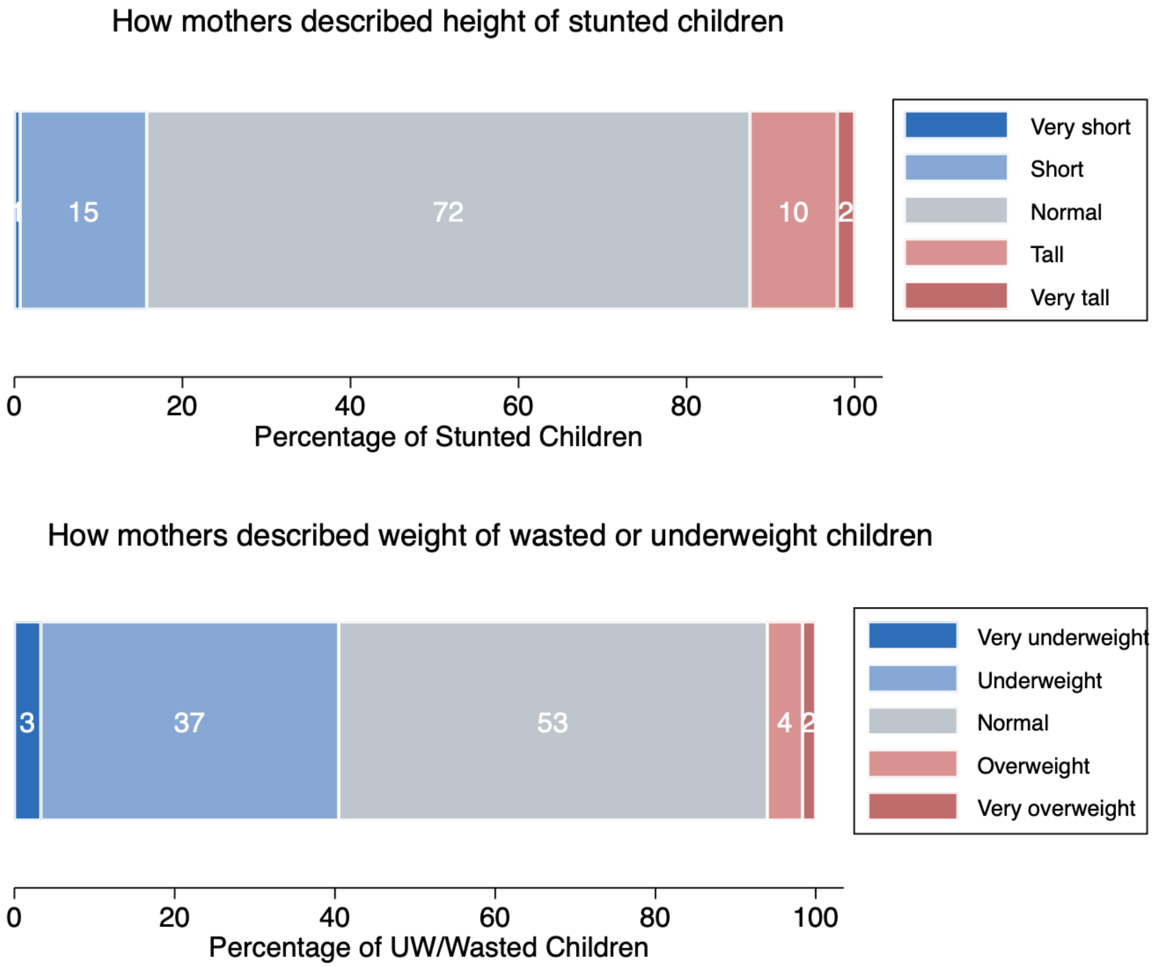
Notes: Histograms of children's perceived and measured percentiles relative to WHO standards at baseline. Panel (a) reports height percentiles; Panel (b) reports weight percentiles. The red dashed lines indicate the sample means.

Figure 3. Perceived Height Percentiles: Local vs. Global Peers



Notes: Binned scatterplot of perceived height-for-age percentile relative to local peers (mandal level) against their perceived percentile relative to global WHO reference population. The dashed gray line denotes the 45-degree line of equality. The solid black line shows the fitted OLS regression line. The blue diamond marks the sample means.

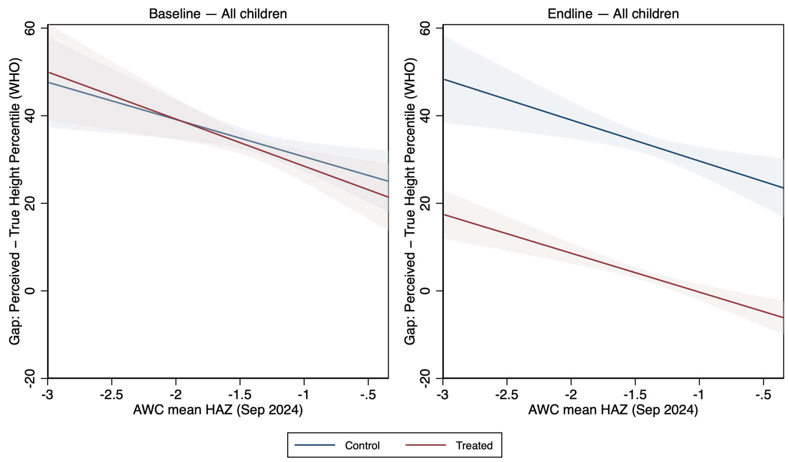
Figure 4. Mothers' Classification of Malnourished Children



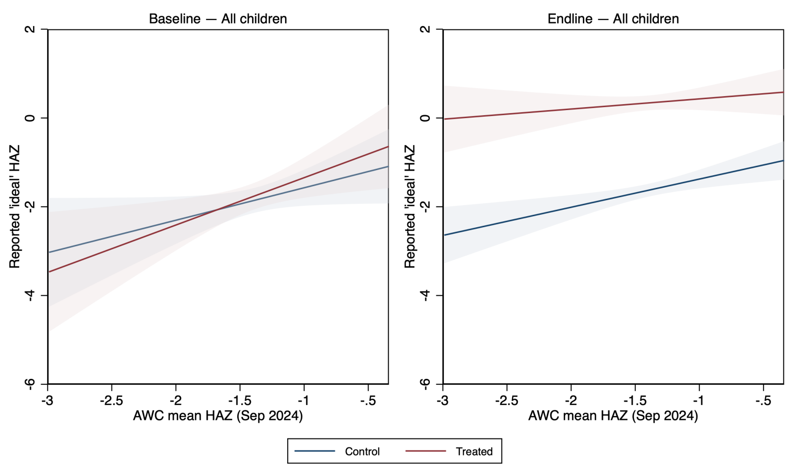
Notes: The top panel shows the share of mothers classifying their child's height as "very short", "short", "normal", "tall" or "very tall" for stunted children. The bottom panel shows the share of mothers classifying their child's weight as "very underweight", "underweight", "normal", "overweight" or "very overweight" for underweight or wasted children. The numbers represent unadjusted proportions.

Figure 5. Local Reference Bias in Perceptions of Child Growth, at Baseline and Endline

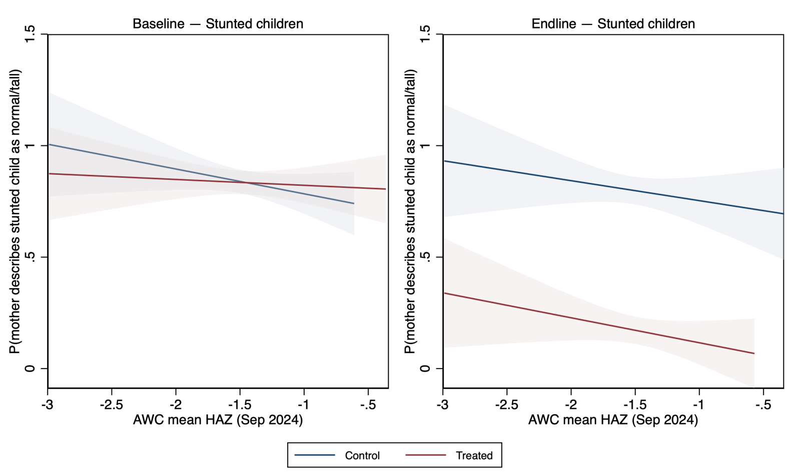
(a) Height Percentile Gap



(b) Perceived Ideal Height



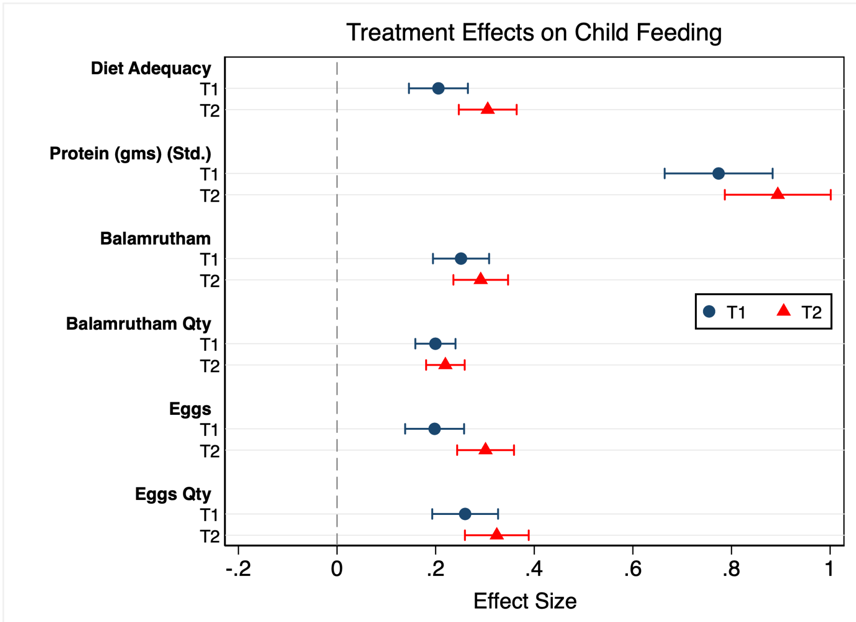
(c) Misclassification of Stunted Children



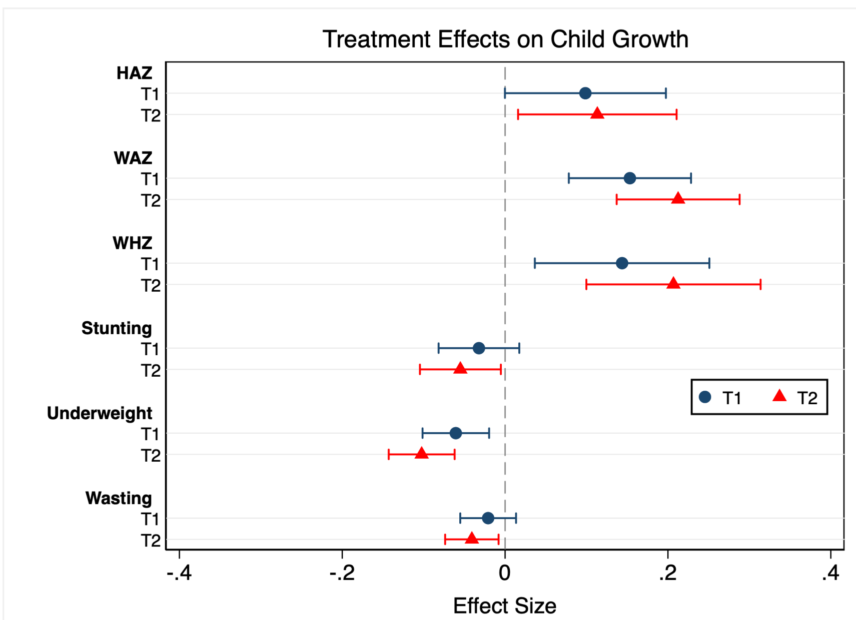
Notes: Each panel plots maternal perceptions against local mean height-for-age z-score (HAZ) within the Anganwadi Center, at baseline and endline. Panel (a) shows the height percentile gap (perceived – true), Panel (b) shows reported ideal height expressed as a z-score, and Panel (c) shows misclassification of stunted children, with stunting status defined separately for each survey round to reflect children's contemporaneous nutritional status at the time mothers reported their perceptions. Lines depict fitted values from an OLS regression with 95% confidence bands. Regression estimates with controls are reported in Tables 2 and 3.

