

**ANALYSING THE DETERMINANTS OF MALNUTRITION  
AMONG CHILDREN UNDER FIVE YEARS OF AGE IN  
BIHAR STATE, INDIA**

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**Analysing the determinants of malnutrition among  
children under five years of age in Bihar State, India**

A thesis submitted in partial fulfilment of the requirement  
for the degree of Masters of Public Health

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## DECLARATION

This thesis (Analysing the determinants of malnutrition among children less than five years of age in Bihar State, India) is my own work.

Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements at the Royal Tropical Institute (KIT).

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## **LIST OF ABBREVIATIONS**

ANC:	Antenatal Check-up
ANM:	Auxiliary nursing-midwife
AWW:	Anganwadi worker
AWC:	Anganwadi Centre
CDPO:	Child development programme officer
DLHS:	District level health survey
GOI:	Government of India
H/A:	Height For age
ICDS:	Integrated Child Development Services
IQ:	Intelligence Quotient
IFA:	Iron folic acid
IYCF:	Infant and young child feeding Practices.
MOH&FW:	Ministry of health & Family Welfare
MOHB:	Ministry of Health Bihar State
NFHS:	National Family health survey
NCHS:	National Health Centre Statistics
PHC:	Primary Health Centre
PEM:	Protein energy malnutrition
PDS:	Public distribution system
RDA:	Recommended Dietary allowance
SD:	Standard Deviation
SC:	Sub-Centre
TT:	Tetanus Toxoid
UNICEF:	United Nations international child Emergency Fund
UN:	United Nations
WHO:	World Health Organization
WFP:	World Food Programme
W/H:	Weight for Height
W/A:	Weight for Age

## GLOSSARY

**Stunting:** It is defined as the percentage of children aged from 0 to 59 months whose height for age is below minus two standard deviation which represents moderate stunting and below minus three standard deviation which represents severe stunting from the median of the WHO Child Growth Standards. It reflects chronic undernutrition in children in the most critical period of growth and development in early life.

**Wasting:** It is defined as the percentage of children aged from 0 to 59 months whose weight for height is below minus two standard deviation which represents moderate wasting. Further below minus three standard deviation represents severe wasting from the median of the WHO Child growth standards. It reflects acute undernutrition in children.

**Underweight:** It is defined as the percentage of children aged from 0 to 59 whose weight for age is below minus two standard deviation which represents moderate underweight. Further below minus three standard deviation represents severe underweight from the median of WHO Child Growth standards. It reflects composite form of undernutrition that includes both stunting and wasting in children.

**Improved water supply:** The source of drinking water is considered improved if it is protected from outside contamination, particularly faecal matter. It includes piped water in a dwelling, plot or yard, and other improved sources e.g. public taps or stand pipes tube wells or boreholes, protected dug wells protected springs and rainwater collection.

**Improved sanitation:** An improved sanitation facility is one that hygienically separates human excreta from human contact. These include flush or pour-flush toilet/latrine with a piped sewer system or septic tank, pit latrine with slab or improved ventilation

## **ABSTRACT**

**Background:** Undernutrition among children under five years of age is alarming in Bihar State. There has been an improvement in the nutritional status indicators over the last two decades. But still, the present situation is quite alarming.

**Objective:** To analyse the determinants of malnutrition among children under five years of age in Bihar State, India.

**Methodology:** The present study is a literature review of available published and unpublished data. Analysis has been carried out using the Adapted UNICEF conceptual framework.

**Findings:** Study identified that the determinants of undernutrition in Bihar State are multifactorial. These are a poor health status of the children, a poor nutritional status of mothers, inadequate ANC visits, improper child feeding practices, food insecurity at household level, poor health services and poor hygiene and sanitation and flaws in the existing nutritional programme.

**Conclusion:** Improvement in the nutritional status would become evident when child would have adequate access to affordable, nutritional food with a good maternal and childcare practices, availability of a good quality of health services, satisfactory environmental conditions especially safe water supply and sanitation.

All these factors are directly or indirectly related to childhood diseases, which, in turn have a strong impact on the nutritional status of children.

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## **INTRODUCTION AND ORGANISATION OF THESIS**

As per UNICEF good nutrition lays the foundation for healthy, thriving and productive nations. 5.9 million children died under age of five in 2015 and 45% of these deaths were related to undernutrition. India has the world's highest number of children suffering from undernutrition. Within India, Bihar State is the worst affected state in this regard.

It is the second state with the highest population, of children under six years of age, next to Uttar Pradesh. It has a high prevalence of undernutrition among these children. Though with continued efforts, the level of undernutrition in Bihar State has dropped down but the decline has not been adequate. Prevention of undernutrition required intervention at a very basic level. Despite this realization, undernutrition is still prevalent at a higher level in Bihar State. It is therefore worth to carry out a study analysing the determinants of undernutrition in children and identifying the lacunae/flaws in the existing nutritional programme in Bihar State. Further to give advice and make recommendations to the policy makers for improving the nutritional status of children.

Being a Medical Officer from India and having gained professional work experience in Paediatrics, initially, followed by teaching work experience (Demonstrator), in the Department of Pharmacology, the researcher was keenly interested in the problems affecting children. Of which undernutrition among children under five years of age is a most rampant one, especially in Bihar State, which has got the worst health indicators in India. This formed the basis for choosing the present study.

This thesis is based on a literature review, which identifies determinants influencing undernutrition among children under five years of age in Bihar State. Determinants have been studied on the adapted conceptual framework of UNICEF. The thesis is structured in six chapters. Chapter one presents a general introduction to the childhood malnutrition. Chapter two presents the background information of Bihar State. Chapter three presents the problem statement, justification, general objectives and specific objectives. Chapter four presents Methodology for the study. Chapter five presents the analysis of determinants of malnutrition among children under five years of age in Bihar State. Chapter six is the final chapter, which presents the discussion of findings, conclusion and finally the recommendations.

# **1. CHAPTER I: GENERAL INTRODUCTION TO CHILDHOOD MALNUTRITION**

## **1.1. Childhood Malnutrition**

The World Food Programme defines malnutrition as “a state in which the physical function of an individual or child is impaired to the point where he or she can no longer maintain an adequate bodily performance process such as growth, pregnancy, lactation and recovering from disease”. It could be both undernutrition and over nutrition. Undernutrition is a pervasive problem in all developing countries. Undernutrition is more prevalent under five years of age, mostly effecting the age of 6-24 months, which is weaning and the post weaning period of the child age. As per the WHO (2002) estimation 27% (168 million) of children under five are under weight. The two main constituents of undernutrition are Protein Energy malnutrition and Micronutrient deficiency (1).The term “Malnutrition” used in this thesis will only refer to undernutrition reflected by underweight, stunting and wasting under five years of age of children.

## **1.2. Extent of malnutrition**

Adequate nutrition is essential in early childhood. The extent of protein energy malnutrition (PEM) in developing countries is measured by anthropometric data, which includes three indicators; height-for-age (H/A), weight-for-age (W/A), weight-for-height (W/H). They are the commonly used indicators to assess the growth status of the children. If these parameters fall below the anthropometric cut off  $<-2$  standard deviation of the median, H/A, W/A, W/H of the National Centre for Health Statistics (NCHS)/WHO international reference population, this is referred as Stunting (H/A), underweight (W/A), and wasting (W/H) and if they fall  $<-3SD$  below then they are termed as severe stunting, wasting and underweight respectively (Annex 1.1). Stunting represents chronic malnutrition in under 2-3 years of age due to a poor socioeconomic status, repeated infections and poor feeding practices. Wasting indicates the recent or severe process of weight loss, which is associated with acute starvation or severe disease. Under weight is low weight for age, which reflects body mass relative to chronological age (2)

The prevalence of stunting has decreased globally between 1990 and 2014 from 39.6% to 23.8% respectively. Half of the stunted children are living in Asia and Africa. 50 million children are wasting worldwide, of which 16 million were severely wasting in 2014. Asia has 34.3 million of wasting children (Annex 1.2). As per the UN estimation report, 2.1 million children in India died before reaching the age of five years(3).

### 1.3. Effects and consequences of malnutrition

Child malnutrition is the major contributor for under five mortality and morbidity due to susceptibility to infection. Apart from its effect on the physical growth, child malnutrition also affects cognitive development and the (Intelligence quotient) IQ of the child, resulting in delayed enrolment, higher absenteeism and poor performance in school. Evidence has shown that there is an irreversible physical and cognitive damage due to undernutrition which is a major threat to human development. Malnutrition among mothers has its own undesirable consequences, like obstructed labour, a poor pregnancy outcome, postpartum haemorrhage and premature babies (4). Evidences have shown that severe irreversible physical and neurocognitive damage due to stunting is a major threat to human development. The growth faltering starts from in-utero and continues for the two years of post-natal life (5).

### 1.4. Causes of Malnutrition

The causes of malnutrition are multispectral related primarily to food, health and caring practices. It has been divided into basic, underlying and immediate causes. These three causes are interrelated to each other for the development of undernutrition in children under five years of age, globally. A poor dietary intake and disease (immediate causes), poor household food security, caring practices, health system and environmental sanitation (underlying causes), and economic factors political factors and availability of resource (basic causes) are responsible for the malnutrition in children under five years of age globally (6).

## 2. CHAPTER II: BACKGROUND INFORMATION OF BIHAR STATE, INDIA

### 2.1. Geography of Bihar State

Bihar State is located in the eastern part of India. Geographically it is the 12th largest state in India and third largest by its population (7).



**Figure 1.1: Map of Bihar State**  
(Source: Google)

This state is a flood prone state with 76% of the population in the north Bihar State living under the recurring threats of flood devastation because it is drained by a number of rivers (8).

These floods affect Bihar's agriculture leading to destruction of crops, livestock's thereby affecting the livelihood. The resultant poverty brings in its wake poor sanitation and hygiene, which in turn leads to infections and poor nutrition.

Poverty also brings poor sanitation and hygiene to Bihar State, which in turn leads to infections, and poor nutrition.

### 2.2. Demography and Socio-Economic Status of Bihar State

The total population of Bihar State as per census 2011 is 104.5 million. It constitutes 8.60 percent of India in 2011. The Female Population is 50 million and the male population is 54.2 million. The total child population (between 0-6 years) of Bihar State is 19.13 million, thus placing it on the second place in population for children under 6 years of age, whereas the first ranking state in this regard is Uttar Pradesh with a population of 30.7 million in this age group(9). Table 1.1 shows the gender wise breakup of the population and 0-6 years of population in urban and rural areas of Bihar State as per census of India 2011(10). The population growth density is 1,106 km<sup>2</sup> (11).

