CHAPTER – 10

Discussion

10.1: Comparison of anthropometric characteristics of present study with others studies

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10.1.1: Regional Studies

Table 10.1.1.1 and figure 10.1.1.1 present comparison between mean values of height among girls of present and regional studies. 3 to 6 years aged girls had greater mean in the present study compare to tribal and rural girls. 10 years aged Rural girls (NNMB, 2012) had lower mean than the present study. 7 to 10 years aged Rural girls had higher mean than present study. Greater mean values were observed at the age of 11and 12 years aged Tribal girls (NNMB, 2009).

Table 10.1.1.2 and figure 10.1.1.2 represent comparison between mean values of weight of present and regional study. Lower mean values were observed in tribal and rural girls at the age of 3 to 6 years in comparison to the present study. 7 to 12 years aged Tribal girls had higher mean than the nonindustrial girls (NNMB, 2009). But 7 to 12 years aged Rural girls had lower mean than industrial girls (NNMB, 2012)

Table 10.1.1.3 and figure 10.1.1.3 present comparison between mean of MUAC among girls of regional and present study. Lower mean value was observed in Tribal girls than nonindustrial girls and industrial area girls. Only 12 years aged nonindustrial girls had lower mean of MUAC than Tribal girls (NNMB, 2009). As well as same condition was observed in Rural girls (NNMB, 2012).

Table 10.1.1.4 and figure 10.1.1.4 represent comparison between mean values of height among boys of present and regional study. 3 to 6 years aged Tribal boys had lower mean of height than nonindustrial and industrial boys. 7 to 12 years aged Tribal boys had greater mean values than nonindustrial boys. Lower mean values of height were observed at the age of 3 to 9 years aged Rural boys (NNMB, 2012) than present study. 11 and 12 years aged Tribal boys (NNMB, 2009) had higher mean in comparison to the present study.

Table 10.1.1.5 and figure 10.1.1.5 show comparison between mean values of weight of boys of regional and present study. 3 to 5 years aged boys had low mean weight compare to nonindustrial boys. Industrial boys of all age groups had higher mean than Tribal boys except 12 years aged boys (NNMB, 2009). Rural boys (NNMB, 2012) of all age groups had lower mean than industrial boys.

Comparison between mean values of MUAC among boys of regional and present study is showed on the table of 10.1.1.6 and figure 10.1.1.6. Lower mean values of MUAC were observed in Tribal and Rural boys (NNMB, 2009; NNMB, 2012) compare to the nonindustrial and industrial boys.

10.1.2: National Studies

Table 10.1.2.1 to 10.1.2.10 and figure 10.1.2.1 to 10.1.2.10 present comparison of present study with national study. Table 10.1.2.1 and figure 10.1.2.1 show comparison between mean height among girls of present and national study. Higher mean value of height among girls (8 and 9 years) was observed in the study of Qamra et al., (2012) than the present study. But allover girls had lower mean value in the study of Qamra et al., (2012) than the present study. Other two national studies were represented 6 to 12 years aged girls had higher mean height than present study.

Table 10.1.2.2 and figure 10.1.2.2 present comparison of mean values of weight among children of the national with present study. 8 years aged girls had higher mean (21.80 kg) value of weight in the study of Qamra et al., (2012) than the present study (19.41 kg for nonindustrial area and 21.02 kg for industrial area). Otherwise in the present study, girls had higher mean value of weight compare to the study of Qamra et al., (2012). Lower mean value was observed in the present study than the other two national studies.

Comparison of mean values of sitting height among children of present with national studies is showed in table 10.1.2.3 and figure 10.1.2.3. 3 and 4 years aged girls had low mean in the study of Qamra et al., (2012) than industrial area girls although girls had higher mean in the study of Qamra et al., (2012) than nonindustrial area girls. Low mean values were observed in the study of Mitra et al., (2002) compare to the present study. But higher mean values were seen in the study of Agarwal et al., (1992) than the present study.

Table 6.2.4 and figure 6.2.4 present comparison of mean values of MUAC among girls of present study with national study. Greater values of mean were observed in the study of Agarwal et al., (1992) than the present study. Girls had lower mean values of MUAC in the study of Mitra et al., (2002) than the present study. Only 12 years aged girls had higher mean values in the study of Qamra et al., (2012) than the nonindustrial area. Girls of overall age groups had lower mean values in the study of Qamra et al., (2012) than the present study.