Figure 6. Treatment Effects on Child Feeding and Growth Outcomes

(a)

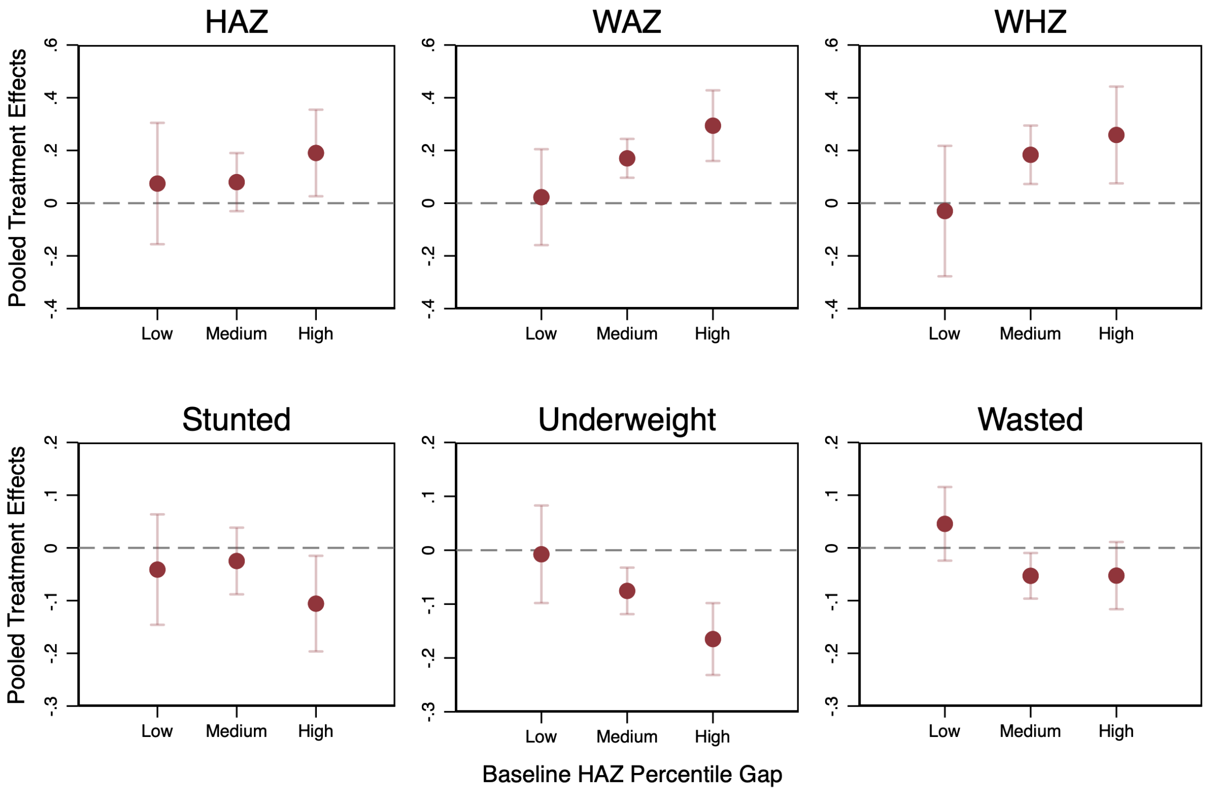


(b)



Notes: The figures present the treatment effect estimates of the belief-correction intervention (T1) and the belief-correction + knowledge intervention (T2) relative to the control group on child feeding and growth outcomes. The regressions include the standard set of controls: child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.

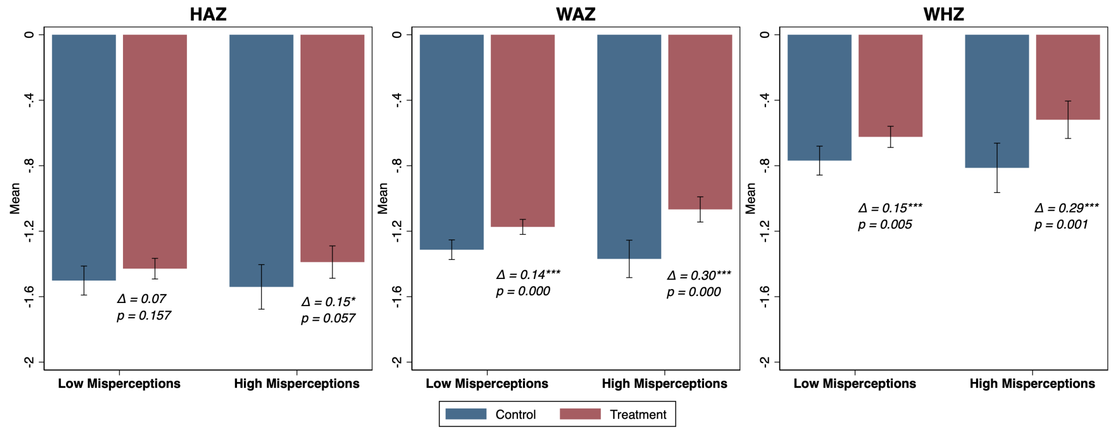
Figure 7. Heterogeneity in Treatment Effects by Baseline Height Percentile Gap



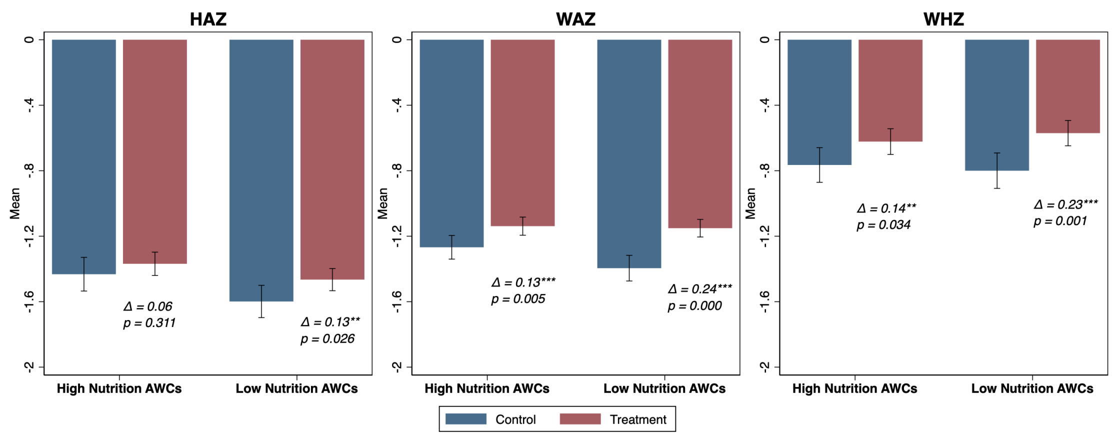
Notes: Plots of pooled treatment effect estimates on anthropometric outcomes by baseline height percentile gap categories: Low (gap < 10), Medium ($10 \leq$ gap < 50), and High (gap ≥ 50). Each point represents an ANCOVA coefficient conditional on baseline outcome and controls; vertical whiskers denote 95% confidence intervals. Standard errors are clustered at the AWC level. Regression estimates are reported in Table 8.

Figure 8. Heterogeneity in Treatment Effects on Child Anthropometric Z-scores

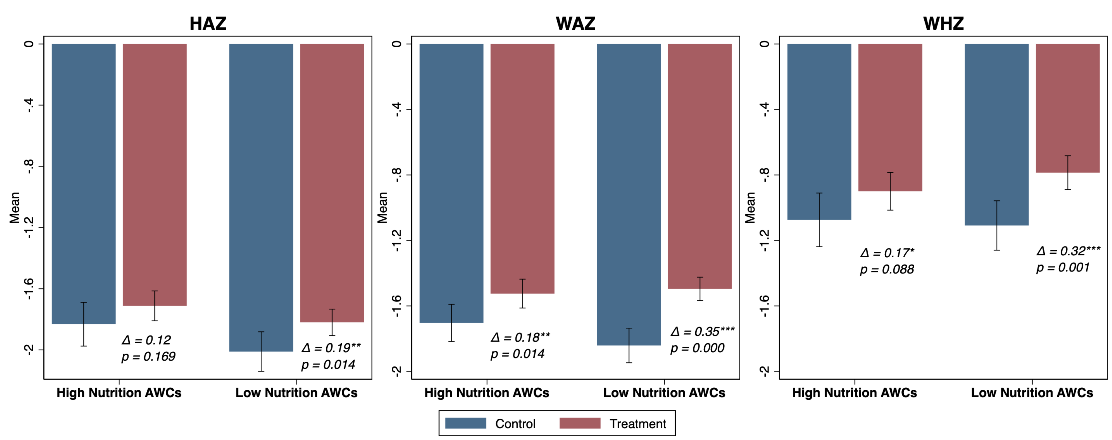
(a) By Baseline Misperceptions



(b) By Local Nutritional Environment (AWC Mean HAZ)