**Table 1.1: Population of Bihar State, census, 2011, India**

Rural population (in figures):

	Persons	Males	Females
<b>2001</b>	<b>74316709</b>	<b>38594996</b>	<b>35721713</b>
<b>2011</b>	<b>92341436</b>	<b>48073850</b>	<b>44267586</b>

Urban population (in figures):

	Persons	Males	Females
<b>2001</b>	<b>8681800</b>	<b>4648799</b>	<b>4033001</b>
<b>2011</b>	<b>11758016</b>	<b>6204307</b>	<b>5553709</b>

Population 0-6 years

	Persons	Males	Females
<b>2001</b>	<b>16806063</b>	<b>8652705</b>	<b>8153358</b>
<b>2011</b>	<b>19133964</b>	<b>9887239</b>	<b>9246725</b>

Rural population 0-6 years

	Persons	Males	Females
<b>2001</b>	<b>15398489</b>	<b>7921089</b>	<b>7477400</b>
<b>2011</b>	<b>17383701</b>	<b>8971671</b>	<b>8412030</b>

**0-6 years Sex ratio Female per 1000 Male**

	Total	Rural	Urban
<b>2001</b>	<b>919</b>	<b>926</b>	<b>868</b>
<b>2011</b>	<b>918</b>	<b>921</b>	<b>895</b>

Source: census of India

Bihar State has a mean family size of 5.6. Female literacy is very poor especially in rural Bihar State where 67.7% of women are illiterate. Only 17.15% of the population in rural areas has access to electricity. 92.5% of population has safe drinking water but only 1% has a tap water supply. All these factors make it essential to gain knowledge about their inter-relationship, which leads to malnutrition. Bihar State has a huge gender disparity among female and male children. In Bihar State agriculture is the main source of livelihood. 76% of the rural population is engaged in agricultural work (12). Its agricultural productivity is one of the lowest, leading to rural poverty, which is leading to low nutrition and migration of labour.

In recent years, growth in the economy of Bihar State has increased but still the per capita in Bihar State stands at \$233.0, which is quite low compared to national per capita income of \$594.53 as depicted in table 1.2 (13).

**Table 1.2: Per capita income in Bihar State**

Per capita income	2009-10	13-14
India	\$504.76	\$594.53
Bihar State	\$158.30	\$233.01
Agricultural growth	3.70%	

Source: Economic survey of Bihar State 2014-15

The problem of low per capita income in Bihar State is further aggravated by the fact that there is a huge variation in per capita income across the various districts as shown in Table 1.3

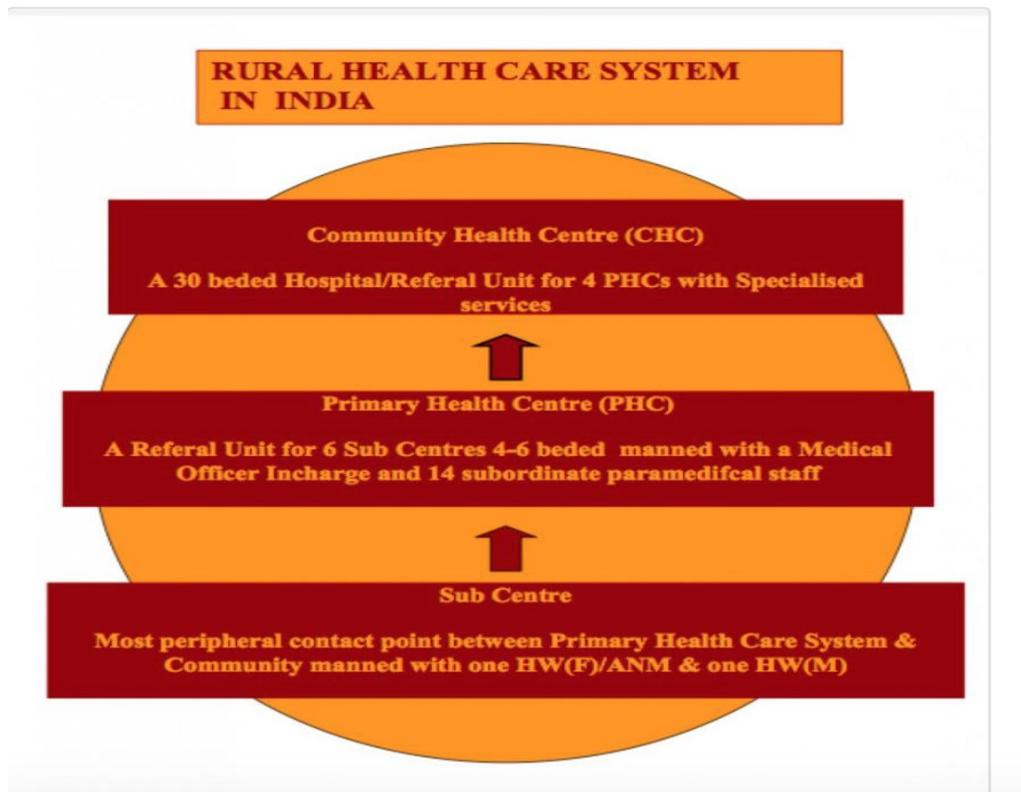
**Table 1.3: variations in per capita income**

Patna	\$938.92
Munger	\$328
Begusarai	\$281
Madhepura	\$128.16
Suapaul	\$126.43

Source: Economic survey of Bihar State 2012

### 2.3. Health system

As can be seen in figure 1.2, the health care system in rural India is a three tier system comprised of a Sub-centre (being the peripheral most contact point between the health system and the community), Primary health centres (PHCs) (a referral unit for 6 SCs), and community health centres (CHCs), (a referral unit for 4 PHCs) in Bihar State (14).



**Figure.1.2: Rural health care system in India**

Source: futurechallenge.org.

### 2.4. Nutrition Programme and its Core Services

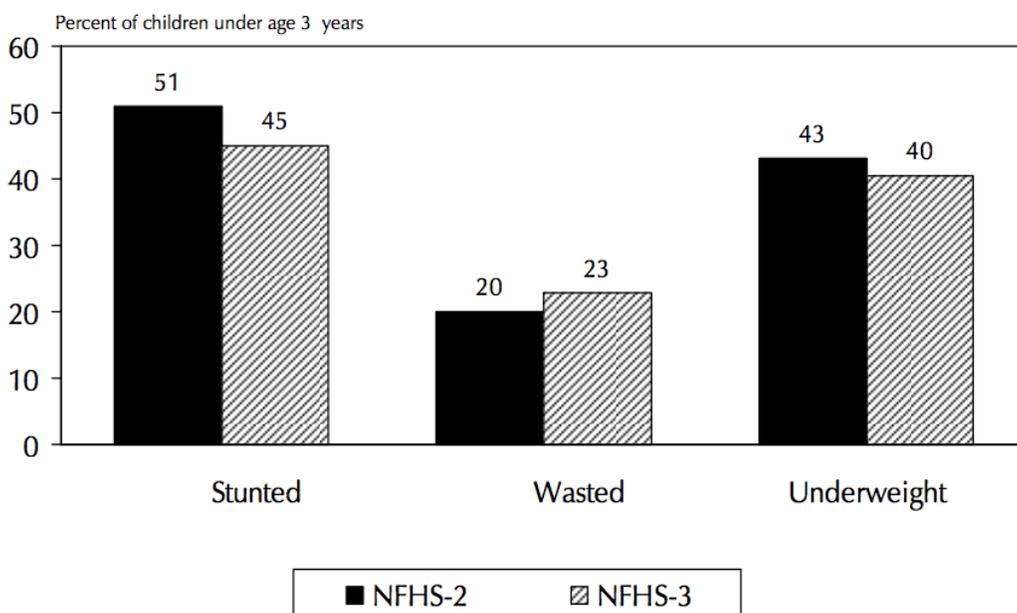
India has the world largest and unique early childhood development programme known as the Integrated Child Development Services Programme (ICDS) launched in 1975, initially in 33 community development blocks but it now covers the whole country. This programme is run under the supervision of the Ministry of Women

and Child Development. It is an outreach programme started as a primary response to meet the nutritional and developmental needs of children below 6 years, adolescent girls, pregnant women and lactating mothers. Under this programme, supplementary nutrition is provided to beneficiaries, free of cost. In addition, other services are provided free of cost under this programme, including immunization, deworming of children, non-formal pre-school education and referral services for sick children to the nearby sub-centre or primary health centre (15).(Annex 1.3, 1.4)

### 3. CHAPTER III: PROBLEM STATEMENT, JUSTIFICATION, RESEARCH QUESTIONS, GENERAL AND SPECIFIC OBJECTIVES

#### 3.1. Problem statement

Undernutrition is one of the major underlying causes of infant and young children mortality. In lower-middle-income countries like India, children under five years of age are more vulnerable to malnutrition because of a low dietary intake, infectious diseases, and lack of appropriate care and an inequitable distribution of food at household level. In India there has been an overall decrease in underweight from 43% to 40% from the National family Health Survey NFHS-2 to NFHS-3, a decrease in stunting from 51% to 45% but wasting has increased from 20% to 23%. (Annex 1.5)



Source: NFHS

**Figure 1.3: Trends of Malnutrition in India**

Survey results of NFHS-2 and NFHS-3 at the national level revealed a decline in prevalence of underweight and stunting but wasting showed an increased as shown in figure 1.3. A similar trend was seen in Bihar State when state wise survey results of NFHS-2 and NFHS-3 were accessed. Although the prevalence of all the three indicators of undernutrition were higher than the national average as shown in table 1.4 (16).<sup>1</sup>

<sup>1</sup> In my problem statement the data is from NFHS-3 (2005-06) because it has been compiled at national level. Whereas the NFHS-4 is completed in 2015 and has not been compiled at National level yet. To avoid confusion between the comparisons, I choose NFHS-3 data for my problem statement. In rest of my study I have compared the data of Bihar at state level with other states as per current NFHS-4 survey and not at National level due to the above-mentioned reason.

**Table 1.4: Nutritional indicators of children under-five years of age, Bihar State**

	<b>Stunting</b>		<b>Wasting</b>		<b>Underweight</b>	
	<b>Height for age</b>		<b>Weight for height</b>		<b>Weight for age</b>	
<b>Survey</b>	Percentage below-3 SD	Percentage below-2 SD	Percentage below-3 SD	Percentage above-2 SD	Percentage below-3 SD	Percentage below-2 SD
<b>NFHS-3</b>	29.1	55.6	8.3	27.1	24.1	55.9
<b>NFHS-2</b>	47.2	70.0	5.5	21.0	36.2	71.3

Source: NFHS

It is evident from the state wise survey result, that many states in India are doing well compared to Bihar State, which is lagging behind as shown in table 1.5. This prompted the researcher to analyse the determinants of undernutrition and evaluate the performance of existing nutritional programme in Bihar State.

**Table 1.5 Nutritional status of children of Bihar versus other states, India**

<b>State</b>	<b>Height for age</b>		<b>Weight for height</b>		<b>Weight for age</b>	
	Percentage below -3SD	Percentage below -2SD	Percentage below -3SD	Percentage below -2SD	Percentage below -3SD	Percentage below -2SD
Bihar	29.1	55.6	8.3	27.1	24.1	55.9
Kerala	6.5	24.5	4.1	15.9	4.7	22.9
Tamil Nadu	10.9	30.9	8.9	22.2	6.4	29.8

Source: NFHS-3

Evidence shows that The Integrated Child Development Services (ICDS) Nutrition programme despite being in service in India, since 40 years, did not have a significant positive impact on the problem of malnutrition in Bihar State.