Table 10.1.2.5 and figure 10.1.2.5 represent comparison of mean values of BMI among girls of the present with national study. 9 and10 years aged industrial area girls had higher mean values, was observed in the present study than the study of Basu et al., (2014). Girls of all age group had higher mean values of BMI in the study of Basu et al., (2014) than the present study.

Comparison of mean values of height of national with present study is presented in the table 10.1.2.6 and figure 10.1.2.2. Low mean value was observed at the age of 5 years aged boys in the study of Agarwal et al., (1992) than the present study. But boys of other age group had greater mean vales of height in the study of Agarwal et al., (1992) than the present study. 6 to 11 year aged boys had higher mean value of height in the study of Fazili et al., (2012) than the present study. Lower mean values were observed in the study of Qamta et al., (2012) than the industrial area boys.

Table 10.1.2.7 and figure 10.1.2.7 present comparison of mean of weight among the children of the present with national studies. In the study of Agarwal et al., (1992), boys had higher mean than the present study as well as higher mean value of weight was observed in the study of Fazili et al., (2012) than the present study. 7, 8 and 12 years aged boys had higher mean value in the study of Qamra et al., (2012) than the nonindustrial area boys. Boys of all age group had greater mean values in the present study than the boys of the study of Qamra et al., (2012).

Table 10.1.2.8 and figure 10.1.2.8 present comparison of mean of sitting height among the boys of the present with other national studies. 11 and 12 years aged boys had higher mean in the study of Agarwal et al., (1992) compare to the present study. Lower mean was observed in the study of Mitra et al., (2002) than the present study. 3 and 4 years aged children had higher mean value of weight in the study of Qamra et al., (2012) compare to the present study.

Comparison of mean MUAC among boys of the preset and national studies is represented on the table 10.1.2.9 and figure 10.1.2.9. Higher mean values were observed at the age of 6, 7 and 12 years in the study of Agarwal et al., (1992) than the nonindustrial area boys. Lower mean values of MUAC among the boys were observed in the study of Mitra et al., (2002) in all age groups. Overall boys had lower mean value in the study of Qamra et al., (2012) comare to the present study.

Mishing tribal boys had higher mean value of BMI compare to the nonindustrial area boys. Kaibarta (Basu et al., 2014) caste boys had lower mean than industrial area boys except 5 years boys. The comparison of mean values of BMI among boys of present with national studies is presented on table 10.1.2.10 and figure 10.1.2.10.

10.1.3: International studies

Tables 10.1.3.1 to 10.1.3.6 represent the comparison of anthropometric characteristics among the children of the present study with other international study. Table 10.1.3.1 and figure 10.1.3.1show comparison of mean height among children of present study with other international study. It was seen that nonindustrial girls and industrial girls had greater mean height than Netherland girls at the age of 3 and 4 years. Another age group shows lower mean value was observed in present study than the other international (Jeroen et al., 2014; Eze et al., 2017) study.

Table 10.1.3.2 and figure 10.01.3.2 present comparison of mean weight among children of present with international study. 6 to 12 years aged Nigerian children (Eze et al., 2017) had higher mean value than present study.

Comparison of mean value of BMI is represented on table 10.1.3.3 and figure 10.1.3.3. Over all higher mean value of BMI was observed in Nigerian children compare to the present study (Eze et al., 2017).

Table 10.1.3.4 and figure 10.1.3.4 show comparison of mean height among children of international with present study. Only 3 years aged children had higher mean value of the present study than international study (Jeroen et al., 2014). Netherland and Nigerian boys had greater mean value of height compare to present study (Eze et al., 2017).

Table 10.1.3.5 and figure 10.1.3.5 present comparison mean weight among the children of international with present study. Overall higher mean value of weight was observed in international study than present study (CDC, 2009; Eze et al., 2017).

Table 10.1.3.6 and figure 10.1.3.6 present comparison of mean values of BMI among children of present study with international study. Overall (6 to 12 years) aged children had greater mean values were observed in international study than present study (CDC, 2009; Eze et al., 2017).