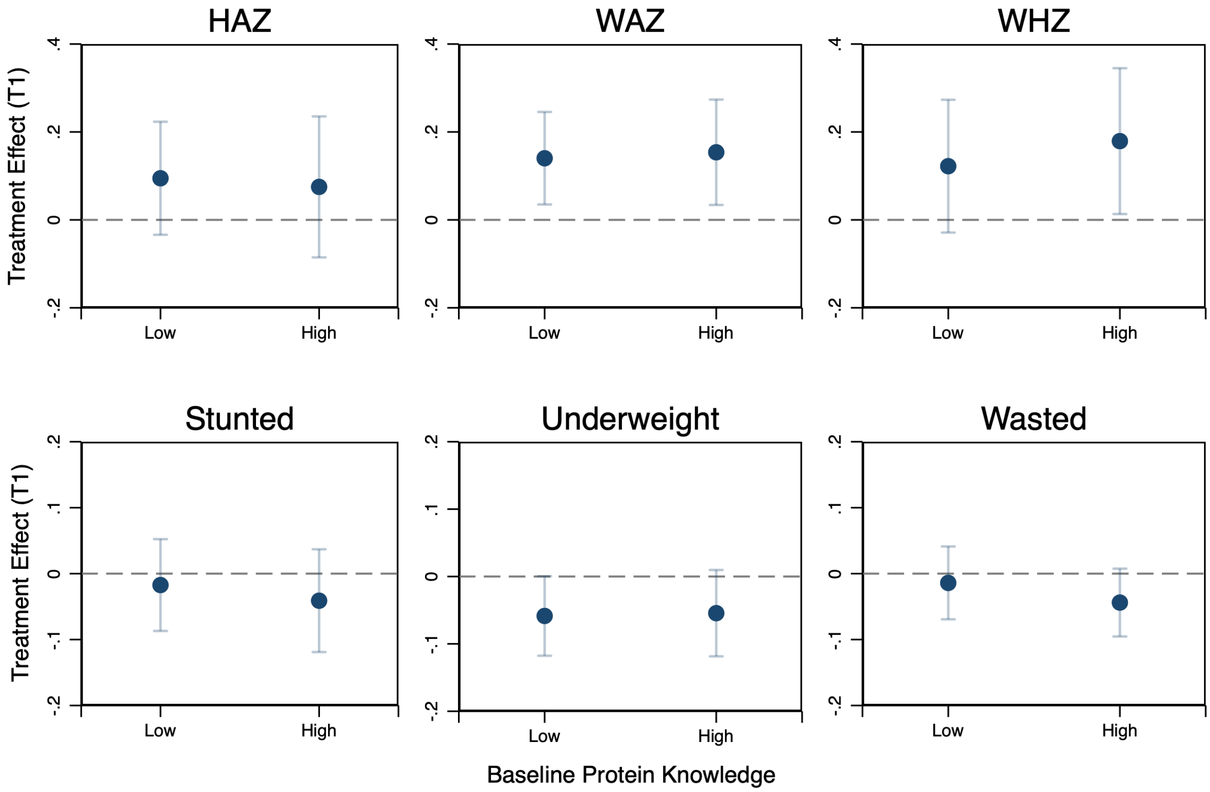


(c) By Local Nutritional Environment, Malnourished Children



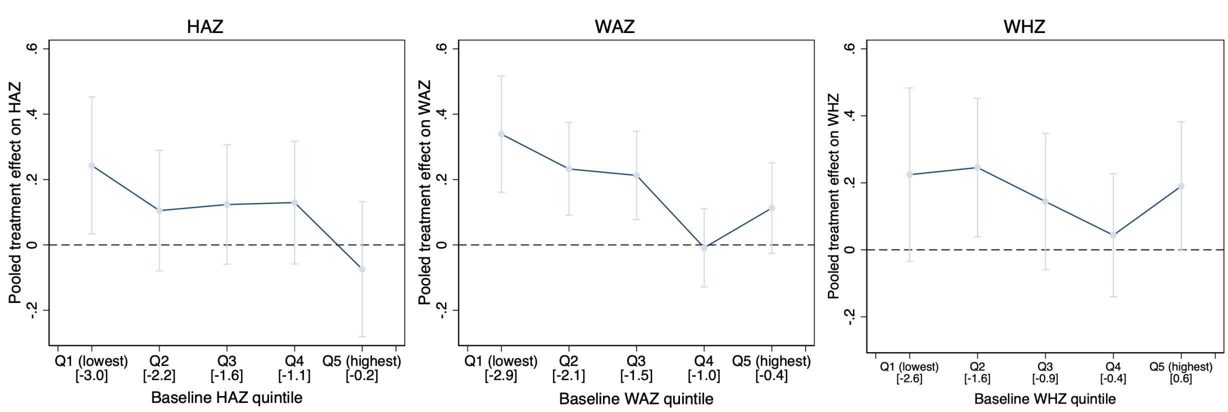
Notes: Plots of means and treatment effect estimates on child anthropometric outcomes across different sub-groups. Panel A compares effects for mothers with high versus low baseline height percentile gap: Low (gap < 50), and High (gap ≥ 50). Relative to Figure 7 which used three categories, the low and medium gap groups are combined here for ease of presentation. Panel B compares outcomes for children in low- versus high-nutrition Anganwadi Centers (AWCs), defined by mean baseline HAZ. Panel C focuses on children who were malnourished at baseline (stunted, underweight, or wasted), comparing those in low- versus high-nutrition AWCs. Δs represent coefficients from an ANCOVA regression conditional on baseline outcome and controls; vertical whiskers denote 95% CIs. Standard errors are clustered at the AWC level.

Figure 9. Heterogeneity in Treatment 1 Effects by Baseline Protein Knowledge



Notes: Plots of treatment effect estimates (T1) on anthropometric outcomes by baseline knowledge on effectiveness of protein-rich foods relative to staple foods in promoting child growth. The "High knowledge" group includes mothers who ranked protein-rich foods above staples at baseline and "Low knowledge" includes those who did not. Each point represents an ANCOVA coefficient conditional on baseline outcome and controls; vertical whiskers denote 95% confidence intervals. Standard errors are clustered at the AWC level.

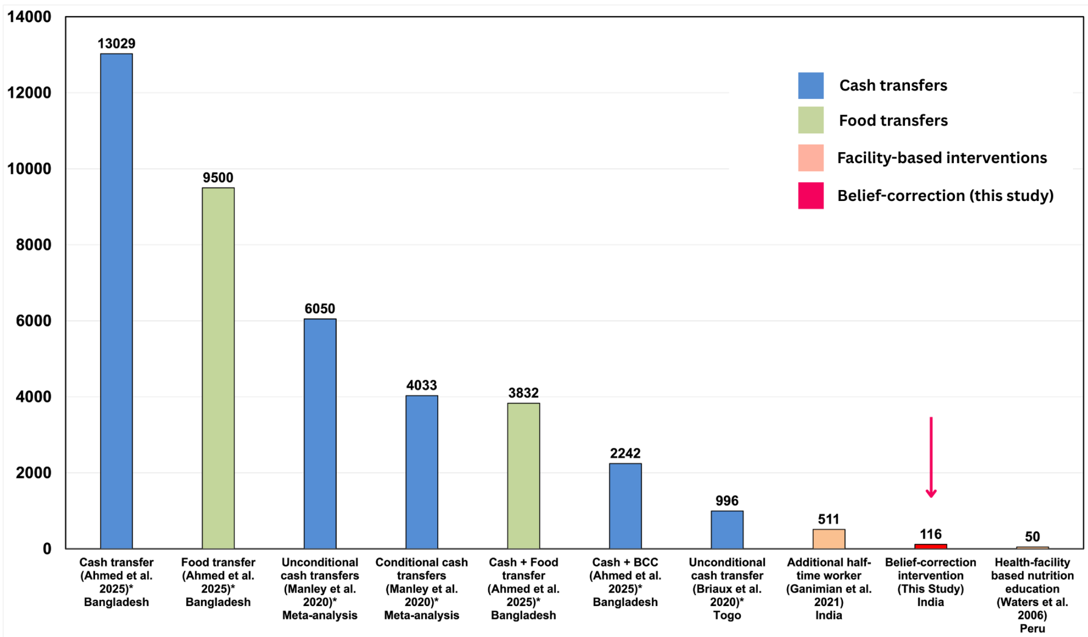
Figure 10. Distributional Treatment Effects on Child Growth



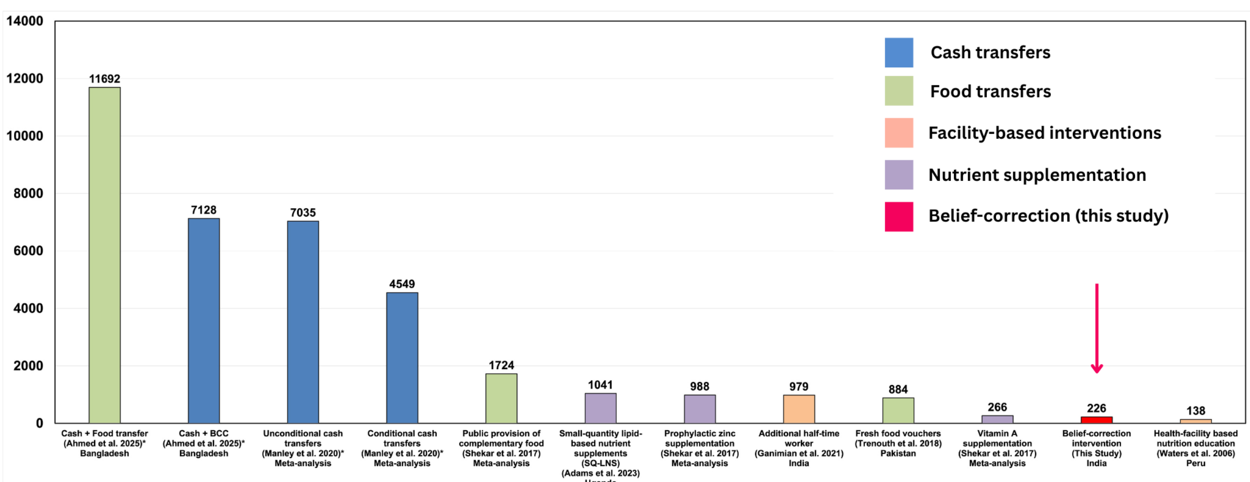
Notes: Pooled treatment effects on height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ), estimated separately by quintiles of the baseline anthropometric distribution. Vertical bars show 95% confidence intervals.

Figure 11. Cost-effectiveness Relative to Other Nutrition Interventions

(a) Cost per 1 SD Increase in HAZ



(b) Cost per Stunting Case Averted



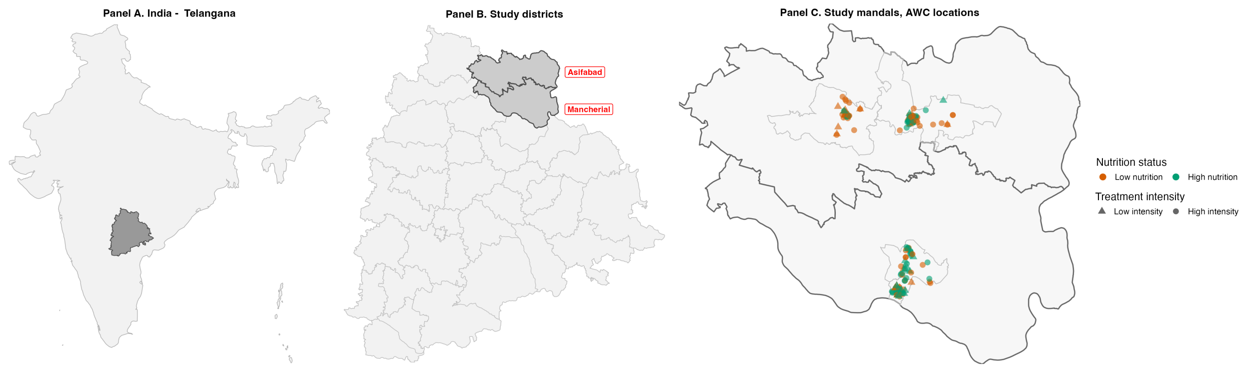
Notes: Notes: This figure benchmarks the cost-effectiveness of the belief-correction intervention against a range of nutrition and transfer programs from the literature. Panel A reports the cost per 1 SD increase in height-for-age (HAZ), and Panel B reports the cost per stunting case averted. "*" denotes studies that do not specify full programmatic costs, and therefore represent lower-bound estimates based only on transfer values.