### 3.2. Justification

It has been recognized that in humans, the period of greatest susceptibility to nutritional deficiencies start from pregnancy and continue until the age of two years. (17). From the problem statement discussed so far, the status of undernutrition in Bihar State is quite alarming. Bihar State has the second highest number of children in the country and the problem of undernutrition will aggravate further if no adequate steps are taken to prevent it. This along with the fact that the ICDS programme directed against the problem of undernutrition, is running for the last forty years but failed to curb the menace of childhood malnutrition which led the researcher to ponder whether: i) the increase in the malnutrition trend is due to its determinants which are very specific to Bihar State and different from other states, ii) Programme interventions are not sufficient enough or iii) There are other factors responsible for malnutrition.

We know that malnutrition has its consequences leading the children to poor cognitive development, poor growth, recurrent infections etc. As malnutrition clutches are getting stronger on children in Bihar State, there is an urgent need to find out what factors are responsible for the no improvement in the nutrition status of the children under five in Bihar State. What programme are being run in Bihar State to combat malnutrition, and what recommendations can be made on how to improve the programme delivery with an aim to improve the malnutrition status of children under five in Bihar State.

### 3.3. General objective

To analyse the determinants and the available nutrition programme related to undernutrition among children under five years of age in Bihar State, India, in order to advice policy makers on how to improve their nutritional status.

#### Research Questions

- i. To what extent is the morbidity of the children under five years of age in Bihar State, India, related to the nutrition status of the children?
- ii. What are the factors (e.g. early initiation of breast feeding, duration of breast feeding, hygiene and sanitation etc.) are related to child undernutrition in children under five years in Bihar State, India?
- iii. What is the available (nutrition) programme engaged in the fight against child undernutrition especially in children under five years in Bihar State, India?
- iv. What key recommendations needed to be made to policy makers to improve the nutritional status of children under five years in Bihar State, India?

### 3.4. Specific objectives

- i. To determine the nutritional status of the children under five years of age in Bihar State, India.
- ii. To identify the relationship between caring practices (breast feeding, supplementary feeding, health system, hygiene and sanitation) and undernutrition in children under five years of age in Bihar State, India.
- iii. To evaluate available nutrition programme, engaged in the fight against malnutrition in children under five years of age in Bihar State, India.
- iv. To provide key recommendations needed by policy makers to improve the nutritional status of children under five years in Bihar State, India.

## **4. CHAPTER IV: METHODOLOGY**

### **4.1. Research Design**

The present thesis is a descriptive study based on a literature review. Research from previous researchers, addressing the nutritional status of children under five years of age and its determinants, has been reviewed. Data from available published and unpublished literature has been reviewed.

### **4.2. Search strategy**

For the purpose of literature review Google was used to find various websites like "MOH&FW" (Ministry of Health and Family welfare), "GOI" (Government of India), "MOHB" (Ministry Of Health, Bihar State). Data pertaining to NFHS, census of India, the malnutrition trend in India, health indicators of Bihar State were searched using selected key words. The other websites like WHO, UNICEF etc. were used to get information on global trends of malnutrition and strategies used for the intervention of nutritional programme. Information from books, policy documents, standard guidelines and protocols was studied regarding malnutrition among children under five years of age in India and specifically in Bihar State. Various search engines like Google scholar, Scopus, PubMed were used to find out the articles related to undernutrition among children less than five years of age. Search was done as per the research questions using different key words from them. Information was also gathered from the e-library of the Vrije Universiteit. From the articles thus obtained, the relevant articles were selected by narrowing my search criteria by using Boolean operators "AND", "OR" and by putting the search words like "malnutrition and children under five", "Nutrition AND children", "stunting AND children AND Bihar State" in different search engines. The bibliographies of relevant articles were also used to get more information. I gathered the information for present study where I was having free online access, accessible to KIT library and partner institutions.

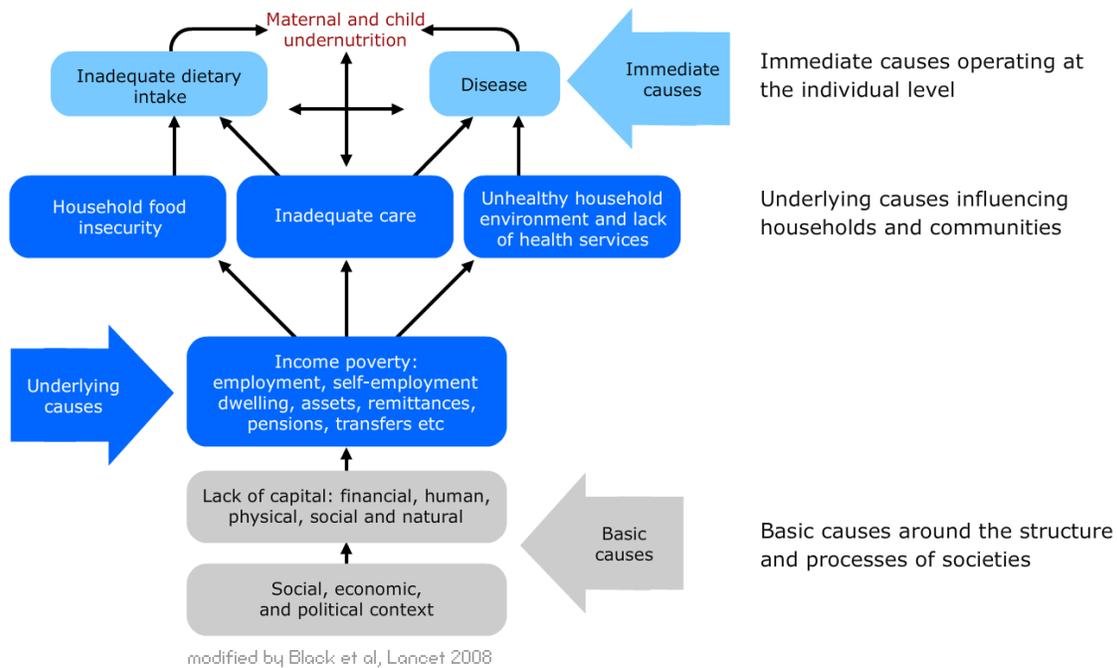
### **4.3. Key words used in the literature search**

The following key words were used: Bihar State, stunting, wasting, underweight, dietary-intake, breast-feeding, diarrhoea, acute respiratory infection, fever, sanitation, feeding practices, health services, children under five, Integrated Child Development services (ICDS).

**Research table 1.6**

<b>Objectives</b>	<b>Source</b>	<b>Keywords</b>	<b>Search strings</b>
Objective 1	<ul style="list-style-type: none"> <li>• PubMed,</li> <li>• Google scholar,</li> <li>• Vrije universiteit KIT</li> </ul>	<ul style="list-style-type: none"> <li>• Stunting</li> <li>• Wasting</li> <li>• Underweight</li> <li>• Bihar State</li> <li>• Undernutrition</li> <li>• Diarrhoea</li> <li>• Acute respiratory infection</li> <li>• Fever</li> <li>• Breast feeding</li> <li>• Complimentary feeding</li> </ul>	<p>"Stunting AND Bihar State"</p> <p>"Wasting AND Bihar State"</p> <p>"Underweight AND Bihar State"</p> <p>"Breast feeding AND Bihar State"</p> <p>"Malnutrition In Bihar State"</p> <p>"Diarrhoea in Bihar State."</p> <p>"Diarrhoea and malnutrition in Bihar State"</p> <p>"Supplementary feedings in children under 5 Bihar State"</p> <p>"Dietary supplement in children in Bihar State."</p> <p>"Diarrhoea in children under 5 in Bihar State"</p>
Objective 2.	<ul style="list-style-type: none"> <li>• PubMed</li> <li>• Google scholar</li> <li>• Vrije universiteit</li> <li>• KIT</li> </ul>	<ul style="list-style-type: none"> <li>• Antenatal care</li> <li>• Food in security</li> <li>• Health services</li> <li>• Hygiene</li> <li>• Sanitation</li> </ul>	<p>"Antenatal care AND malnutrition"</p> <p>"Food security AND malnutrition"</p> <p>"Hygiene AND malnutrition"</p> <p>"Health services AND Bihar State"</p> <p>"Sanitation AND Bihar State"</p>
Objective 3	<ul style="list-style-type: none"> <li>• PubMed</li> <li>• Google scholar</li> <li>• Vrije universiteit</li> <li>• KIT</li> </ul>	<ul style="list-style-type: none"> <li>• Nutrition programme in Bihar State</li> <li>• Integrated child development services (ICDS)</li> <li>• Challenges with ICDS</li> <li>• Services of ICDS.</li> </ul>	<p>"ICDS AND Bihar State"</p> <p>"ICDS AND its services"</p> <p>"ICDS AND its challenges in Bihar State"</p>
<p><b>Other sources:</b></p> <ul style="list-style-type: none"> <li>• Websites of Ministry of Health and Family welfare</li> <li>• India and Bihar State statistics Service</li> <li>• WHO, WFP</li> </ul>	<ul style="list-style-type: none"> <li>• Google Scholar,</li> <li>• Google,</li> <li>• Internet</li> </ul>	<ul style="list-style-type: none"> <li>• National family health survey</li> <li>• District level health survey</li> <li>• Census of India</li> <li>• Annual health reports</li> <li>• Trend of malnutrition</li> <li>• Guidelines for prevention of Malnutrition</li> <li>• Strategies for intervention for nutritional programme.</li> </ul>	

#### 4.4. Conceptual Framework



**Figure 1.4: Conceptual Framework (UNICEF)**  
**Source: UNICEF**

To study the determinants of malnutrition, the conceptual framework for Maternal and Child malnutrition, given by UNICEF, was used. The conceptual framework analyses the cause of malnutrition in any community and also the interrelationship between various contributing factors. As depicted in figure 1.3, the immediate causes pertain to dietary intake and disease, operating at individual level. The immediate causes are influenced by the underlying causes, operating at household and community level. These are comprised of factors like household food insecurity, inadequate care, lack of health services, an unhealthy household environment which is a reflection of income and poverty. On a still wider perspective (society level), basic causes comprising of social, economic and political factors have been implicated

My thesis was a web based literature review. Several limitations were encountered in accessing data on which I as the researcher had no influence. Accordingly the conceptual framework was modified and the Adapted conceptual framework given in table 1.7 was applied to answer the research questions.

**Table 1.7: Adapted Conceptual framework of UNICEF**

Immediate causes	Underlying causes
<ul style="list-style-type: none"><li>• Inadequate dietary intake</li><li>• Common childhood Diseases in children</li></ul>	<ul style="list-style-type: none"><li>• Inadequate care of mother and children</li><li>• Household food insecurity</li><li>• Hygiene and sanitation</li></ul>

After applying this framework I expected, based on my literature review, that these factors might be prevalent in Bihar State.