10.2: Comparison of prevalence of undernutrition among children of the present study with other studies

Table 10.2.1 and figure 10.2.1 represent comparison of prevalence of the undernutrition among the children of the present study with regional studies. Maximum overall prevalence of underweight (63.30%) and wasting (50.00%) were found in school going children of Arambag (Bose and Mondal, 2010). The present study clearly indicated that higher prevalence of underweight (44.16%) was found in nonindustrial school going children than the Santal children (33.70%) of Purulia district (Chowdhury et al., 2008), Slum children (31.70%) of Chetla (Mandal et al., 2014), primary school children (40.23%) of Burdwan (Pramanik et al., 2015) and under five children (41.00%) of Bankura (Sarkar., 2016). But lower prevalence of underweight (32.37%) was found in industrial children than other regional studies. Higher prevalence of stunting (28.34%) was found in nonindustrial children than other regional studies except Bengalee Muslim children (38.50%) of North Bengal (Sen et al., 2011) and under five children (51.00%) of Bankura (Sarkar., 2016) as well as higher prevalence of stunting (23.03%) in industrial children than Santal children (17.90%) of Puruliya (Chowdhury et al., 2008) and Primary school children (19.76%) of Burdwan (Pramanik et al., 2015). Lower prevalence of wasting (30.76%) was found in nonindustrial children than the School going children (50.00%) of Arambag (Bose and Mondal., 2010) and Bengalee preschool children (35.37%) of Sundarban (Giri et al., 2017) as well as lower prevalence (21.90%) of wasting in industrial children than other regional studies except Bengalee Muslim children (17.40%) North Bengal (Sen et al., 2011).

Table 10.2.2 and figure 10.2.2 depict comparison of prevalence of undernutrition among children of present study with national studies. The present study clearly indicated that higher prevalence of underweight (44.16%), stunting (28.34%) and wasting (30.76%) were found in nonindustrial school going children of the present study than the other presented national studies. Higher prevalence of underweight (32.37%) was found in industrial children than the other national studies except rural school children (36.20%) of Maharastra (Vaidya et al., 2015). Lower prevalence of stunting (23.03%) was found in industrial children than Tripura’s children (Ray et al., 2013), School going children (23.28%) of Rural India (Singh et al., 2014) and Preschool children (26.70%) of Kerala (Chellamma et al., 2017). Higher prevalence (21.90%) of wasting was found in industrial children than national studies.

Table 10.2.3 and figure 10.2.3 depict comparison of prevalence of undernutrition among children of the present study with international studies. Higher prevalence (44.61%) of underweight was found in nonindustrial children than the other international studies except school aged children (47.00%) of Ethiopia (Elema. 2018) as well as same condition was observed in industrial children (32.37%). Higher prevalence (28.34%) of stunting was observed in nonindustrial children than the children of Nepal (13.00%, Joshi et al., 2011), children of Iran (9.53%, Kavosi et al., 2014), children of Bangladesh (11.80%, Haque et al., 2014), children of Ethiopia (19.60%, Degarege et al., 2015) and Nepal (24.54%, Mansur et al., 2015). Lower prevalence (23.03%) of stunting was found in industrial children than the children of Ethiopia (Rural 42.70% and Urban 29.20%, Herrador et al., 2014), children of Nepal (24.54%, Mansur et al., 2015), children of Pakistan (45.10%, Abbasi et al., 2018) and Ethiopia (34.00%, Elema., 2018). Higher prevalence of wasting was observed in present study than the international studies, which was presented in that table.

Table 10.2.4 and figure 10.2.4 present comparison of prevalence of thinness of children of different studies with present study. Higher prevalence of thinness was found in studied children than the international and national studies. But in regional studies higher prevalence of thinness was observed in preschool children (81.25%) of Sagar Block (Giri et al., 2017) and preschool Bengalee Hindu children (85.16%) of Arambag (Mandal et al., 2009) than the present study.

Table 10.2.5 and figure 10.2.5 show that comparison of prevalence of CIAF among the children of different studies with present study. Higher prevalence of CIAF was observed in nonindustrial children than the Rural school children (50.20%) of Purba medinipur (Acharya et al., 2013), Rural children (32.10%) of Singur (Roy et al., 2018) and Bengali Muslim population (57.60%) of North Bengal (Sen et al. 2011). Lower prevalence (47.70%) of CIAF was observed in industrial children than the presented all regional studies except Rural children (32.10%) of Singur (Roy et al., 2018). Higher prevalence of CIAF was found in nonindustrial children than the children of presented all national studies but prevalence of CIAF (47.70%) of industrial children was very low than national studies except under five children (37.00%) of Chennai (Ramesh et al., 2017). Higher prevalence of CIAF was found in nonindustrial children than presented all international studies but prevalence of CIAF (47.70%) of industrial children was very low than international studies.