Supplemental Appendix

Contents

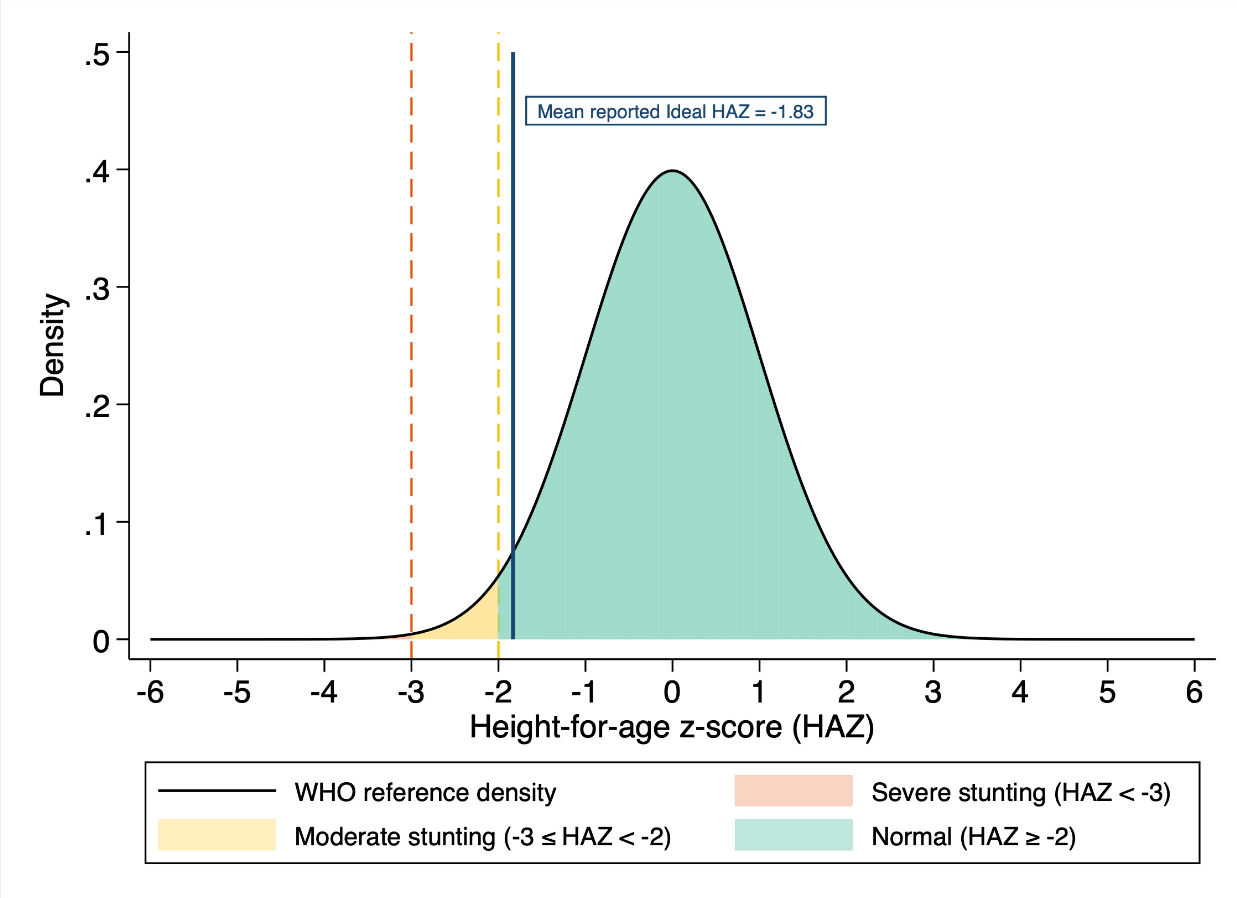
A Additional Figures

Appendix Figure A1. Study Setting



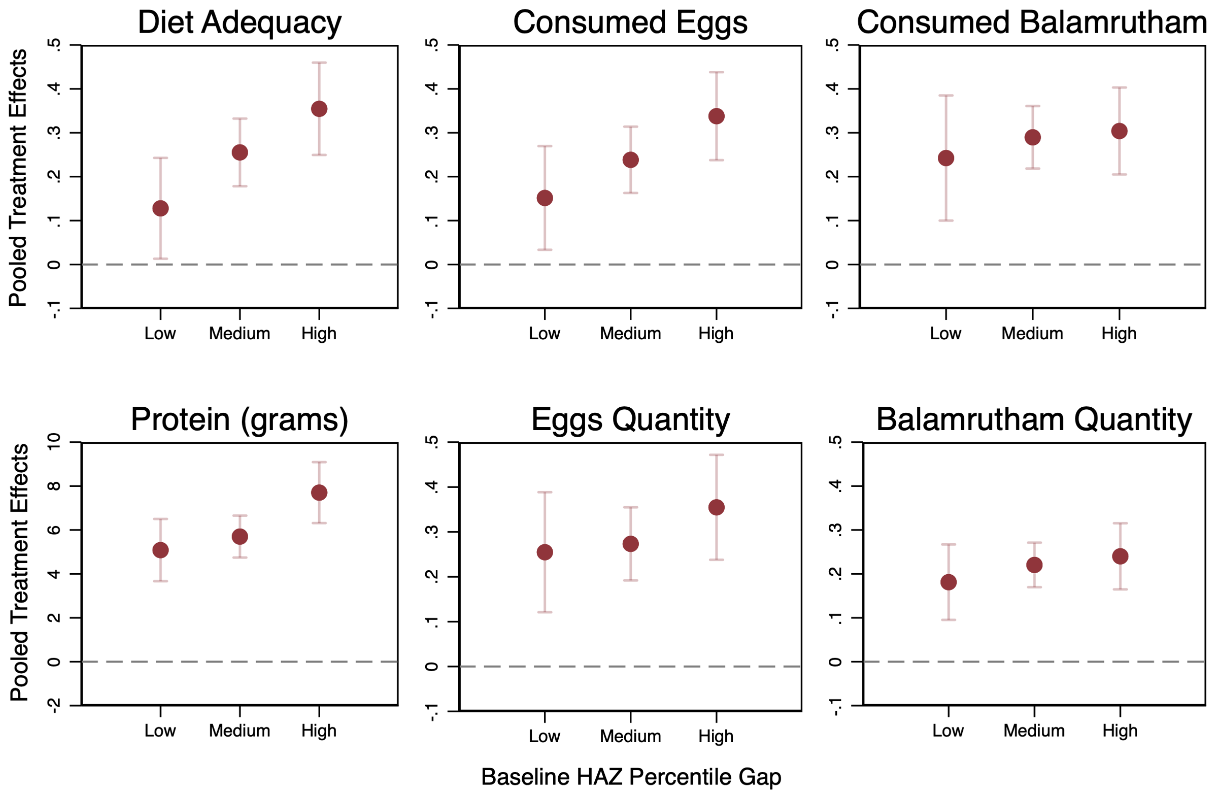
Notes: Map of Telangana indicating the two study districts (Mancherial and Asifabad) and locations of sampled Anganwadi Centers (AWCs). Light-gray boundaries in Panel C reflect administrative mandals (sub-districts) as of 2025. Orange-colored markers indicate low-nutrition AWCs and green-colored markers indicate high-nutrition AWCs, based on average child height- and weight-for-age z-scores.

Appendix Figure A2. Perceived Ideal Height Relative to WHO Growth Standards



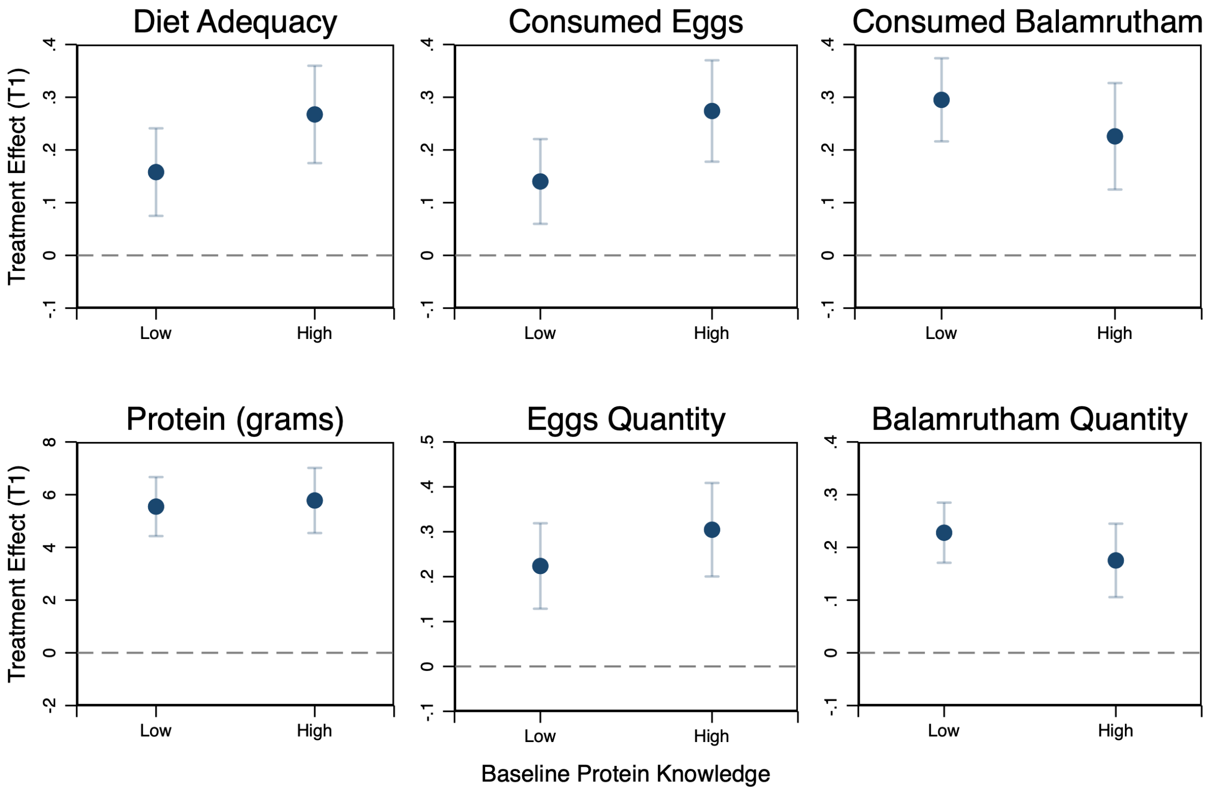
Notes: Histogram of height-for-age z-scores based on WHO growth standards. Orange = severe stunting, Yellow = moderate stunting, Green = normal height. Mothers reported what they considered to be the "ideal" height for their child's age in centimeters, which was converted to a WHO height-for-age z-score. The navy vertical line indicates the mean reported ideal z-score.