## 5. CHAPTER V: DETERMINANTS OF MALNUTRITION AND ANALYSIS OF NUTRITION PROGRAMME IN BIHAR STATE

### 5.1. Extent of morbidity of Undernutrition in Bihar State

To find out the morbidity related to the nutritional status among the children less than five years of age in Bihar State. The immediate causes like dietary intake and diseases, common at this age group, have been analysed. As per the data from NFHS-4, the infant mortality rate in Bihar State is 48% and the under-five mortality rate is 58% per 1000 live births, which is quite high(18). The first two years of life are critical for the growth and development of the child. This is the period when nutritional deficiencies generally worsen if adequate diet is not given to the children. Bihar State has shown a decreasing trend in morbidity of undernutrition from NFHS-2 to 4 as shown in table 1.8 below.

**Table 1.8: Trend of undernutrition in Bihar State**

Bihar State	NFHS-2	NFHS-3	NFHS-4
Stunting	70%	55.6%	48.3%
Wasting	21.0%	27.1%	20.8%
Under-weight	71.3%	55.9%	43.9%

Source: NFHS

The current nutritional status of the children under five years of age in Bihar State is; stunting 48.3%, wasting 20.8% and under-weight 43.9%. Table 1.9 compares the children of Bihar State with children from the states of Goa and Tamil Nadu. Table represents stunting, wasting and underweight of these states. The values reflects good nutritional indicators which reflects the low morbidity of undernutrition in children, whereas the other two states (Madhya Pradesh and Karnataka) have poor nutritional indicators like Bihar State. Studies have shown that good nutrition or dietary intake of the children, in the form of breast-feeding and complimentary feeding, is required for good development of children under the age of five, in developing countries(19). Inadequate nutrition is a problem throughout India but it is most pronounced in Bihar State.

**Table 1.9: The current nutritional indicators of Bihar State versus other States of India**

State	Stunting	Wasting	Underweight
	Height-for-age	Weight-for-height	Weight-for-age
Bihar State	48.3%	20.8%	43.9%
Madhya Pradesh	42.0%	25.8%	42.8%
Karnataka	36.2%	26.1%	35.2%
Tamil Nadu	27.1%	19.7%	23.8%
Goa	20.1%	21.9%	23.8%

Source: NFHS-4

## 5.2. Determinants of malnutrition in Bihar State

### 5.2.1. Immediate causes

From the adapted conceptual framework given by UNICEF, the immediate causes of undernutrition are poor dietary intake and childhood diseases which are being analysed. The common childhood diseases prevalent in Bihar State are diarrhoea, acute respiratory infections and fever. Evidence brought the knowledge that deficiency of micronutrients due to diarrhoea, other infections or due to poor dietary intake has an effect on the linear growth of children under five years of age(20).

As explained in table 2.0, diarrhoea is more prevalent in Bihar State (10%) as compared to states Tripura (4.9%) and Goa (3.8%). The percentage of children suffering from acute respiratory infection (ART) is 2.5% and the percentage of children suffering from fever is 59.8% as compared to Tripura (2.6%, 73.0%) and Goa (1.4%, 83.2%) respectively.

The high prevalence of childhood diseases are being noticed in Madhya Pradesh and Maharashtra as well, which depicts that similar determinants may be responsible for undernutrition in children of these states too (18). Studies have shown that infectious diseases in childhood are the cause of morbidity and mortality in developing countries (21)

**Table 2.0: Prevalence of child hood diseases in Bihar State versus other States of India**

State	Diarrhoea	ART	Fever
Bihar State	10.4%	2.5%	59.8%
Madhya Pradesh	9.5%	2.1%	70.9%
Maharashtra	8.5%	2.4%	84.7%
Tripura	4.9%	2.6%	73.0%
Goa	3.8%	1.4%	83.2%

Source: NFHS-4

It has been concluded that breast-feeding plays an important role in decreasing the morbidity and mortality due to diarrhoea. Young infants who are not breast-fed have more chances of diarrhoea compared to those who are breast-fed. Exclusive breast-feeding up to six month is very beneficial for the infants, but in Bihar State only 0.7% of the children under six months of age are exclusively breast-fed.

On an average, the duration of breast-feeding in Bihar State is only 2 months. This highlights the importance of breast feeding in improving the nutritional status of the children. This can be done by fulfilling the dietary requirements up to the age of six months by reducing the chances of diarrhoea. Which in turn is one of the immediate causes of the undernutrition among children under five years of age in Bihar State (22).

The guidelines recommended under infant and young child feeding practices (IYCF) (23) are not being followed properly in Bihar State. The evidence from Table 2.1 clearly shows the comparison of IYCF practices being followed in the state of Bihar, and other states. In Bihar State 34.9% of new borne children are breast-fed within the first hour after delivery.

**Table 2.1 Infant and young child feeding practices in Bihar State versus other States**

State	Breast feeding with-in first hour	Exclusive breast feeding	Children 6-8 months receiving solid /semisolid food	Breast fed children receiving adequate diet	Non-breast-fed children receiving adequate diet
Bihar State	34.9%	53.5%	30.7%	7.3%	9.2%
Goa	73.3%	60.9%	66.8%	9%	15.1%
Manipur	65.4%	73.6%	78.8%	19.3%	14.1%
Madhya Pradesh	34.5%	58.2%	38.1%	6.9%	4.8%
Uttarakhand	27.8%	51.0%	46.7%	8.6%	7.9%

Source: NFHS-4

53.5% of the children are exclusively breast-fed in comparison to the other two states; Goa and Manipur, (60.9%, 73.6%). Only 30.7 % of the children under the age of 6-8 months are receiving solid/semi solid food in Bihar state. It has very poor percentage of 7.3% and 9.2 % of adequate diet in both breast-fed and non-breast-fed children in Bihar state. But these values are bit higher in Goa and Manipur (9%, 19.3%), (15.1% 14.1%) respectively. This depicts the poor infant young child feeding practices in Bihar State. The factors responsible for poor IYCF practices, include a low level of maternal education and no or less information provided by frontline workers to the mothers at the Aanganwadi centres<sup>2</sup>. The poor performing states for IYCF, in addition to Bihar State are Madhya Pradesh and Uttarakhand. The Good IYCF needs to be followed to bring about the improvement in the nutritional status of children under five years of age in Bihar State(24). Almost half of the breast-fed children in Bihar state do not get any solid or semisolid food.<sup>3</sup> The role of maternal education about the complimentary feeding and Nutritional counselling is very helpful for their children. (25,26)

### 5.2.2. Underlying causes

The immediate causes are closely linked to underlying causes like food insecurity at household level, inadequate maternal and

<sup>2</sup> Aanganwadi center is a government-sponsored child –care and mother-care center in India. The word means “courtyard shelter”.

<sup>3</sup> WHO recommendation of introduction of solid or semi-solid food to infants around the age of six months; this is because by that age breast milk is not sufficient for the optimal growth of the child.

childcare, unhealthy household environment, education, information regarding care practices and lack of health services.

Evidence has shown that the poor nutritional status of the mothers is responsible for the poor nutritional status of the children. I, as a researcher found that early-age marriage and early pregnancy is one of the reasons for the poor nutritional status of the mothers in Bihar state. Table 2.2 shows that in Bihar State 39% of the women aged 20-24 are married before the age of 18 years and 12.2% of the women aged 15-19 years already experienced motherhood or were pregnant at the time of the survey. These indicators are very low in Goa and Puducherry which shows that marriage at a legal age has a good effect on the future child as well as on the mother's health status which ultimately leads to a good impact on undernutrition.

**Table 2.2: Early child marriages in Bihar State versus other States of India**

State	Women age 20-24 years married before age 18years	Women age 15-19 years who were already mothers or pregnant at the time of survey (%)
Bihar State	39.1%	12.2%
Puducherry	10.7%	3.5%
Goa	9.8%	2.9%
Tripura	32.2%	18.3%
West Bengal	40.7%	18.3%

Source: NFHS-4

Studies have shown that early marriages have a great impact on the child nutritional status and the mother as well (27). The proper pre-natal and postnatal care has an impact on child growth. Incorporation of nutrition intervention should cover both pregnancy and post-natal period (28).

Another determinant is the antenatal care rendered during pregnancy; this is further depended upon factors such as poverty, illiteracy, parity and the duration of the stay in a particular locality. NFHS-4 data has revealed that as shown in table 2.3, 34.6% of women in Bihar State had visited an ANC during their first trimester of pregnancy and only 14.4% of pregnant women had four ANC visits during their pregnancy. As per the data from NFHS-4, Bihar State is the worst state with poor Antenatal care indicators in India.

The good antenatal indicators of Goa and Puducherry reflect the good health care services. The full antenatal care is very poor in Bihar State (3.3%). 42.3 % of the women had received post-natal care within two days of delivery. Poor ANC leads to low birth weight babies which in turn are more prone to undernutrition if not being properly cared for.

Studies have shown that a proper ANC visit, with good nutritional counselling during pregnancy, is very beneficial. It directly reduces the chance of undernutrition in both mother and child (29).

**Table 2.3: ANC visits by pregnant women in Bihar State versus other States of India**

State	ANC in first trimester	Four ANC visits	Tetanus toxoid	Consumption of folic acid for 100 days during pregnancy	Mothers who had full ANC	Mothers who received post-natal care from Doctor/nurse/Lady health worker/midwife within two days of delivery
Bihar	34.6%	14.4%	89.6%	9.7%	3.3%	42.3%
Goa	84.4%	89.0%	96.2%	67.4%	63.3%	92.4%
Puducherry	80.6%	87.7%	82.1%	66.6%	55.6%	84.9%

Source: NFHS-4

The education level of the mother plays a crucial role in the care of children, as the mother is always the first contact with their babies and good education leads to good information grasping which is always helpful for the children and whole family. Regarding the education level of the female, overall 49.6% of women are literate in comparison to male (77%). No other state, in comparison to Bihar State, has a poor education level as Bihar State, while the highest level of education has been found in Goa (89%). Research has shown that there is a strong relationship between mother's education and the child's nutritional status. (30,31)

At the household level, food insecurity is defined as an inability of the household to acquire or consume an adequate quantity and quality of food. This may be due to inadequate food supply or lack of resources. Food insecurity leads to decrease in the consumption of a less variety of food. It further leads to decrease the portion size of the meals to a decrease in number of meals consumed per day. Bihar State is an agricultural land and the farmers have to cope every year with challenges as drought, floods and irrigation problems.

Fluctuations in agricultural production, aggravated by climate change, lack of infrastructure and slow progress of nutrition improvement programme, have a negative effect on the household food security. These factors ultimately results in undernutrition in the household especially in children and women. The picture from ICDS is not good. The richer household mostly took up the supplemental food programme. This causes further marginalizing the accessibility of the poor and economically weaker population to get benefits from supplementary food supply at Aanganwadi centres in Bihar State. Although the overall food availability has been increased in Bihar State, the per capita availability of food grains is among the lowest in Bihar State. The public distribution system

(PDS) in Bihar State has done some improvements by supplying grains at the household who is below the poverty line but this initiative has to run in a successful way(32)

The per capita income of Bihar State (\$233.4) is very low as compared to the national level (\$594). Poverty is also the underlying cause of undernutrition in Bihar State. Helen Keller international has addressed how undernutrition and household food insecurity can be tackled through implementation of the Enhanced homestead food (33,34).