10.3: Interaction between bio-social variables and nutritional status

School going children constitute a major part of the community whose health and nutritional status will indicate the changing tend of nutritional profile of a region. Despite enormous economic progress achieved in the past two to three decades, undrnutrition among children in both urban and rural India still claims many lives due to the immense population size, illiteracy, inadequate access to health facilities and socioeconomic disparities in India (Nandy et al., 2005, Bisai et al., 2014, Rengma et al., 2016, Meshram et al., 2012, Biswas et al., 2011, Ramesh et al., 2017, Yadav et al., 2016, Arora et al., 2014, Sarkar. 2016, Pal et al., 2017; Henauw et al., 2003). In the present cross-sectional study was presented nutritional status among school going children of two areas of Purba Medinipur, and it was also observed that association between undernutrition and socio-economic status in both areas. Result of the x^2 test showed that child nutritional status was significantly associated with fathers' education, mothers' education, house type, no of living room, sanitation and fuel type and illness in nonindustrial area. But it also seen that prevalence of undernutrition was significantly associated with fathers' education, mothers' education, fathers' occupation, house type, number of living room, family income and expenditure in industrial area.

Binary logistic regression used to determine probable risk factors for undernourished children of two areas. Result of this analysis showed that in this study, undernutrition was significantly higher in children whose parents were educated upto upper primary compared with children whose parents were educated above upper primary in nonindustrial area, similarly prevalence of undernutrition was significantly high in children whose parents were educated upto secondary compared with children whose parents were educated above secondary in industrial area, which was similar with previous study (Headey and Hoddinott. 2015). It also seen that improving socio-economic condition along with parental education and preventing infections through personal hygiene might help to improve the nutritional status among the children (Meshram et al., 2011, Meshram et al., 2012, Owoaje et al., 2014, Garcia Cruz et al., 2017, Kavosi et al., 2014, Pal et al., 2017, Vollmer et al., 2017). The higher prevalence of undernutrition among children did not used proper sanitary system compared to those children used proper sanitary system in nonindustrial area. The sanitation and nutrition links refers to the multiple connections between sanitation practices and nutritional outcomes. There are three identified direct pathways through which poor sanitation (and associated open defecation) may adversely affect nutritional outcomes in children: diarrhoeal diseases (Briend, 2015; Walker, 2013), environmental enteropathy (Humphrey, 2009), and nematode infections (Pruss- Ustun and Corvalan, 2006). Indeed, the World Health Organization estimates that as much as 50 per cent of childhood under nutrition is associated with poor WASH (Pruss-Ustun et al., 2008). Sanitation can be promoted by the health sector through a stand-alone programme such as sanitation marketing or included in disease-specific control programmes such as the 'SAFE' approach to infectious disease (Mariotti and Pruss, 2000). Alternatively, it can be incorporated into a wider integrated community health package such as HEP (Health Extension Programme), which was developed in 2004 to prevent the five most prevalent diseases in the country (Terefe and Welle, 2008; Bibby and Knapp, 2007; Mara et al., 2010; Dodos et al., 2018) safe sanitation and hygiene became a major focus within HEP because of the recognition that these diseases are all linked with poor environmental health. Thus, in 2008, The Lancet wrote, ''the shamefully weak presence of the health sector in advocating for improved access to water and sanitation is incomprehensible and completely short-sighted" (Lancet, 2008). Some previous study those are similar to the present study (Humphrey 2009; Mara et al., 2010; Singh et al., 2015.). The lower prevalence of undernutrition among children was found into the families used smokeless fuel type for cooking purpose rather than other type in nonindustrial area. Totality of the effect of lack proper toilet facilities, cooking fuel type and housing conditions by constructing an Index of Household Environment Health Risk (HEHRI) on child undernutrition in rural area (Singh et al., 2015; WHO, 1990). These fuels include wood, crop and agricultural residue, animal dung and straw, which are easily accessible from inexpensive farm resources (Holdren and Smith, 2000; Smith, 2002). The risk of IAP arises due to incomplete combustion of biomass fuels in inefficient stoves, located in poorly ventilated areas leading to emission of smoke, particulate matter and polluting gases (such as carbon monoxide and oxides of nitrogen and sulphur). According to the WHO, Indoor Air Pollution (IAP) due to solid fuels is among the ten most important risk factors (after water and sanitation) in global burden of disease leading to respiratory diseases (Shaziya, and Prakash, 2014; Rayhan et al., 2019), anemia, blindness and other disorders (WHO, 2000; WHO, 2004; WHO, 2016) especially for women and children (Wichmann and Voyi, 2006), who spend most of the time in indoors and in the vicinity of cooking areas (Mishra, et al., 2002; Duflo et al., 2008; WHO, 2008). Some previous study those are similar to the present study (Smith, 2000; Perera, 2017; Balietti and Datta, 2018; Bhagowalia and Gupta, 2011, Sharma et al., 2011; Garcia Cruz et al., 2017). But low income and expenditure had greater risk for being undernourished children in industrial area. Similar studies have already reported that the children belonging to lower income and expenditure have a greater risk for undernutrition (Kirk et al., 2018; Katoch and Sharma, 2016; Owoaje et al., 2014; Mondal et al., 2015; Tigga et al., 2015; Rengma et al., 2016; Pal et al., 2017). The higher prevalence of undernourished children was found in industrial area, those children were living in house having less than two rooms. Some previous study those are similar to the present study (Biswas et al., 2013; Owoaje et al., 2014). Fathers' occupation was also significantly associated with undernourished children. Significantly higher risk was found in manual groups for being undernourished children of industrial area than non manual groups. Some previous study those are similar to the present study (Tigga et al., 2015; Owoaje et al., 2014; Rengma et al., 2016; Pal et al., 2017).