Appendix Figure A3. Heterogeneity in Treatment Effects by Baseline Height Percentile Gap, Child Diet Outcomes



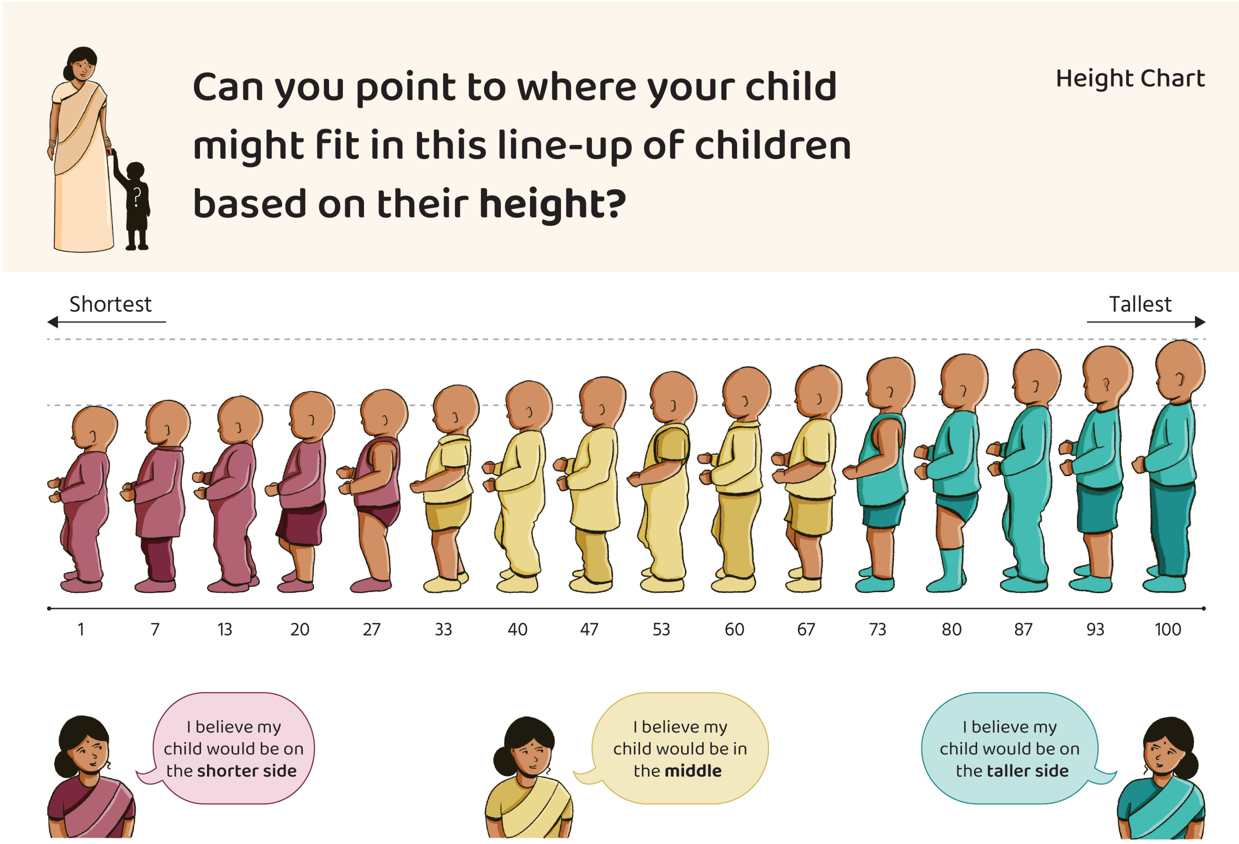
Notes: Plots of pooled treatment effect estimates on child feeding outcomes by baseline height percentile gap categories: Low (gap < 10), Medium ($10 \leq$ gap < 50), and High (gap ≥ 50). Each point represents an ANCOVA coefficient conditional on baseline outcome and controls; vertical whiskers denote 95% confidence intervals. Standard errors are clustered at the AWC level. Regression estimates are reported in Table 8.

Appendix Figure A4. Heterogeneity in Treatment 1 Effects by Baseline Protein Knowledge, Child Diet Outcomes



Notes: Plots of treatment effect estimates (T1) on child feeding outcomes by baseline knowledge on effectiveness of protein-rich foods relative to staple foods in promoting child growth. The "High knowledge" group includes mothers who ranked protein-rich foods above staples at baseline and "Low knowledge" includes those who did not. Each point represents an ANCOVA coefficient conditional on baseline outcome and controls; vertical whiskers denote 95% confidence intervals. Standard errors are clustered at the AWC level.

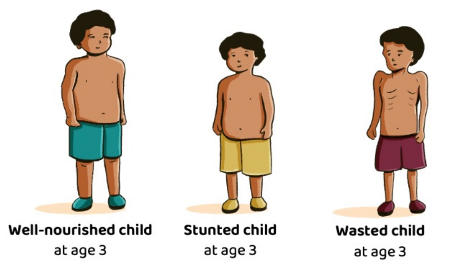
Appendix Figure A5. Visual Aid for Delivering Percentile Feedback



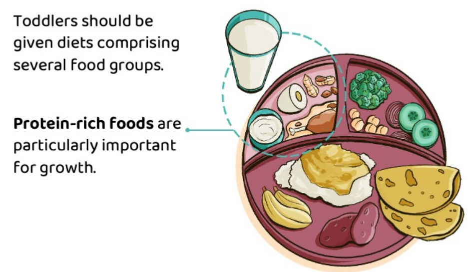
Notes: Illustrative picture card used by enumerators to elicit mothers' perceived height-for-age percentiles and provide percentile feedback (for T1 and T2). The version shown to respondents was in Telugu. An analogous card was used for weight. Design credit: Revisual Labs.

Appendix Figure A6. Selected Clips from Animated Video for Treatment 2

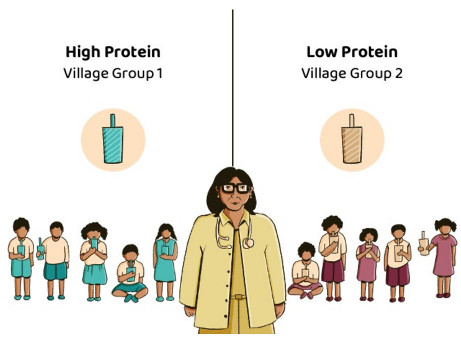
(a)



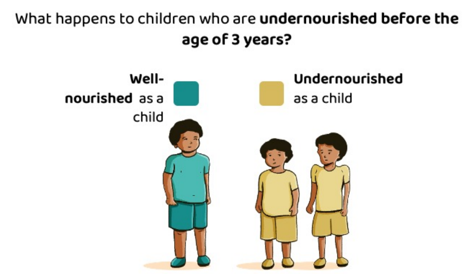
(b)



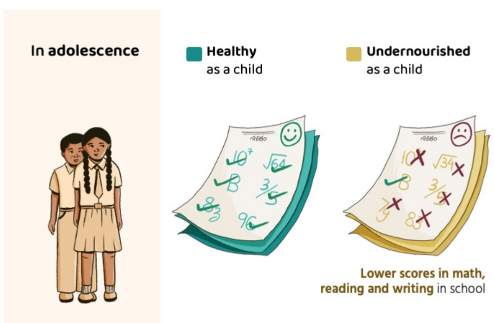
(c)



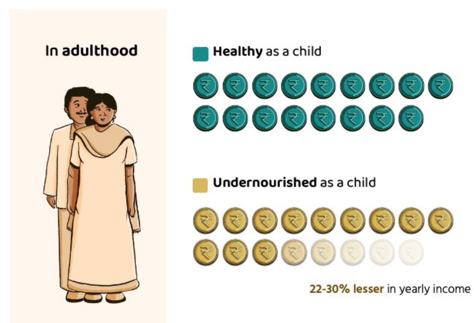
(d)



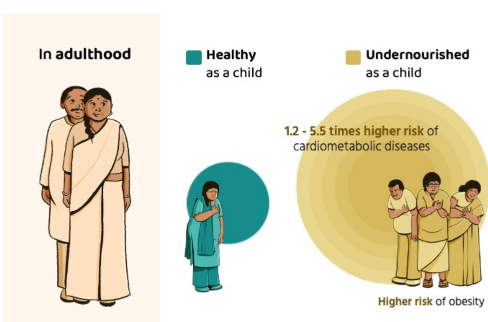
(e)



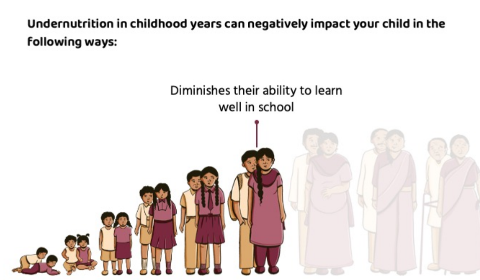
(f)



(g)

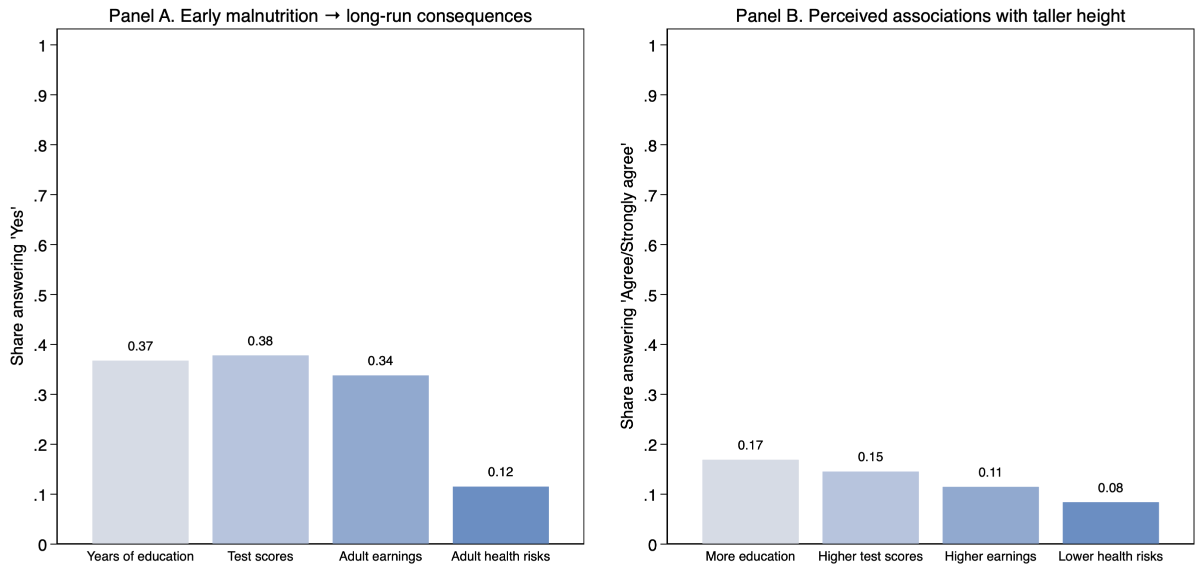


(h)