On the public health front, poor access to safe drinking water and inadequate sanitation, also affects the nutritional status of the children, mainly by increased chances of infections. 96.5% of the population in Bihar state has access to an improved water supply but only 1% of the population has privileges to piped water supply, which clearly indicates that the rest of the population has to traverse variable distances to collect water. Further 80% of the population in Bihar State defecates in the open, which again has its own associated hazards. The world health organization estimates that 50% of undernutrition is associated with repeated diarrhoea or intestinal worm infections from unsafe water or poor sanitation. Stunting can result from enteropathy caused by an inflammation that keeps a child body from absorbing nutrients and calories. Exposure of poor sanitation and hygiene in children leads to the ingestion of bacteria and viruses. This causes poor intestinal absorption of food in children. Which is linked to stunting and anaemia and that keep the child on poor growth development due to undernutrition(35). Victor et al. has shown that improving the child feeding, women’s nutrition and household sanitation can prevent childhood stunting (36).

Further analysis of health services, available in Bihar State, brought into the light substantial gaps in the health sector infrastructure and health manpower available as shown in table 2.4 and table 2.5 (37).

**Table 2.4: Health sector Infrastructure in Bihar State**

Type of health centre	Required	Functional	Shortfall
Sub-centre	14959	8909	6050
Primary health centre	2489	1648	841
Community health centre	622	70	552

Source: (RHS Bulletin March 2012)

**Table 2.5: Health manpower in Bihar State**

Type of health centre and health manpower	Required	Functional	Shortfall
<u>Sub-centre</u>	8909	1240	7699
Male	10557	8904	1653
Female			
<u>Primary health centre</u>	1648	1850	228
Doctor			
<u>Community health centre:</u>	280	151	129
Doctor			

Source: (RHS Bulletin March 2012)

A poor health infrastructure and services overburden/exert too much pressure on the existing health infrastructure and manpower, which is bound to compromise the quality of health care to render. In this setting, where the health centres are lacking in number, the large distance to the service point obviously increases. The poor quality, of the health services rendered, adversely affects the health seeking behaviour of the people, thereby reducing its utilization. This results in morbidity and mortality of the population, especially in the vulnerable groups. Among these vulnerable groups, mothers and children form the major part. Studies have shown that uneven distribution of human resources and lack of infrastructure in the health sector has a great impact on the health services (38,39).

### 5.2.3. Basic Causes

The basic causes for undernutrition are political, economic, cultural and the religious system and institutional structures that govern society. The inequitable distribution of power, money and resources in society, leads to poor democratic governance, which results in the less hearing of the poor people's voice in decision making over the allocated resources. Political instability leads to higher indices of undernutrition as compared to the countries that are politically stable. This situation is not good in Bihar State as this state is not politically stable. Bihar State has a rich natural resources based economy. But due to its poor economic performance, which includes, low utilization of resources, low investment to build resources, inadequate infrastructure, poor institutional support, has put this state in the low – level equilibrium trap (40). The total per capita of health expenditure in Bihar State is low (\$4.5). The states are not spending at their own level in a good pace which leads to the overall impact on the system (41). People are an asset when they are skilled but in Bihar State there are more unskilled and poorly educated people. It has led to unemployment. This leads to poverty, inequality and poor education. From poor governance and low investment, the education and health condition of Bihar State are very poor. There is a low investment by the public sector, in building physical and economic infrastructures. Lack of inter-sectoral coordination, between various ministries of government, such as the Ministry of Health and Welfare, the Ministry of Women and Child

Health, the Ministry of Agriculture and the Ministry of Finance have added to the problem of non-implementing the proper programme and policies, which lead to the development of problems such as undernutrition, lack of infrastructure, lack of health services, poverty and unemployment etc.

### 5.3. Analysis of Nutritional Programme in Bihar State.

Paediatric undernutrition has always been a matter of concern on global as well as at national level. The Government of India has launched various vertical programme to tackle undernutrition in the community adequately. The Integrated child development services (ICDS) is one of the world's largest Nutritional programme launched by the Government of India. This programme is for children under six years of age, adolescent girls, pregnant and lactating mothers. The rationale of this programme was that the routine maternal child health service was not reaching the target population. The nutritional part of health was not covered by the health services and there was need for the community participation for further development of the children and women, thus the Government of India launched this programme. Presently there are 6000 blocks of ICDS programme in whole India. It is recommended that there should be one Anganwadi centre (AWC) per 1000 population in rural/urban area and per 700 populations in tribal areas.(42).

#### **Supplementary nutrition and growth monitoring**

The two important components of ICDS are supplementary food supply and growth monitoring of the children. Table 2.6 depicts the revised values of energy and protein provided by ICDS in a supplementary nutrition programme.

As we look at the various services, provided by the ICDS in Bihar State, their utilization by the beneficiaries is not impressive. As shown in the Table 2.7, Bihar State has a very low utilization of the services whereas the Orissa and Chhattisgarh had a very good utilization of services provided in this programme.

**Table: 2.6: The revised norms of supplementary nutrition energy under ICDS**

Age	Calorie	Protein
6-72 months	500 Kcal	10-15grams
Severely malnourished child	600 Kcal	20-25 grams
Pregnant and nursing Mother	800 Kcal	18-20 grams

Source: ICDS guidelines

**Table 2.7: ICDS services for children under 6 years of age in Bihar versus other States of India**

State	Percentage of children age 0-71 months who received any services	Percentage of children under age six years who:					Percentage whose mothers received counselling from an AWC after child was weighed
		Received food supplements	Received immunization	Received health check-ups	Went for early childhood care/pr e-school	Were weighed	
India	32.9	26.3	20	15.8	22.8	18.2	48.9
Bihar	9.9	4.2	7.7	0.8	4.8	0.7	*
Orissa	65.8	52.5	41.6	43.1	27.7	56.1	29.6
Chhattisgarh	65.2	58.5	46.0	32.2	37.1	45.1	48.1
Delhi	12.4	11.5	4.9	3.4	7.7	3.7	4

Source: NFHS-3

Data explained in table 2.7, Bihar State has a very low percentage of services availed from AWCs. These services have very undermined performance in Bihar State, which may result from the severe shortage of support staff, lack of skilled workers, lack of food supply, lack of training opportunities, lack of a supervisor child development officer (CDPO), whose function it is to supervise the functioning of the programme. The high cost of rice, wheat /millet and other nutritious food in the market might be one of the reason for poor food supplementation in Bihar state. The lack of a basic infrastructure may hinder the workers to perform all of the activities, as per the guidelines of ICDS. The lack of a reliable database on outcome indicators, might be the reason to which the officials don't have any objectives, which can be used further to make policies in a better way and to enhance the better working of ICDS services.

Studies showed that giving supplementary food, to the undernourished children in the first two years of their life, has a positive effect on their growth and stunting (43,44).

As per the report from the planning commission of India, the evaluation of ICDS has been done and it highlighted pit falls of the ICDS throughout the country. There is an order from the Apex court that this programme should be universalized but still in Bihar State this programme got only 1/5<sup>th</sup> of effective coverage. Due to the constraint on the supply chain, the non-delivery of food in Bihar State is very much prominent.

As stated in the Table 2.8 below, the status of the effective coverage<sup>4</sup> of supplementary nutrition programme for children is different statistically. The actual percentage (29.4%) of children receiving food is much less than the registered children (52.6%) at AWCs. There is a big difference between the supply-chain (43.9%) and demand-side (3.58%) constraint, which leads to non-delivery of food at AWCs. The supply-side constraint happens due to poor resources and administration whereas the demand-side signifies that the population or beneficiaries have no information about the program or are not motivated to come, due to the poor supply of food at AWCs (42).

**Table 2.8: ICDS coverage in Bihar State versus other States of India**

State	Receiving Food		Effective coverage as % of children recorded in delivery register	Not receiving food due to Constraints on		Awareness of food entitlement (%)
	As % of Children recorded in delivery register	Average number of days per month		Supply side	Demand side	
				As % of children recorded in delivery register	As % of children recorded in delivery register	
Bihar	52.6	14	29.4	43.9	3.58	16.44
Kerala	75.8	20	60.7	12.0	10.46	95.89
Tamil Nadu	76.0	21	63.7	15.0	9.25	87.67
Uttarakhand	81.9	8	26.2	12.9	5.25	19.3

Source: Evaluation Report on Integrated Child Development Services Vol. I

Reports have shown that the protein and calories are not being provided as per the standard norms, set by the government, table 2.6. Evaluation has reported that an expenditure is missing from the daily lunch component of the food being provided to the beneficiaries. It is also found that quality and quantity of the take-home ration does not match the programme recommended level as various factors lead to poor quality purchased and poor distribution. There is a mismatch in the allocation of and delivery of funds for supplementary nutrition to both children, pregnant and lactating mothers; the funds are not spent on beneficiaries to provide them healthy food, which has an effect on the nutrition of the children. There are very few learning activities provided by the AWC's due to following factors:

- i. AWC's are closed
- ii. Staff has poor skills
- iii. Staff is not motivated
- iv. Staff doesn't have enough training and pre-school education

<sup>4</sup> (Percentage of beneficiary recorded in the delivery register actually receiving food)\*(proportion of number of day's food received in a month.)

material to get the children engaged at AWCs (45).

Literature review (a systematic review) study has shown that an effective nutrition training of health workers has significantly improved the daily energy intake and frequent feeding of children between 6-23 months of age (46).

As stated in Table 2.9, the supplementary nutritional supply to adolescent, pregnant and lactating mothers is below average. The percentage of registered pregnant/lactating mothers is (68%) and adolescent (67.6%) is much higher as compared to the effective actual coverage of only 27.2% and 24.3% respectively. The constraints on the supply side not receiving food is more as compared to the demand side of not receiving food by beneficiaries at AWCs. The awareness of food entitlements among these beneficiaries is 14.3% and 20.9%. This relates to the poor nutrition of pregnant women, lactating mothers and adolescent girls, which has further impact on the nutritional status of their children. (Annex 1.6) Evidence has proven that a good nutrition during the adolescent period, during pregnancy and lactation have good results on the nutrition of children(47,48)

**Table 2.9: ICDS services to Adolescent girls, Pregnant women and Nursing mothers**

State	Receiving food		Effective coverage as % of those recorded in delivery register	Not receiving food due to constraints on		Awareness of food entitlements
	As % of those recorded in delivery register	Average number of days per month		Supply side	Demand side	
				As % of those recorded in delivery register	As % of those recorded in delivery register	
Bihar						
Lactating and pregnant mothers	68.0	10	27.2	29.2	2.8	14.3
Adolescent-t Girls	67.6	9	24.3	31.6	0.8	20.9

Source: Evaluation Report on Integrated Child Development Service vol.1

Bihar State ranked very low, in terms of intended behavioural changes, among ICDS beneficiaries. It has been found that on an average, less time is being spent by AWWs on pre-school education, on feeding practices and nutritional education to the mothers. The main services of ICDS are not being done in a proper way, which has shown a poor impact on children nutrition as well as pregnant and lactating mothers in Bihar State.

