



# Review of the Association of Protein Supplementation for Pregnant Women and Positive Birth Outcomes

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## Introduction

Maternal nutrition during gestation critically impacts the survival, growth and development of the foetus. Thus, maternal undernutrition or overnutrition can have an adverse impact on the development of the foetus, especially the lack or excess of maternal dietary protein intake.<sup>1</sup> The effects of foetal nutrition could have possible intergenerational effects that might persist well into adulthood.<sup>2</sup> While the Sustainable Development Goals are based on the principle of “not leaving the furthest behind”, the nutritional needs of the pregnant women are often neglected.<sup>3</sup> Ten key direct nutrition specific interventions are endorsed by the Lancet 2013 series, eight of which were endorsed by the World Health Organisation. Of these ten interventions, three have seen no scale up at all. One of these three unscaled interventions is the protein energy supplementation.<sup>4</sup>

Undernutrition in pregnant women can result in lower birthweights, which is an indicator of restricted intrauterine growth.<sup>5</sup> As a domino effect, this leads to stunting by 24 months of age, and further irreversible outcomes such as decreased cognitive function, shorter height as an adult, impaired immune function and malnutrition and an increased risk of chronic diseases in later life.<sup>6,7</sup> Maternal undernutrition can also responsible for the long-term negative impact on adult income and school achievements.<sup>6</sup>

While protein supplementation has been suggested as a nutrition specific intervention, the lack of its scale up could be associated with the lack of knowledge about its effectiveness, especially in low- to middle-income settings. Protein supplementation can improve birth length and birthweights, and would alleviate the short-term and long-term adverse consequences of maternal undernutrition.<sup>8</sup> The current review aims to analyse the evidence from recent clinical trials that study the association of protein supplementation in maternal nutrition with short-term and long-term birth outcomes.

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## Methodology

### Search strategy and Selection criteria

A search was conducted in the PubMed database for studies published between January 1, 2002 to May 30, 2020. The Zotero 5.0.85 software was used to manage the selected studies. The search term selected for the purpose of the study was “protein AND supplementation AND pregnan\* AND matern\* AND nutrition”. An English language filter was placed on this search. Only full-text studies were included in the evidence synthesis. The studies identified by this search were further analysed for their eligibility. Eligible studies were those that demonstrated the following characteristics:

(1) Clinical trials

AND

(2) Described the impact of nutritional protein supplementation for pregnant women

Studies that were excluded were

(1) Preprints, reviews, editorials and letters

OR

(2) Studies that provided data about nutritional supplementation in the general population

OR

(3) Studies with provided data about nutritional supplementation in the pregnant women but did not include the term protein supplementation

The flow for the number of studies included in the evidence synthesis is given in Figure 1.

## Synthesis of Evidence

The seven studies selected for the synthesis of evidence were mined for the following components: the name, year and place of the study, the total number of participants, nutritional supplementation and outcome (Table 1). Each study was also analysed to determine its quality. The quality of the included study was assessed using the “Newcastle-Ottawa Quality Assessment Form for Cohort Studies”. Depending on the number of starts in each of the three domains (selection, comparability and outcome) the quality was considered good, fair or poor. Overall, the quality for each study was considered good with low risk of bias.

## Results

Table 1: Overview of the seven studies included in the review

Study	Year and Place	Number of Study Participants	Nutritional Supplementation	Outcome	Quality
<i>Glosz et al.</i> <sup>9</sup>	2018 USA	343	Fortified corn-soy blend (CSB+) with multiple-micronutrient supplement (CSB+UNIMMAP); or (3) CSB+ with iron and folic acid (CSB+IFA)	The current antenatal standard of care (CSB+IFA) is not enough to improve the nutritional statuses of moderately malnourished pregnant women	Good Quality
<i>Hambidge et al.</i> <sup>10</sup>	2019 Multi-country	3163	Protein-energy supplement was also provided if maternal body mass index (kg/m <sup>2</sup> ) was <20 or gestational weight gain was less than recommendations	Protein supplementation late in the first semester or before conception improves fetal growth-related birth outcomes	Good Quality
<i>Okala et al.</i> <sup>11</sup>	2019 London	875	Multiple micronutrient (MMN), protein-energy (PE), or PE + MMN	Enhanced antibody responses to the DTP vaccine in early infancy	Good Quality
<i>Johnson et al.</i> <sup>12</sup>	2016 UK	620	Protein-energy (PE) and/or multiple-micronutrients (MMNs) + lipid-based nutritional supplements (LNSs)	Positive and significant association of PE supplementation with birth weight among women who demonstrated the greatest gestational weight gain.	Good Quality
<i>Callaghan-Gillespie et al.</i> <sup>13</sup>	2017 Malawi	1828	Fortified corn-soy blend (CSB+) with a daily multiple micronutrient antenatal supplement [United Nations International Multiple Micronutrient Preparation (UNIMMAP)]	Helps in maternal weight gain	Good Quality
<i>Huybregts et al.</i> <sup>14</sup>	2009 Burkina Faso	1296	Prenatal MMN-fortified food supplement (FFS)	<ol style="list-style-type: none"> <li>1. The FFS group had a significantly higher birth length (+4.6 mm; P = 0.001).</li> <li>2. FFS supplementation resulted in a modestly higher birth weight (+31 g; P = 0.197)</li> </ol>	Good Quality
<i>Rasmussen et al.</i> <sup>15</sup>	2010 Central America	520	Two villages received Atole, a gruel containing protein	<ol style="list-style-type: none"> <li>1. Overall increase in birthweight of 117 g (P &lt; 0.05)</li> <li>2. Decrease in the proportion of babies who weighed &lt;2500 g at birth, from ~18 to ~9% (P &lt; 0.05)</li> </ol>	Good Quality

## Discussion

Protein supplementation is a type of nutrition specific intervention that has been associated with improved birthweight and birth size.<sup>8</sup> This review observed a similar association even in low- and middle-income settings.

As observed in the synthesis, protein supplementation was associated with an increase in maternal weight.<sup>12,13</sup> Furthermore, improved foetal growth related birth outcomes were positively associated with protein supplementation late in the first trimester or before conception, especially in cases where the greatest gestational weight gain was observed.<sup>10,12</sup> The study conducted by Rasmussen et al in two villages in Central America observed that higher protein supplementation was positively associated with the birthweight of the babies, and was also associated with a decrease in underweight babies.<sup>15</sup> This association was supported by the study conducted in Burkina Faso by Huybregts and team. They also observed that protein supplementation was associated with a significantly higher birth length.<sup>14</sup> Enhanced antibody response to the DTP vaccine was recently identified as a short-term benefit of maternal nutrition to infants.<sup>11</sup>

While the evidence suggests that protein supplementation during pregnancy is necessary to improve birth outcomes, a few studies also suggest that this supplementation alone will not improve the nutritional status of malnourished pregnant women.<sup>9,13</sup> Thus, additional nutrition specific interventions such as iron folic acid and vitamin supplementation are necessary for pregnant women. There is currently a lack of scale up of these interventions and the short-comings of this scale up, as well as the solutions to tackle these gaps, have been outlined in the Mother's First Spotlight 2020 document.

### About Mothers First

Mothers First is a community based targeted nutrition project in India. Its mission is to provide nutrition to malnourished pregnant mothers and their children, breaking the cycle of malnutrition in communities. It advocates for the inclusion of maternal nutrition in global nutrition policy and global targets. It was established in 2004 as the Varanasi Children's Hospital. Mothers First is a registered charity, number CHY 19325.

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