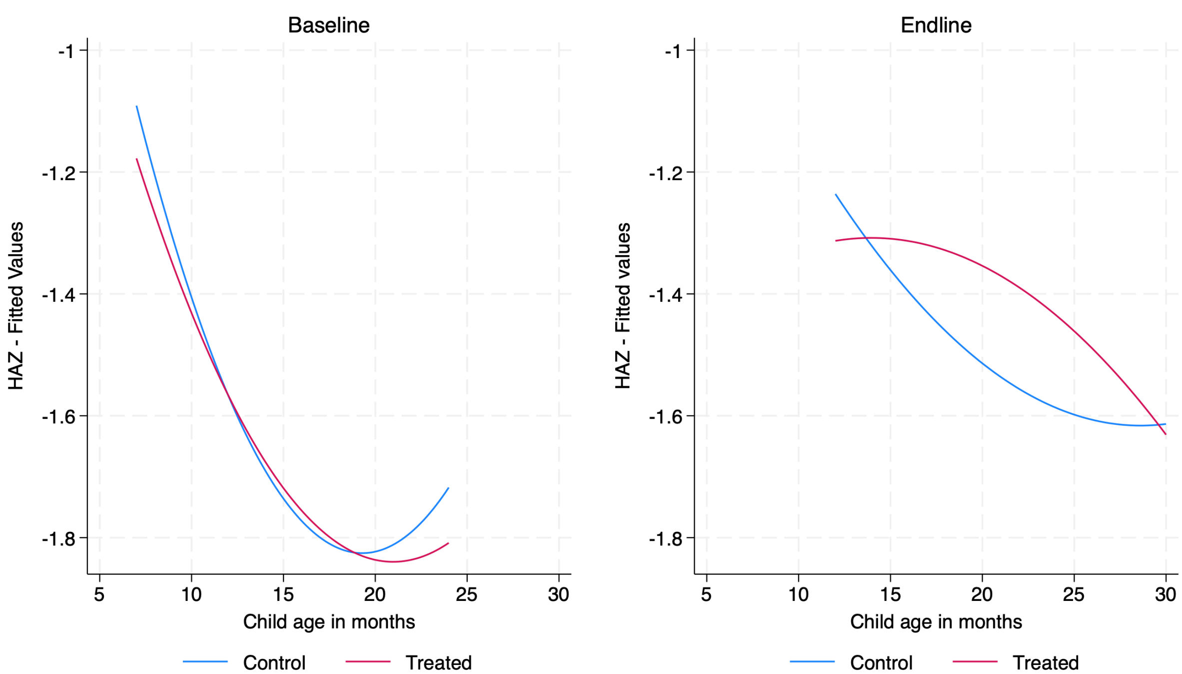
Notes: Screenshots from the animated video used in Treatment 2. Panels illustrate contrasting life trajectories of well-nourished versus malnourished children, emphasizing long-term consequences for education, earnings, and health. The version shown to respondents was in Telugu. Video duration: 5 minutes. Design credit: Revisual Labs.

Appendix Figure A7. Beliefs on Height and Consequences of Malnutrition



Notes: The bars plot baseline maternal beliefs about the long-term consequences of child height. Bars represent the share of mothers reporting associations with education, test scores, earnings, and health. Outcomes coded as binary indicators.

Appendix Figure A8. Age Profiles of Child Height-for-Age at Baseline and Endline



Notes: This figure plots quadratic fitted values of height-for-age z-scores (HAZ) by child age in months for treatment and control groups at baseline (left panel) and endline (right panel).

B Additional Tables

Appendix Table A1. Baseline Summary Statistics and Balance

	Full Sample				Control	T1	T2	T1 - C	T2 - C	T1 - T2	F-test for balance across all 3 groups	
	Mean	SD	Min	Max	Mean	Mean	Mean	p-val T1 = C	p-val T2 = C	p-val T1 = T2	F-stat	p-val
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Child Characteristics												
Age (in months)	16.08	5.26	7.00	24.00	16.38	16.04	15.80	0.287	0.082	0.482	1.548	0.213
Female	0.50	0.50	0.00	1.00	0.51	0.48	0.50	0.245	0.642	0.488	0.683	0.505
Birth Order	1.70	0.74	1.00	5.00	1.65	1.72	1.72	0.140	0.158	0.921	1.450	0.235
Mother Characteristics												
Age (years)	26.29	4.17	17.00	45.00	26.29	26.15	26.43	0.616	0.592	0.273	0.603	0.548
Education (years)	11.31	4.36	0.00	19.00	11.24	11.37	11.33	0.624	0.727	0.892	0.127	0.880
Has secondary education +	0.78	0.42	0.00	1.00	0.76	0.78	0.79	0.412	0.188	0.621	0.883	0.414
Number of Children	1.74	0.75	1.00	5.00	1.70	1.77	1.75	0.188	0.324	0.732	0.969	0.380
Household Characteristics												
Number of household members	5.19	1.98	3.00	17.00	5.15	5.36	5.06	0.104	0.450	0.017	2.931	0.054
Monthly household income (USD)	266.04	210.10	34.71	2314.01	261.32	271.90	265.07	0.419	0.773	0.616	0.330	0.719
Monthly household income per-capita (USD)	53.86	39.65	7.71	385.67	53.53	53.69	54.37	0.950	0.725	0.786	0.069	0.933
Poverty Probability Index (PPI) Score	62.80	14.28	14.00	85.00	62.24	63.04	63.12	0.367	0.332	0.921	0.588	0.556
PPI Index - Low wealth	0.60	0.49	0.00	1.00	0.61	0.61	0.57	0.954	0.240	0.220	0.958	0.384
Household toilet	0.91	0.28	0.00	1.00	0.91	0.91	0.92	0.982	0.367	0.357	0.570	0.565
Caste - SC	0.19	0.39	0.00	1.00	0.17	0.19	0.20	0.401	0.259	0.775	0.698	0.498
Caste - ST	0.06	0.25	0.00	1.00	0.06	0.06	0.07	0.775	0.732	0.533	0.195	0.823
Caste - OBC	0.62	0.49	0.00	1.00	0.64	0.63	0.60	0.709	0.153	0.295	1.088	0.337
Anthropometric Variables												
Mother's Weight (kg)	51.92	11.93	27.05	99.99	51.46	52.30	52.00	0.269	0.468	0.692	0.632	0.532
Mother's Height (cm)	152.39	5.70	132.30	170.20	152.54	152.58	152.05	0.910	0.164	0.133	1.435	0.238
Mother Height <150cm	0.31	0.46	0.00	1.00	0.30	0.31	0.32	0.840	0.525	0.667	0.210	0.811
Child Height-for-age Z-score (HAZ)	-1.66	1.15	-5.81	2.82	-1.66	-1.65	-1.67	0.931	0.880	0.822	0.026	0.974
Child Weight-for-age Z-score (WAZ)	-1.57	1.02	-5.54	1.68	-1.58	-1.57	-1.57	0.858	0.896	0.959	0.017	0.983
Child Weight-for-height Z-score (WHZ)	-0.99	1.28	-5.97	4.97	-1.02	-1.00	-0.96	0.847	0.521	0.666	0.216	0.806
Child Stunted	0.38	0.49	0.00	1.00	0.37	0.39	0.37	0.404	0.945	0.447	0.424	0.654
Child Underweight	0.33	0.47	0.00	1.00	0.34	0.32	0.32	0.475	0.626	0.821	0.267	0.766
Child Wasted	0.21	0.40	0.00	1.00	0.20	0.22	0.21	0.409	0.685	0.676	0.341	0.711
Child MUAC	13.94	1.10	10.70	18.00	13.96	13.96	13.91	0.922	0.460	0.545	0.306	0.736
Child Feeding (24-hour diet recall)												
Number of meals	3.32	1.07	0.00	7.00	3.37	3.29	3.29	0.228	0.214	0.986	1.004	0.367
Meets minimum frequency of meals criteria	0.74	0.44	0.00	1.00	0.74	0.74	0.75	0.851	0.657	0.800	0.099	0.906
Number of food groups	4.60	1.32	1.00	8.00	4.60	4.57	4.62	0.645	0.816	0.497	0.239	0.788
Meets minimum diet diversity criteria	0.46	0.50	0.00	1.00	0.46	0.45	0.47	0.800	0.748	0.567	0.164	0.848
Meets minimum diet adequacy criteria	0.39	0.49	0.00	1.00	0.40	0.39	0.40	0.753	0.967	0.786	0.058	0.944
Consumed any protein source (non-dairy)	0.84	0.37	0.00	1.00	0.84	0.83	0.84	0.493	0.913	0.430	0.362	0.696
Protein consumed (gms)	8.78	6.86	0.00	38.45	8.70	8.92	8.74	0.612	0.934	0.677	0.145	0.865
Child Illness (14-day period before survey date)												
Any illness	0.62	0.48	0.00	1.00	0.63	0.63	0.61	0.806	0.397	0.550	0.378	0.685
Diarrhea	0.14	0.35	0.00	1.00	0.15	0.13	0.14	0.200	0.512	0.531	0.826	0.438
Sample Sizes	1527				517	504	506					
F-test of joint significance												
F-stat								0.054	0.096	0.263		
p-val								0.816	0.756	0.608		

Notes: This table reports baseline characteristics of the study sample (N = 1,527), disaggregated by random assignment to Treatment 1 (T1), Treatment 2 (T2), and the control group (C). Child anthropometric z-scores are calculated using WHO growth standards. "Low wealth" is defined as households with Poverty Probability Index scores in the bottom half of the distribution. F-tests of joint significance, and p-values for differences in means between groups, reported in columns (8)–(12) present omnibus balance tests pooling all baseline variables, separately for each pairwise comparison (T1 vs C, T2 vs C, and T1 vs T2). The F-tests in columns (11-12) reports the joint test of equality of means across for each variable all three groups. Robust standard errors are reported.