As the studies have shown that good nutritional education can improve the nutritional status with or without supplementary feeding in children(48)(49). As stated in the report the average time spent by AWWs on feeding is 46 minutes whereas on reports maintaining it is 120 minutes. This is very important to take into consideration, that services recommended under ICDS should be rendered in a responsible way. Equal distribution of the time to each service should be there and not focus only to keep the records high to impress the higher authorities. AWW are also involved in other schemes beside ICDS, which took a lot of time and gets less time for ICDS services to be fulfilled. In Bihar State 90% of the AWWs are involved in other schemes like the polio eradication programme. Although 98.6% of the AWWs are from the same village and they work in the same village AWCs, but their skill level is very poor (2.2%)(49).The education level of AWWs in Bihar State is, that 4.5% of AWWs are illiterate, 43.7% have high school education, 26.1% have higher school education and 17,5% are having a graduate level and high education.

The community perception, regarding AWCs, is very less (38%). The community participation in the ICDS programme is 18%. 82% of the community is not participating in any activity of the program. It is confirmed, from the studies, that community participation in nutritional education, has a good effect on the nutrition status of the children under five in lower-middle income countries (50).

Poor maintenance of records and poor administration is the bottleneck for the higher authorities, to get a clear idea on the ground level situation of beneficiaries. Maintenance of registers for all the services is on average below 50% in India, in Bihar State it is less than 5%. Maintenance of immunization, child weight and growth registers are less than 10% in AWCs in Bihar State, whereas in Tamil Nadu and West Bengal state, the maintenance of records is 80%. This may be due to the poor knowledge of AWWs of record maintenance, except for a very small proportion of AWWs who are educated and trained. The supply of medicine kits is only 10%. The other states of India like Kerala, Himachal Pradesh have the separate program for 15-45 years old women, but Bihar State has no such program.

Reports have shown that the administration section is weak. There are no or very few visits from the higher officials to the AWCs. On average an auxiliary nurse midwife visits AWCs only 8 times in six months. The ICDS supervisor made only five visits in six months. The supervisors mostly focused on bookkeeping. The block education officer and district project officer made no visits to the AWCs. The child development project officer (CDPO), does on an

average, one visit in six month and ignored totally to prepare the growth charts for measuring the growth of children at AWCs in Bihar State. Even the visits by Medical officers are very low, only one visit in six months. Aanganwadi centre (AWC) plays an important role in the delivery of the services to the beneficiaries. There is a shortfall of AWCs (37.2 shortfalls (in `000) as per the norms in Bihar State, based on the distribution of AWCs per population density. (Annex1.8).

Lack of adequate infrastructure in ICDS and human resources, to deliver six services, has adversely affected the quality delivery of services, leading to a poor impact of ICDS. Out of the 20 major states in India, Bihar State ranked at no. 20 in infrastructure facility. Only 16.1 % of AWCs has their owned housing facility, 55% are rented, 12.5 % are working in school premises and 16.5% are in other places. Space is used mainly for the cooking and storage for supplementary nutrition. This situation is very alarming in Bihar State. 30% of AWW reported about the less adequate space at AWCs. Adequate space was only found in Tamil Nadu, and Gujarat state. AWCs in Bihar State only have 9.3% of drinking water with 88.6% of hand pumps to meet the drink water demand by beneficiaries. 80% of AWC canters have no toilet facilities. The inventory, like the weighing machine and pre-school education kits were only 12.9%, which indicates why the children are not weighed at these AWCs.

It has been mentioned in the report that records of weights of children, growth monitoring information etc. are maintained at AWCS. But many of the AWCs have no weighing machine or trained AWWs who can perform this task to weigh the children. In providence of health check-ups and referral services, Bihar State is not performing up to average level.

## **6. CHAPTER VI: DISCUSSION, CONCLUSION AND RECOMMENDATIONS**

### **6.1 Discussion**

The purpose of this study was to analyse the determinants of undernutrition among children under five years of age in Bihar State, India. Knowledge of the health-related epidemiological situation of an area and the trends there-in is a vital pre-requisite for planning and subsequent review of strategies for the retention and control of any health related event in the area. The study was a literature review based on the UNICEF conceptual framework. Researcher have tried to explain the determinants of undernutrition in Bihar State based on the accessible data that was available for present study.

The UNICEF conceptual framework helped researcher to find out the answers of research objectives. It also helped in the analysis as it presented the interaction between the factors. The data in present study was taken from the National Family Health Survey (NFHS -3, NFHS-4). Comparison of determinants of undernutrition in Bihar State has been done with other states of India as per NFHS-4 data. It has not been done at national level because the NFHS-4 is a recent survey, completed only in 2015, thus a national level data of NFHS-4 has not been yet compiled. The NFHS-4 data provides a consistent, large database, which has been used for analysing the pattern of undernutrition among children under five years of age in Bihar State. This study has shown the relationship between the risk factors that have been explained.

The extent of undernutrition in the form of stunting, wasting and underweight in children under five years of age in Bihar State (Refer Table 1.8) has been changed positively over the last one and half decade. But still the prevalence of undernutrition is alarming in Bihar State. The findings indicate multi-sectorial factors that are responsible for the undernutrition in children under five years of age in Bihar State. These include the nutritional status of the mother, children (poor dietary intake in the form of breast-feeding, complimentary feeding) and health status of the children, which includes childhood diseases. The other important factors influencing the nutrition status of the children in Bihar State are: poor caring practices of children and mothers, household food insecurity, poor health services, and poor sanitation and hygiene. The major important findings which related to this study are the poor functioning of the Integrated Child Development Programme (ICDS), the nutritional programme, which is in its functional service since 40 years in India.

The results of present study showed that undernutrition is highly prevalent in Bihar State as compared to other states of India such as Goa State and Tamil Nadu State (table 1.9) where the prevalence of stunting and wasting is almost half, compared to Bihar State. This shows that these states have good health interventions regarding to the health status of their population.

Various causes of undernutrition were studied based on the UNICEF conceptual framework. Data from the available studies pertaining to dietary intake and diseases have shown that persistent childhood diseases constitute an important causative factor of undernutrition in children under five years of age (21). Prevalence of important childhood diseases in Bihar State (Refer Table 2.0) is high as compared to other states (Madhya Pradesh and Maharashtra States). The prevalence of infectious diseases reflects the poor

dietary intake which aggravates undernutrition in children under five years of age in Bihar State (22). It is recognized that frequent diarrhoea in children can lead to undernutrition while undernutrition aggravates the course of diarrhoea. Undernutrition is also risk for ART, the respiratory infections increase the demand of energy and adversely affect the nutritional status.

Infant and Young Child Feeding practices were found to be ranked very low in Bihar State compared to other states. Exclusive breast-feeding in Bihar State lasts only two months (Refer Table 2.1) with only 0.7% of children in Bihar State being exclusively breast-fed. Children do not get adequate complimentary feeding in Bihar State. This may be due to less awareness of the mothers regarding the health benefits of breast-feeding to their children. It may also be due to poor information being provided by frontline health workers to lactating mothers. Studies have shown that children who are breast-fed have a less chance of diarrhoea as compared to children who are not breast-fed (22). Good IYCF provides adequate nutrition and develop immunity and good growth of the children. This keeps children away from the effects of undernutrition. Evidences shows that proper and timely complementary feeding of the children, by educating mothers, have an effect on length gain and weight gain in children as well (26).

The poor nutritional status of the mother plays an important role in undernutrition of children less than five years of age. In Bihar State, two factors come into focus, regarding the poor nutritional status of the mother: a) early marriages of girls and b) poor antenatal care during the pregnancy. Bihar State has a high percentage of early marriages, (Refer Table 2.2) as compared to other states such as Puducherry and Goa. Early child marriage followed by early child bearing adversely affects the nutritional status of both mother and future children as well. This results in low birth weight babies, leading to undernourished children. One of the studies in India has shown the high risk of undernutrition in young children, born from mothers who get married as minors compared to young children born from women who married at legal age. It further leads to poverty and maternal depression. Evidence has shown that early marriage is the leading cause of undernutrition both in mothers and children (27).

Another contributory factor for undernutrition of children less than five years of age, is the antenatal care during pregnancy. As recommended by WHO and MOHFW-GOI, a minimum of 4 antenatal visits are required, with the first one in the first trimester of pregnancy along with two doses of tetanus toxoid immunization and consumption of iron folic acid tablets. Poor antenatal care is also

found at a higher level in Bihar State whereas the other states have quite good percentages of all components of antenatal care (Refer Table 2.3). The number of antenatal visits is important in this regard as these visits provide an opportunity to discuss and seek advice on breast-feeding and IYCF practices and also on prevention of common childhood illnesses. Reasons for the poor ANC visits may be the access to the health services, availability of health services, health-seeking behaviour of the women, financial status of the family and the women autonomy in the family. Studies have shown that proper ANC visits and good nutritional counselling during pregnancy has a direct effect on the new-born baby and its their nutritional status (29).

The Education level of the mother plays a vital role in the child's nutrition (31). Findings have revealed that the mother's education level in Bihar State is below average (19). Poor education of mothers leads to poor feeding practice outcomes, poor health services utilization, and poor autonomy at household level while the good education level will lead the women to overcome these poor outcomes.

The other result in relation to undernutrition among children under five years of age in Bihar State is the food insecurity in Bihar State. A large proportion of its population is dependent on agriculture as livelihood. As this state is prone to floods every year, with the consequent destruction of crops, it affects the availability of and the accessibility of food in monetary terms, this will lead to food insecurity at household level and development of stunting under the age of five. A safe water supply and sanitation are also important factors in this regard when studied, the hazards from poor hygiene and sanitation practices especially increased the risk of infectious diseases this is a known fact. This is further supported by the studies which have shown the effect of poor sanitation and hygiene on undernutrition. Studies have emphasized that in addition to focus on quality and quantity, it would be better to find out the causes of poor sanitation and hygiene, which are the leading cause of infections in childhood, causing undernutrition in children under five years of age. Literature review has shown that poor sanitation is responsible for recurrent intestinal infections which leads to poor absorption pushing children towards undernutrition. Studies have shown that improvement of mother education over good hygienic practices, can lead to a less chance of development of undernutrition under five years of age (35, 36). Other important determinants that this study brought forward were the poor health infrastructure, and shortfall of healthy manpower (which probably shows the poor outcome of health services in Bihar State) which leads to poor health services delivered to the people. The maximum impact of these poor

health services is being borne by the vulnerable and health-needy population especially mothers and children.