Step wise logistic regression analysis showed that mothers' education was significantly associated with prevalence of undernutrition of the children in nonindustrial area. Result of this analysis showed that in this study, undernutrition was significantly higher in children whose mothers were educated upto upper primary compared with children whose mothers were educated above upper primary in nonindustrial area. However no significant association was found with regard to family income and expenditure in nonindustrial area. Female education can also influence child health by increasing the decision-making power of women within the family. Women generally are the primary care givers in their home, devoting more time to the protection and care of their children than men (Caldwell, 1993; Akresh et al., 2012; Bbaale, 2014). The more education a woman receives, the more likely she is to be the primary decision-maker with regards to her children's health. Thus, past findings suggest that female autonomy is another pathway through which maternal education influences child health (Jejeebhoy, 1995; Frost et al., 2005). One of the most commonly researched links between maternal education and children's health. Its association with child mortality and health has largely been explained by the link between educational attainment and an increased ability to buy goods and services linked with health outcomes (Cleland & Van Ginneken, 1988; Defo, 1997; Watson, 2016). Education has a clear connection to income (Owoaje et al., 2014). Higher levels of income are correlated with better housing conditions; thus, households with latrine facilities, piped water, and electricity generally have lower contaminant levels than households without such amenities (Barrett & Browne, 1996; Defo, 1997; Martin et al., 1983). Education facilitates mothers' learning about the causation, prevention, recognition, and cure of disease, as well as nutritional requirements that can subsequently affect their health behavior (Caldwell, 1979; Cleland & Van Ginneken, 1988; Defo, 1997; Frenzen & Hogan, 1982). Furthermore, education can lead women to greater exposure and better understanding of health messages and recommendations through mass media or other sources. Educated mothers have sound knowledge and practice of feeding and health management of their children (Makoka and Masibo, 2015; Frost et al., 2005; Smith J.P. and Forrester R. 2017; Smith et al., 2016). Some research has shown that higher levels of education are associated with specific types of health knowledge, including awareness of the dangers of not boiling water, the importance of hand washing after latrine use, the proper use of oral rehydration therapy to treat diarrhea, and an understanding of contagions as a cause of disease (Boerma et al., 1991; Owoaje et al., 2014; Garcia Cruz et al., 2017; Kavosi et al., 2014; Pal et al., 2017). In addition to basic health knowledge, education can also influence attitudes about health behavior by producing a shift away from traditional beliefs and practices, leading to a greater receptivity to novel ideas and practices, and a more frequent acceptance of rational explanations of disease and modern medicine (Barrett & Browne, 1996; Cleland & Van Ginneken, 1988; Defo, 1997). Previous research has found an association between higher education and lower fertility, reproduction at low-risk ages, and longer birth intervals (Cleland & Van Ginneken, 1988; Shah et al., 2003; Hien et al., 2008). These reproductive factors are all associated with increased child survival. Cleland and Van Ginneken (1988) argued that the effect of maternal education on childhood mortality has little to do with shifting reproductive behavior, whereas others have argued for reproductive linkages between maternal education and child survival (Mason. 1984). Mother's education is closely associated with multidisciplinary factors which are related to child health and nutrition (Kraamwinkel et al., 2019; Vikram and Vanneman, 2019). Some previous study it is clear that mother education is a vital factor for child health and nutrition (Meshram et al., 2012; Frost et al., 2005; Haq et al., 2017; Kraamwinkel et al., 2019; Bajracharya and Subedi, 2017; García Cruz et al., 2017; Owoaje et al., 2014; Vollmer et al., 2017; Makoka and Masibo, 2015; Makoka, 2013; Bisai et al., 2014; Roy et al., 2018), which is similar to the present study.