Appendix Table A2. Correlates of Misperceptions

Dependent Variable:	Height Percentile Gap (1)	Ideal Child Height (Z) (2)	Describe child's height as "normal" or "tall" (3)
Female	-3.120**	0.428***	-0.056**
	(1.503)	(0.162)	(0.028)
Age category (16-24m)	7.738***	-0.621***	0.025
	(1.542)	(0.168)	(0.032)
First Child	1.280	0.010	0.033
	(1.462)	(0.177)	(0.031)
Malnourished	7.193***	-0.718***	
	(1.482)	(0.188)	
Mother education (12+ years)	1.858	0.338*	0.045
	(1.530)	(0.190)	(0.034)
Household members (6+)	-1.724	-0.280	0.044
	(1.725)	(0.239)	(0.038)
Low wealth (PPI index)	-2.199	0.370	-0.017
	(1.760)	(0.240)	(0.038)
Below median per capita income	-1.811	-0.128	0.028
	(1.411)	(0.172)	(0.036)
Low AWC mean HAZ	5.318***	-0.261	0.079***
	(1.840)	(0.189)	(0.029)
Constant	25.281***	-1.465***	0.756***
	(2.340)	(0.318)	(0.054)
Observations	1,527	1,527	578
R-squared	0.056	0.033	0.024
Sample	All children	All children	Stunted children

Notes: AWC mean HAZ is from September 2024, just before the start of the baseline survey. Covariates include binary indicators of child-level (malnutrition status, age in months, sex), mother-level (education in years), household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score), and Anganwadi-level (average child HAZ) characteristics. Robust standard errors are reported.
$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Appendix Table A3. Treatment Effects: Other Outcomes

	Beliefs			Diet			Health		
Dependent Variable:	Weight percentile gap	Ideal child weight (Z)	Describe child's weight as "normal"	Diet diversity	Quantity of Balamrutham in last calendar month (gms)	Quantity of eggs in last calendar month (number)	Mid upper arm circumference	Illness in last 2 weeks	Cognition z-score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment 1	-21.381***	0.297***	-0.362***	0.198***	219.002***	1.664***	0.203***	-0.088***	0.052
	(1.240)	(0.061)	(0.066)	(0.034)	(44.764)	(0.365)	(0.065)	(0.031)	(0.064)
Observations	1,021	1,021	234	1,021	1,021	1,021	1,020	1,021	1,021
R-squared	0.364	0.317	0.242	0.090	0.061	0.093	0.369	0.064	0.171
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All children	All children	Underweight/ wasted children	All children	All children	All children	All children	All children	All children
Control Mean - EL	22.51	0.220	0.540	0.430	1181	11.81	14.26	0.640	0.420
% Change T			-67%	46%	19%	14%	1%	-14%	

Notes: This table reports the effects of the belief-correction intervention (Treatment 1) relative to the control group on other belief, diet, and health outcomes. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Appendix Table A4. Cross-arm Treatment Effects: Feeding Practices and Nutritional Investments

	24-hour diet recall						Willingness-to-pay for bundle of protein-rich foods (Rs.)	Household food expenditure in last month (Rs.)
Dependent Variable:	Diet adequacy	Total protein consumed (gm)	Consumed Balamrutham	Quantity of Balamrutham (bowls)	Consumed eggs	Quantity of eggs (number)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment 1	0.204***	5.611***	0.252***	0.200***	0.196***	0.257***	1,086.533***	94.702
	(0.032)	(0.420)	(0.032)	(0.023)	(0.032)	(0.036)	(101.243)	(193.460)
Treatment 2	0.299***	6.481***	0.294***	0.222***	0.295***	0.321***	1,261.713***	165.765
	(0.034)	(0.429)	(0.031)	(0.023)	(0.032)	(0.036)	(95.496)	(187.292)
Observations	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,513
R-squared	0.104	0.226	0.112	0.128	0.103	0.110	0.173	0.271
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean - EL	0.340	7.830	0.510	0.250	0.410	0.430	1331	5849
% Change T1	60%	72%	49%	80%	48%	60%	82%	2%
% Change T2	90%	83%	57%	88%	73%	75%	95%	3%
Pooled Treatment Effect	0.251***	6.042***	0.273***	0.211***	0.245***	0.289***	1170***	129.9
Pooled SE	(0.030)	(0.380)	(0.029)	(0.021)	(0.028)	(0.033)	(84.080)	(167.5)
T1 = T2 p-val	0.001	0.022	0.110	0.258	0.001	0.037	0.092	0.694

Notes: This table reports the effects of the belief-correction intervention (Treatment 1) and the belief-correction + knowledge intervention (Treatment 2) relative to the control group on child feeding practices and nutritional investments. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Appendix Table A5. Cross-arm Treatment Effects: Other Outcomes

	Beliefs			Diet			Health		
Dependent Variable:	Weight percentile gap	Ideal child weight (Z)	Describe child's weight as "normal"	Diet diversity	Quantity of Balamrutham in last calendar month (gms)	Quantity of eggs in last calendar month (number)	Mid upper arm circumference	Illness in last 2 weeks	Cognition z-score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment 1	-21.620***	0.299***	-0.363***	0.198***	222.857***	1.703***	0.213***	-0.085***	0.052
	(1.233)	(0.062)	(0.065)	(0.033)	(44.837)	(0.368)	(0.064)	(0.031)	(0.064)
Treatment 2	-22.626***	0.339***	-0.326***	0.276***	267.117***	2.955***	0.274***	-0.090***	0.097
	(1.231)	(0.057)	(0.073)	(0.034)	(45.543)	(0.379)	(0.061)	(0.034)	(0.063)
Observations	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527
R-squared	0.333	0.288	0.231	0.114	0.058	0.093	0.397	0.042	0.171
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean - EL	22.51	0.220	0.540	0.430	1181	11.81	14.26	0.640	0.420
% Change T1			-67%	46%	19%	14%	1%	-13%	
% Change T2			-60%	64%	23%	25%	2%	-14%	
Pooled Treatment Effect	-22.12***	0.319***	-0.348***	0.237***	244.8***	2.323***	0.243***	-0.0880***	0.0740
Pooled SE	(1.112)	(0.054)	(0.060)	(0.031)	(40.520)	(0.338)	(0.056)	(0.028)	(0.057)
T1 = T2 p-val	0.342	0.431	0.587	0.007	0.269	0.000	0.279	0.879	0.403

Notes: This table reports the effects of the belief-correction intervention (Treatment 1) and the belief-correction + knowledge intervention (Treatment 2) relative to the control group on other belief, diet, and health outcomes. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Appendix Table A6. Robustness of Heterogeneity Estimates by Baseline Height Percentile Gap

Correlate controlled for	None (Base Specification)	Child Sex	Child Age Category	Baseline Malnutrition Status	Mother Education	AWW Informed Low Height	AWW Informed Low Weight	AWW Education	Low Nutrition AWC	AWC Mean HAZ
PANEL A: Height-for-age z-score (HAZ)										
Treated	0.070	0.004	0.005	0.002	0.013	0.046	0.040	0.064	0.021	0.022
	(0.112)	(0.116)	(0.173)	(0.119)	(0.123)	(0.112)	(0.116)	(0.113)	(0.115)	(0.183)
Medium Baseline HAZ Percentile Gap	0.000	0.004	0.006	0.011	-0.001	0.002	-0.003	0.001	0.017	0.017
	(0.108)	(0.108)	(0.108)	(0.108)	(0.108)	(0.107)	(0.108)	(0.108)	(0.108)	(0.108)
High Baseline HAZ Percentile Gap	-0.038	-0.042	-0.031	-0.021	-0.040	-0.056	-0.042	-0.037	-0.010	0.001
	(0.108)	(0.107)	(0.107)	(0.107)	(0.108)	(0.108)	(0.108)	(0.108)	(0.109)	(0.107)
Treated#Medium Baseline HAZ Percentile Gap	0.004	0.001	-0.006	-0.010	0.007	-0.006	0.006	0.005	-0.013	-0.015
	(0.126)	(0.126)	(0.128)	(0.129)	(0.126)	(0.125)	(0.126)	(0.126)	(0.127)	(0.126)
Treated#High Baseline HAZ Percentile Gap	0.082	0.088	0.071	0.057	0.081	0.093	0.089	0.081	0.059	0.067
	(0.126)	(0.125)	(0.127)	(0.126)	(0.125)	(0.126)	(0.126)	(0.126)	(0.128)	(0.125)
R-squared	0.414	0.415	0.415	0.416	0.415	0.417	0.415	0.415	0.416	0.423
PANEL B: Weight-for-age z-score (WAZ)										
Treated	0.065	0.086	0.103	-0.006	-0.007	0.059	0.046	0.067	0.026	-0.035
	(0.087)	(0.091)	(0.120)	(0.085)	(0.093)	(0.088)	(0.088)	(0.087)	(0.087)	(0.137)
Medium Baseline HAZ Percentile Gap	-0.002	-0.004	-0.006	0.010	0.000	-0.002	-0.016	-0.002	0.008	0.003
	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.080)	(0.079)	(0.081)	(0.080)	(0.081)
High Baseline HAZ Percentile Gap	-0.053	-0.052	-0.057	-0.037	-0.048	-0.066	-0.074	-0.053	-0.035	-0.041
	(0.095)	(0.095)	(0.096)	(0.095)	(0.096)	(0.095)	(0.094)	(0.095)	(0.094)	(0.096)
Treated#Medium Baseline HAZ Percentile Gap	0.099	0.100	0.104	0.076	0.096	0.098	0.099	0.099	0.087	0.092
	(0.097)	(0.097)	(0.098)	(0.099)	(0.097)	(0.096)	(0.096)	(0.097)	(0.096)	(0.096)
Treated#High Baseline HAZ Percentile Gap	0.236**	0.234**	0.242**	0.205*	0.228**	0.236**	0.229**	0.236**	0.217**	0.224**
	(0.103)	(0.103)	(0.106)	(0.105)	(0.104)	(0.103)	(0.102)	(0.103)	(0.103)	(0.103)
R-squared	0.553	0.553	0.553	0.555	0.554	0.555	0.559	0.553	0.554	0.554
PANEL C: Weight-for-height z-score (WHZ)										
Treated	0.041	0.132	0.126	-0.009	-0.027	0.050	0.036	0.049	0.025	-0.022
	(0.117)	(0.127)	(0.159)	(0.117)	(0.124)	(0.118)	(0.117)	(0.123)	(0.125)	(0.178)
Medium Baseline HAZ Percentile Gap	-0.018	-0.023	-0.025	-0.009	-0.014	-0.018	-0.034	-0.018	-0.017	-0.025
	(0.112)	(0.112)	(0.113)	(0.112)	(0.112)	(0.112)	(0.111)	(0.112)	(0.112)	(0.112)
High Baseline HAZ Percentile Gap	-0.052	-0.047	-0.061	-0.041	-0.045	-0.057	-0.077	-0.052	-0.050	-0.068
	(0.124)	(0.123)	(0.126)	(0.123)	(0.126)	(0.125)	(0.123)	(0.124)	(0.124)	(0.124)
Treated#Medium Baseline HAZ Percentile Gap	0.139	0.143	0.152	0.120	0.134	0.146	0.137	0.139	0.137	0.146
	(0.133)	(0.133)	(0.136)	(0.136)	(0.133)	(0.134)	(0.132)	(0.133)	(0.132)	(0.133)
Treated#High Baseline HAZ Percentile Gap	0.252*	0.243*	0.267*	0.229	0.242	0.243*	0.237	0.252*	0.245*	0.251*
	(0.147)	(0.146)	(0.153)	(0.150)	(0.148)	(0.147)	(0.145)	(0.147)	(0.147)	(0.146)
R-squared	0.325	0.327	0.326	0.326	0.326	0.327	0.333	0.325	0.325	0.328
Observations	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527	1,527
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports heterogeneity in pooled treatment effects on child anthropometric z-scores by baseline height percentile gap, controlling sequentially for various correlates of misperceptions and their interactions with treatment status. Panels A–C report results for height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ), respectively. Column 1 presents the base specification including the standard control variables but no additional correlate. Each subsequent column controls for one correlate of baseline misperceptions and its interaction with the pooled treatment indicator. All columns include the standard set of controls: child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

C Robustness: Alternative Specifications for Anthropometric Outcomes

To assess the robustness of the main anthropometric results, I re-estimate treatment effects using two alternative specifications discussed in Section 3.4. First, I estimate a difference-in-differences (DID) model exploiting the panel nature of the data, comparing changes in outcomes between baseline and endline across treatment and control groups. Second, I replicate the main ANCOVA specification using non-clustered robust standard errors (as pre-specified) without clustering at the AWC level. In both cases, results are substantively similar to the main estimates reported in Table 7, confirming that inference is not sensitive to model specification or the choice of standard-error adjustment.