In India there is no health insurance scheme for the public and 80% of the health expenditure is out of pocket. Inadequate health infrastructure and manpower leaves people with no option but to approach the local traditional healers or go to the private sector. This causes more poverty and forcing them to mortgage or sell their house/agriculture land holding, in order to meet the health expenditure. In such settings, dietary intake, especially of mothers and children, are bound to get compromised due to the poor health services. Studies have shown that uneven distribution of health manpower and poor health infrastructure affects the health services, which lead to the impact on the public. The evidences has shown that by providing good remuneration or by implementing good retention strategies for the retention and motivation of the health workers, this can overcome the problem of shortage of health manpower in the health system (38,39).

Basic causes that were found to affect undernutrition of children under five years were: the poor economic status due to poverty and unemployment, which lead to poor household food security. Poor governance, low investment in public infrastructure like schools, health sectors, which effects the population in different ways leading to the undernutrition problem as one of the impact.

The Integrated Child Development Services programme is one of the world's largest nutritional programme and is running in India since 40 years.

Various pitfalls have been recognized during the analysis of this program. The ICDS scheme is a well-conceived scheme but in my opinion the problem lies in its implementation which is due to its weak funding, lack of accountability, lack of community ownership and the perception of the public related to this programme as it's only a feeding programme and not an early childhood development programme. The strengthening and restructuring of this scheme is in need to overcome these gaps in Bihar State. The present nutritional indicators that are showing poor values in Bihar State, can be related to the poor impact of the ICDS services.

Table 2.7 shows the services delivered by the ICDS in Bihar State in comparison to the national level. The reasons for the poor services may be multifactorial as one reason on its may not be valid or give the whole picture. Further analysis has shown relative reasons such as lack of: commodities, infrastructure, inventories, and financial security which can aggravate all these problems and impacts directly on the children nutrition, especially the children from poor families.

Studies have shown that good supplementary nutrition to the children under two years of age has a positive effect on their growth and development (43, 44). But our findings have shown that children are not getting proper supplementary nutritional supplies at AWCs in Bihar state.

Further evaluation found that food is not fortified with the proper proteins and energy as per the norms recommended by the government, which indicates that the food may have no effect on the nutritional status of the children from this nutrition supply. There may be a reason that there either is missing an expenditure or workers are not motivated to perform their duties (45, 46). They might have poor knowledge about the nutritious value of food supplements. The effective coverage by ICDS is below level for both children and other beneficiaries as compared to the other two states (Kerala and Tamil Nadu States). The numbers recorded in the registers of beneficiaries are not matched with numbers receiving the services. Which shows that either the beneficiaries have no information regarding the AWCs or the workers are not motivated to do their jobs (Refer Table 2.9).

Research has shown that good nutrition during adolescent and the pregnancy period, leads to good results in child nutrition (43, 44). Findings show a picture that AWWs are not spending much time on feeding services (45 minute) while they are busier in record making (120 minutes) which at the end is not matching with the actual numbers. The AWWs focus more on children from 3-6 years whereas the children below three years are not being cared for. One of the service of ICDS programme " The take home ration"<sup>5</sup> being supplied to the lactating mothers and pregnant mothers and for children less than three years. Children under three years are get ignored as there is no record whether this ration supply is being eaten by them or not. This further leads these children towards the impact of undernutrition.

There might be an information gap between mothers and AWWs, which has shown the poor growth development of children that we can see from the nutritional indicators as, mentioned in the analysis.

Evidences have shown that proper nutritional education, without supplementing food supply, can improve the nutritional status of the

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<sup>5</sup> Take Home Ration (THR) is the food supplement of 500 calories of energy and 12-15 gm of protein per child per day in the form of micronutrient Fortified Food /energy dense food marked as ICDS food supplement for age group 6 months to 3 years. Which is being given to beneficiaries to take this ration to home for this age group of children. Similar is for pregnant and lactating mothers with food supplement of 800 calories of energy and 20-25 gm of protein per day in the form of Micronutrient Fortified food and /or dense food as Take Home Ration.

beneficiaries (48, 49), but this is not working well in Bihar State. The education level of AWWs is not very high, which causes the workers to have a poor knowledge of services. Maintenance of record registers of all services (registration of beneficiaries, supplies of amenities, health check-ups, immunization etc.) is very poor. Only 5% of records are being maintained in the AWWs, which causes poor data information to higher authorities and leading to failure of proper implementation of the policies and interventions regarding the programme. Very less community participation has been found in the study, which shows that the community has no information regarding this programme and thus the beneficiaries are lagging behind the benefits of this programme. Administration in the form of poor visits by senior officials, absence of AWWs, poor visits by auxiliary midwives, whose function it is to provide immunization and antenatal nutrition guidance to the pregnant mothers, is very poor in Bihar state.

The lack of inventory such as lack of weighing machines, lack of growth charts, utensils for cooking was another obstacle found in the evaluation of this programme. These factors show why the children are not weighed at the centres and why they are not being provided with food supplementation at AWCs. Lack of sanitation and hygiene was another factor which seems to be responsible for undernutrition, as the children are coming in a poor hygienic environment this makes them more vulnerable to infections which leads to undernutrition in children. The infrastructure for AWCs is below average as most of the AWCs are in rented houses, where they cannot accommodate the children and also can't perform indoor activities. This affects the poor attendance of the children in AWCs causing the children to miss the opportunity of getting supplementary food at AWCs.

This study had various strong points. A clear literature search strategy was vital for the identification, retrieval and analysis of the relevant literature. The researcher got the information regarding the determinants of undernutrition through the stated research objectives. This is not always easy, especially when most of the required data can only be obtained from government institutions. The information requirement about the present nutritional status of children under five years of age in Bihar State, was also possible because of the publication of the NFHS surveys. This gives this thesis relevance and applicability in the current situation in Bihar State, India. The relationship between different determinants causing undernutrition in children under five years of age in Bihar State have also been explored at length. The idea was to find common nexus points between these determinants and find out what is the best way to prioritize the determinants of undernutrition

in Bihar State. The impact of ICDS on the nutritional status of children under five years of age in Bihar State has also been studied as an example of a leading programme in Bihar State. The unique insights, obtained from the analysis of the ICDS, have led to the generation of important recommendations of what future programme must do in order to succeed in bringing down the rates of undernutrition in Bihar State

This study also encountered various limitations. Some data from government sites was not accessible due to security reasons or because it was still undergoing analysis at government level. Some good articles with relevant information were also not accessible due to access limitations; the institutional repositories were not signed up to access this data and the data sometimes required financial payments for access. These reasons blocked researcher's access to key data which researcher think would have been more helpful for present study. There were challenges related to political data accessibility. As in any other country, sensitive programme data was not accessible to the public. The ICDS itself is a big search topic which needs to be explored in more depth; here its services has been explored but it needs to be explored in more detail. Due to the word-count constraint of my thesis, the ICDS programme was thus not explored fully.

The results of my study can be both generalized and transferred to the rest of India and to other Southern Asia countries albeit cautiously. These findings are not only applicable to Bihar State but also to other states of India, especially those who have below or similar trends of undernutrition than Bihar State. Programme implementers based in other states may transfer the findings of this literature review to their areas of operation. For example, one of the important key findings (Refer Table 1.9) is that other states have similar trends of nutritional indicators as Bihar State. This suggests that similar determinants might be responsible for the undernutrition among children of five years of age in those states. However, for the generalizability to be fully confirmed, full data access at country/regional level is required. Even better, this data can be quantitatively collected and evaluated in an experimental manner, for instance. This will ensure broad generalizability of the findings of this research.

## **6.2. Conclusion:**

Child undernutrition in Bihar State is a big public health problem. The nutritional status is influenced by three factors: food, health, and care. The balanced nutritional status of children occurs when the

children have adequate access to affordable and different nutrient rich food with good maternal and childcare practices. Good health services and good environmental conditions like safe water and good sanitation are also needed for the good growth and development of children. All these factors have direct effect on childhood diseases. Though the trend of undernutrition in Bihar State has been changing as seen in the last three NFHS surveys, the current values of stunting, wasting and underweight in children under five years of age are still high. The immediate causes that were found to influence of undernutrition of children under five years in Bihar State included the prevalence of childhood diseases and poor infant feeding practices. Prevalence of Diarrhoea is high in Bihar State causing a poor nutritional status of children. Breast-feeding practices such as including breast-feeding in the first hour of birth, exclusive breast-feeding and inclusion of complimentary feeding has very low values in Bihar State as per the data obtained during analysis. These poor practices and the childhood disease has an effect on the nutritional status of children under five years of age in Bihar State. Analysis of underlying causes revealed the findings of poor maternal nutritional status, antenatal care, caring practices of children resulting in poor nutritional status of their children respectively. Further the lack of health services due to poor infrastructure and health manpower has worst effect on needy population of Bihar state. Poor hygiene, sanitation, and household food insecurity further add to the development of undernutrition in Bihar state. Basic causes that do have effect on undernutrition are poor investment in nutritional programme, poor governance, and poor investment in public health infrastructure and are responsible for the impact on under nutrition (40).

The Analysis of the ICDS programme showed its poor performance in all six services. The Anganwadi workers are the most important functionaries of the programme, they perform their duties but with low enthusiasm and motivation. Poor training, lack of services at AWCs, lack of infrastructure, amenities, and food supply at AWCs is a leading cause of not providing the supplementary food supply to the children and other beneficiaries. Less effective coverage and poor maintenance of records are the bottleneck for the policy makers to have an idea about the ground reality. This leads to a poor development of the programme and their implementation in Bihar State.

### **6.3. Recommendations**

Optimal nutritional status of children is only possible when children have adequate access to affordable, diverse nutrient-rich food,

coupled with good maternal and childcare practices. In addition, they must have good healthcare services and good environmental conditions like safe water and good sanitation. Social economic and political factors further influence these factors.

This literature review proposes the following recommendations geared towards improving the determinants of malnutrition among children under five years of age in Bihar State. It also attempts to state recommendations for the Integrated Child Development Programme in Bihar State.

### **Nutrition specific interventions**

1. Focus should be on the maternal nutritional status during pregnancy. Good interventions should be implemented to target the pregnant women for their nutritional status during their pregnancy.
2. Promotion of Antenatal visits should be increased by proper campaigns particularly at community level to generate the awareness regarding benefits of antenatal check-ups during pregnancy.
3. To enhance the changes in health seeking behaviour of the society by providing counselling and information regarding the poor outcomes of health to the community, if proper utilization of health services is not availed by the needy people.
4. More awareness is needed for the mothers regarding IYCF (early initiation breast feeding, exclusive breast feeding inclusion of complementary feeding).
5. Needs community based integrated IYCF counselling services at large to generate awareness among the pregnant and lactating mothers for the benefits of breast feeding and complementary feedings for their children.
6. Awareness on Good hygiene and sanitation practices is needed for the better improvement of the childhood diseases especially diarrhoea which is the worst cause of the undernutrition in children under the age of five.
7. Focus on adequate health infrastructure and health manpower is needed in Bihar State in order to combat the problems of undernourished children who are in need of health services.
8. Need to have a strong awareness in the society regarding the rules and laws for child marriage act, which is already amended in Indian constitution against child marriage.

### **Nutritional –sensitive interventions**

1. These interventions need the involvement and coordination of other sectors.

2. Reframing of agriculture, education and poverty control policies is in need in Bihar State.
3. Good investment in new techniques for agriculture promotion is highly required.
4. Good investment in making good educational policies and poverty control strategies will help Bihar State to combat the undernutrition influenced by these factors.

### **Recommendations for the ICDS programme**

The ICDS programme aims to adopt a holistic approach in order to be of value to the beneficiaries in Bihar State but it needs some steps to improve.

1. Focus needs to be on children of 0-3 years of age as they generally get neglected in ICDS services.
2. More emphasis is needed on nutrition and health education activities for behaviour change.
3. Good coordination is needed between the ICDS staff and health workers.
4. Continue the supply of supplementary food is needed to every AWC.
5. Supplementary feeding services should be targeted toward the needy beneficiaries; proper admission criteria should be formed to get more and the targeted population to register under this programme, to get entitlement of the supplementary food supply.
6. Training qualities of AWWs need to be improved to have a better influence on the services provided by AWWs to the beneficiaries.
7. Good awareness needs to be generated in the population regarding the ICDS programme in Bihar State.
8. Good infrastructure and availability of amenities is a basic requirement for the functioning of the programme.
9. Prestige and dignity should be given to AWWs by providing good salaries and appraisals in the form of extra financial rewards to those who are showing good performances in the delivery of ICDS services to the beneficiaries.
10. Proper implementation, monitoring and evaluation of this programme is in greatly needed in Bihar State.
11. High quality of data collection in a responsible way is a successful key towards the decision-making for better programme implementation. This will also improve the accountability and quality of performance of all workers of ICDS.
12. To explore the ICDS programme fully in order to assess its strong points and weak points and key learning lessons.

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## 8. ANNEXES

### 8.1 Annex 1.1. Classification for assessing severity of malnutrition by prevalence ranges among children under five years of age. (WHO)

Indicator	Severity of malnutrition by prevalence ranges (%)			
	Low	Medium	High	Very high
Stunting	<20	20-29	30-39	>=40
Underweight	<10	10-19	20-29	>=30
Wasting	< 5	5-9	10-14	>=15

Source: WHO, 2016

## 8.2 Annex 1.2: Global review of malnutrition among children less than five years of age

### Global overview

#### Stunting

The global trend in **stunting** prevalence and numbers of children affected is **decreasing...**




! ...but not fast enough.

Between 1990 and 2014, stunting prevalence **declined** from **39.6** per cent to **23.8** per cent...



- 96M



...and numbers affected **declined** from **255 million** to **159 million**.

#### Overweight

The global trend in **overweight** prevalence and numbers of children affected is **rising.**




Overweight prevalence has **gone up** slightly between 1990 and 2014, from **4.8** per cent to **6.1** per cent...



+ 10M



...and numbers affected have **risen** from **31 million** to **41 million**.

#### Wasting

In 2014, the global **wasting** rate was **7.5 per cent.**



Approximately 1 out of every 13 children in the world was wasted in 2014.



Nearly a third of all wasted children were severely wasted, with a global prevalence in 2014 of **2.4** per cent.

50M



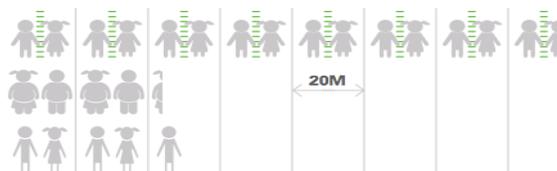
Globally, **50 million** children under 5 were wasted, of which **16 million** were **severely wasted** in 2014.

**In 2014, there were 667 million children under 5 in the world.**  
An estimated:

**159 million** were stunted

**41 million** were overweight

**50 million** were wasted



(each pair of children represents 20 million children)



Source: UNICEF

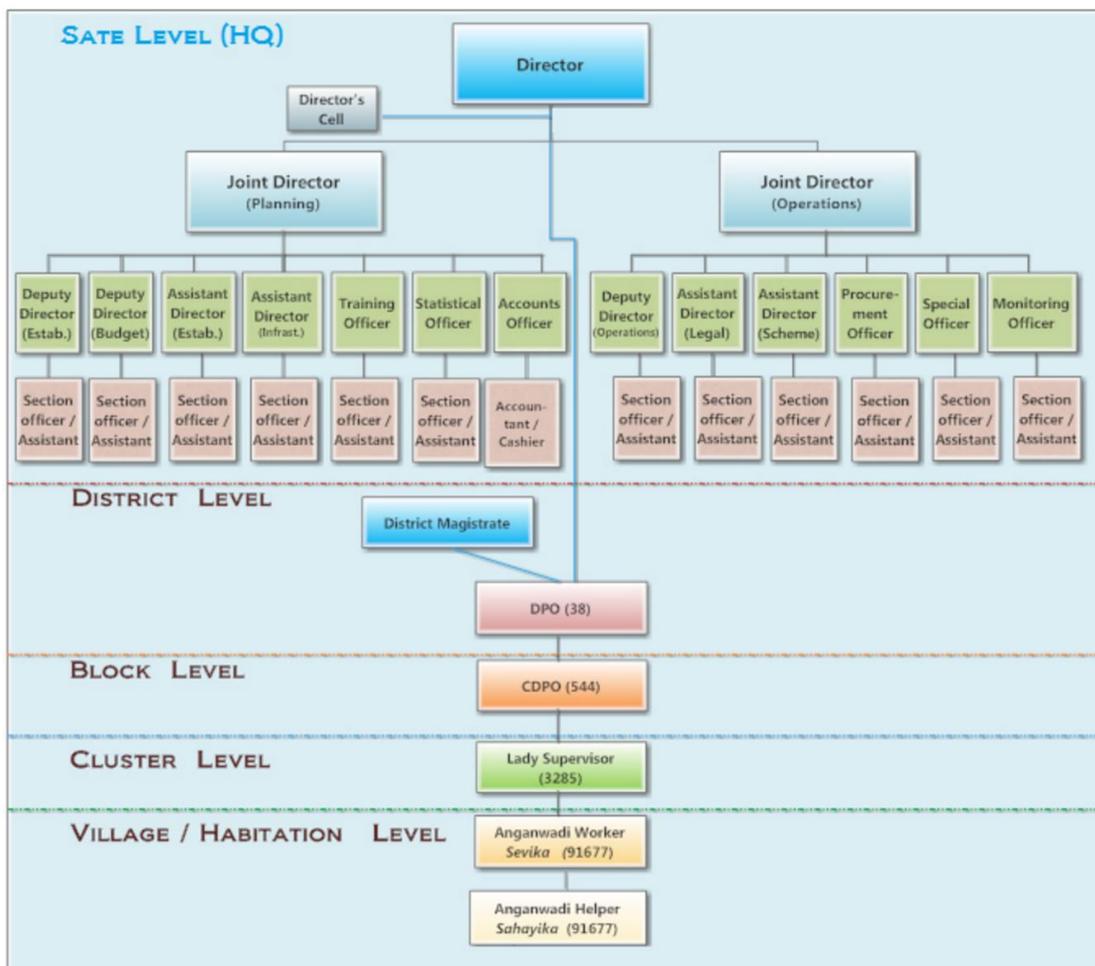
### 8.3 Annex 1.3

Population norms under Integrated Child Development Services (ICDS) Scheme	
<b>Anganwadi Centres (AWCs)</b>	For Rural/Urban Projects Population 400-800 1 AWC 800-1600 2 AWCs 1600-2400 3 AWCs Thereafter in multiples of 800 one AWC
<b>Mini AWC</b>	150-400 1 Mini-AWC
<b>For Tribal/Riverine/Desert, Hilly and other difficult areas/Projects</b>	Population 300-800 1 AWC 150-300 1 Mini AWC

Source: POSHAN, Bihar

## 8.4. Annex 1.4: Organizational chart of Integrated Child Development Services, Bihar State, India

### Organisational Chart



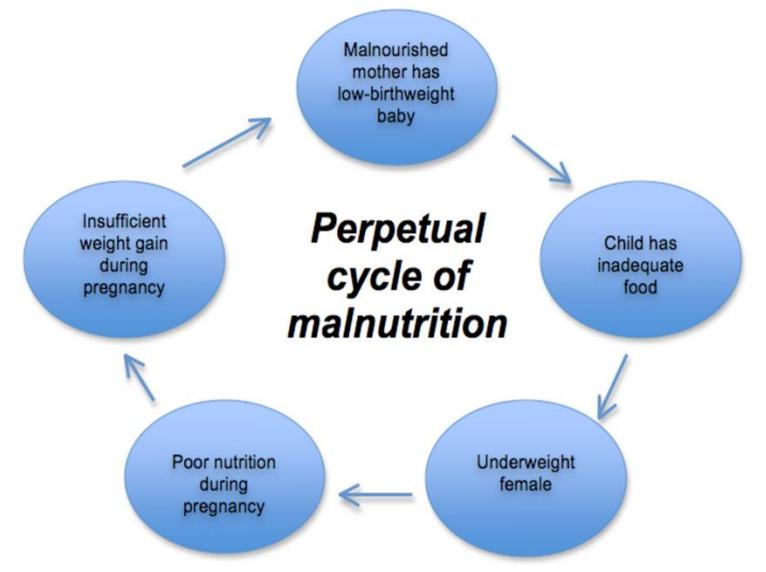
Source: ICDS, Bihar State, India

### 8.5 Annex 1.5 Overall Trends in Nutritional status of children from last two surveys, India

Percentage of children under age three years born to ever-married women classified as malnourished according to three anthropometric indices of nutritional status: height-for-age, weight-for-height, and weight-for-age, by residence, India, NFHS-3 and NFHS-2

Measure of nutrition	NFHS-3 (2005-06)			NFHS-2 (1998-99)		
	Urban	Rural	Total	Urban	Rural	Total
<b>Height-for-age</b>						
Percentage below -3 SD	16.4	23.8	22.0	19.7	30.2	27.7
Percentage below -2 SD <sup>1</sup>	37.4	47.2	44.9	41.1	54.0	51.0
<b>Weight-for-height</b>						
Percentage below -3 SD	6.8	8.3	7.9	5.3	7.1	6.7
Percentage below -2 SD <sup>1</sup>	19.0	24.1	22.9	16.3	20.7	19.7
<b>Weight-for-age</b>						
Percentage below -3 SD	10.6	17.4	15.8	11.3	19.6	17.6
Percentage below -2 SD <sup>1</sup>	30.1	43.7	40.4	34.1	45.3	42.7
Number of children	6,436	20,105	26,541	5,741	18,475	24,215

## 8.6 Annex 1.6: Malnutrition Cycle



Source: FMCH, India

## 8.7 Annex 1.7: Proportion of supervisors in position