Appendix Table A7. Robustness: Difference-in-Differences Estimates for Anthropometric Outcomes

	Continuous			**Binary**		
Dependent Variable:	HAZ (1)	WAZ (2)	WHZ (3)	Stunted (4)	Underweight (5)	Wasted (6)
Treatment 1	-0.004	0.006	0.015	0.025	-0.018	0.020
	(0.021)	(0.016)	(0.031)	(0.021)	(0.019)	(0.020)
Endline	0.136***	0.252***	0.243***	-0.050*	-0.099***	-0.087***
	(0.045)	(0.033)	(0.053)	(0.026)	(0.018)	(0.021)
Treatment 1#Endline	0.092	0.142***	0.125	-0.053	-0.044*	-0.038
	(0.064)	(0.047)	(0.077)	(0.034)	(0.025)	(0.028)
Treatment 2	-0.007	0.007	0.033	0.000	-0.015	0.014
	(0.021)	(0.013)	(0.024)	(0.021)	(0.021)	(0.019)
Treatment 2#Endline	0.119**	0.201***	0.152**	-0.056*	-0.091***	-0.051*
	(0.060)	(0.045)	(0.069)	(0.034)	(0.030)	(0.027)
Observations	3,054	3,054	3,054	3,054	3,054	3,054
R-squared	0.668	0.760	0.612	0.393	0.446	0.308
Controls	Yes	Yes	Yes	Yes	Yes	Yes
T1#EL = T2#EL p-val	0.663	0.245	0.731	0.912	0.104	0.655

Notes: This table reports results from a difference-in-differences (DID) specification comparing changes in anthropometric outcomes between baseline and endline across the treatment and control groups. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Appendix Table A8. Robustness: Non-Clustered Robust Standard Errors for Anthropometric Outcomes

	Continuous			**Binary**		
Dependent Variable:	HAZ (1)	WAZ (2)	WHZ (3)	Stunted (4)	Underweight (5)	Wasted (6)
Treatment 1	0.084*	0.154***	0.155***	-0.028	-0.061***	-0.024
	(0.051)	(0.038)	(0.055)	(0.026)	(0.021)	(0.018)
Treatment 2	0.105**	0.215***	0.217***	-0.054**	-0.105***	-0.045***
	(0.050)	(0.039)	(0.055)	(0.026)	(0.021)	(0.017)
Observations	1,527	1,527	1,527	1,527	1,527	1,527
R-squared	0.414	0.551	0.323	0.243	0.316	0.135
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Control Mean - EL	-1.520	-1.330	-0.770	0.320	0.240	0.110
% Change T1				-9%	-25%	-22%
% Change T2				-17%	-44%	-41%
Pooled Treatment Effect	0.0950	0.184	0.186	-0.0410	-0.0830	-0.0350
Pooled SE	0.0440	0.0330	0.0480	0.0220	0.0180	0.0150
T1 = T2 p-val	0.673	0.109	0.259	0.310	0.0280	0.202

Notes: This table reproduces the main ANCOVA estimates from Table 7 using heteroskedasticity-robust (non-clustered) standard errors, without clustering at the AWC level, as pre-specified. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics.
$^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$

D Assessing Spillover Effects: Control Households in High- vs. Low- Treatment Intensity Centers

To examine whether the information provided to treated mothers generated within-village spillovers, I compare outcomes among control households located in high treatment intensity Anganwadi centers (AWCs) to those in low treatment intensity AWCs. Treatment intensity was varied experimentally at the AWC level. In high-intensity AWCs, approximately 75% of sampled children were assigned to one of the two treatment arms; in low-intensity AWCs, approximately 40% were assigned to treatment, with the remainder assigned to the control group.

If information diffused through social interactions, discussions among mothers, or observations of other children's growth monitoring, control households in high-intensity areas would exhibit improvements relative to those in low-intensity areas. I do not observe consistent evidence of spillover effects, likely because information was delivered privately to mothers in their homes, and the core reference-point feedback was personalized to each child, limiting opportunities for indirect exposure.

Table A12 reports statistically significant positive effects on two diet variables—quantities of Balamrutham and eggs consumed in the past month—for control households in high-intensity areas. However, these effects do not replicate for the corresponding 24-hour dietary-recall measures in Table A10, which show no detectable differences across high- and low-intensity AWCs. Taken together, the evidence on spillovers is weak and overall inconclusive—only 4 of 28 estimated coefficients are statistically significant—with no consistent pattern across belief, diet, and growth indicators. Any potential social learning effects, such as mothers adjusting their reference points after observing growth improvements among treated children, may take longer to materialize and would likely require additional intervention rounds for visible anthropometric changes within the community.

Appendix Table A9. Spillover Effects: Beliefs

Dependent Variable:	Height Percentile Gap (1)	Ideal Child Height (Z) (2)	Describe child's height as "normal" or "tall" (3)	T2 Components Knowledge score on long-term consequences (4)	Rank protein-rich foods higher than staples (5)
High Treatment Intensity	1.609	0.212	-0.112	-0.065	0.009
	(2.395)	(0.132)	(0.080)	(0.110)	(0.041)
Observations	517	517	165	517	517
R-squared	0.129	0.384	0.159	0.289	0.382
Controls	Yes	Yes	Yes	Yes	Yes
Sample	All children	All children	Stunted children	All children	All children

Notes: This table reports spillover effects on beliefs among control households by comparing outcomes in high treatment intensity Anganwadi centers (AWCs)—those with a larger share of treated children—to those in low treatment intensity AWCs. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Appendix Table A10. Spillover Effects: Feeding Practices and Nutritional Investments

Dependent Variable:	24-hour diet recall Diet adequacy (1)	Total protein consumed (gm) (2)	Consumed Balamrutham (3)	Quantity of Balamrutham (bowls) (4)	Consumed eggs (5)	Quantity of eggs (number) (6)	Willingness-to-pay for bundle of protein-rich foods (Rs.) (7)	Household food expenditure in last month (Rs.) (8)
High Treatment Intensity	0.050	0.759	0.075	0.053	-0.007	0.015	14.113	443.794
	(0.050)	(0.625)	(0.055)	(0.034)	(0.050)	(0.056)	(90.176)	(297.558)
Observations	517	517	517	517	517	517	517	510
R-squared	0.074	0.099	0.065	0.075	0.083	0.071	0.095	0.337
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports spillover effects on child feeding practices and nutritional investments among control households by comparing outcomes in high treatment intensity Anganwadi centers (AWCs)—those with a larger share of treated children—to those in low treatment intensity AWCs. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Appendix Table A11. Spillover Effects: Child Growth

	Continuous			Binary		
Dependent Variable:	HAZ (1)	WAZ (2)	WHZ (3)	Stunted (4)	Underweight (5)	Wasted (6)
High Treatment Intensity	-0.010 (0.083)	0.077 (0.058)	0.097 (0.085)	-0.054 (0.045)	-0.057** (0.028)	-0.008 (0.031)
Observations	517	517	517	517	517	517
R-squared	0.460	0.602	0.374	0.279	0.382	0.206
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports spillover effects on child growth outcomes among control households by comparing outcomes in high treatment intensity Anganwadi centers (AWCs)—those with a larger share of treated children—to those in low treatment intensity AWCs. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Appendix Table A12. Spillover Effects: Other Outcomes

	Beliefs			Diet			Health		
Dependent Variable:	Weight percentile gap (1)	Ideal child weight (Z) (2)	Describe child's weight as "normal" (3)	Diet diversity (4)	Quantity of Balamrutham in last calendar month (gms) (5)	Quantity of eggs in last calendar month (number) (6)	Mid upper arm circumference (7)	Illness in last 2 weeks (8)	Cognition z-score (9)
High Treatment Intensity	-3.320* (1.893)	0.044 (0.092)	0.107 (0.111)	0.035 (0.052)	189.249** (74.349)	1.322** (0.570)	0.088 (0.100)	-0.020 (0.047)	-0.087 (0.103)
Observations	517	517	133	517	517	517	516	517	517
R-squared	0.271	0.302	0.220	0.075	0.078	0.126	0.322	0.096	0.146
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All children	All children	Underweight/ wasted children	All children	All children	All children	All children	All children	All children

Notes: This table reports spillover effects on other belief, diet, and health outcomes among control households by comparing outcomes in high treatment intensity Anganwadi centers (AWCs)—those with a larger share of treated children—to those in low treatment intensity AWCs. Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

E Robustness: Sensitivity of Treatment Effects on Anthropometric Outcomes to the Upper Tail of Growth Changes

To assess whether results are sensitive to a small number of children who experienced large growth improvements over the six-month study period, I re-estimate the main specifications excluding those in the upper tail of the distribution of growth changes—defined as height gains above 8 cm, weight gains above 4 kg, or changes in anthropometric z-scores (HAZ, WAZ, or WHZ) exceeding +2 SD between baseline and endline. These thresholds are conservative and intended to test robustness rather than to imply measurement error: given the young age of children (7–24 months at baseline) and high baseline malnutrition levels, rapid catch-up growth is plausible. All anthropometric z-scores fell within biologically plausible ranges as defined by WHO standards, at baseline and endline.

Even after excluding these observations ($\approx$ 26% of the sample), results remain very similar to the main estimates. The pooled treatment effects are 0.09 SD for HAZ, and 0.15 SD for WAZ and WHZ—all statistically significant and similar in magnitude to the full-sample estimates—indicating that results are not driven by a small subset of children experiencing very rapid growth gains.

Appendix Table A13. Robustness: Pooled Treatment Effects, Excluding Children in the Upper Tail of Growth Changes

Dependent Variable:	HAZ (1)	WAZ (2)	WHZ (3)
Treated	0.088** (0.042)	0.149*** (0.032)	0.145*** (0.046)
Observations	1,129	1,129	1,129
R-squared	0.622	0.691	0.506
Controls	Yes	Yes	Yes

Notes: This table reports pooled treatment effects relative to the control group on child anthropometric z-scores, excluding children in the upper tail of the growth-change distribution (height gain > 8 cm, weight gain > 4 kg, or changes in HAZ/WAZ/WHZ > +2 SD between baseline and endline). Controls include child-level (age dummies, sex, baseline HAZ, WAZ, and WHZ), mother-level (education in years, height), and household-level (household size, per capita income in USD, Poverty Probablity Index (PPI) score) characteristics. Standard errors are clustered at the AWC-level. Percentage changes are coefficients divided by control means.
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$