But Stepwise logistic regression analysis estimated significantly greater risks of undernutrition was found in low monthly income for being undernourished children than higher monthly income. At present, there has been a growing movement to pull together evidence on the links among income, nutrition, and health for the design of multisectoral interventions that target nutritional deficiencies (IFPRI Conference, 2016). Income has the potential to benefit child nutrition, and household consumption choices depend on production outcomes only via total earnings, income from any source will be equally beneficial (Kirk et al., 2018; Svedberg, 2000). Under basic household models, income only affects these nutrition-inducing consumption choices by setting the budget constraint, with no other characteristic of income having influence (Skoufias, 2012; Black et al., 2013). A large collection of microeconomic studies attempting to determine the income links to nutrition through specific mechanisms provide mixed and often conflicting results (Black et al., 2013; Kirk et al., 2018). Even income and living condition was better in industrial area than nonindustrial area. Risks of undernutrition were significantly higher in undernourished children living in house having less than two rooms in industrial area. The NFHS–2 dataset contains a standard of living index (SLI) based on household ownership of assets and possessions. The SLI was created by assigning scores to a range of household goods and assets, including the type of house and toilet facilities, fuel used for cooking, and ownership of durable goods (NFHS- 2). Nandy et al., in their study the NFHS–2 index was used to examine the relationship between household living standards and undernutrition. Nandy et al., (2005) reported that compared to children in the referent group (group A), undernourished children in each of the other groups had lower mean SLI scores. Two points are worth noting: first, the children who we thought would be most vulnerable (i.e. those in group D) did on average live in the poorest households; second, children with multiple anthropometric failures (i.e. those in groups C, D and E) had lower mean SLI scores than children with only single failures (groups B, F and Y) or no failure (A). Child health is especially vulnerable to poor living conditions for several reasons. Not only is child exposure usually higher in terms of time spent indoors, but children have much higher respiratory rates relative to their body weight than adults, and more time spent on the floor and placing objects in their mouths. Moreover, their immune systems and metabolic capacities are less developed (Perera et al., 2006). The environment of living room during early life is thus an important source of exposure to chemical, biological, and physical agents (Heyland et al., 2013; Krieger and Higgins, 2002; Harker, 2006; Oudin et al., 2017). Poor living conditions have been reported to be associated with respiratory infections, asthma, and mental health in children (Krieger and Higgins, 2002; Harker, 2006; Oudin et al., 2017) and poor living conditions play a role in the association between income inequality and child health (Sengoelge et al., 2014; Marmot, 2005; Harker, 2006).

Tables

10.1.1: Regional Studies

Table 10.1.1.1: Comparison of mean height (cm) of the present study with regional studies

Study	NNMB Tribal Girls	NNMB Rural Girls	Nonindustrial Girls	Industrial Girls
Year	2007- 2008	2011- 2012	**Present Study**	
Study Area	West Bengal	West Bengal	Nonindustrial area	Industrial area
No. of Children	5068	4486	313	315
Age in years	0 - above 60 years	0 -above 60years	3 - 12 years	3 - 12 years
3	91.50	90.90	101.07	100.56
4	98.00	96.40	104.58	103.88
5	103.20	104.00	107.01	109.27
6	110.30	108.90	110.78	113.91
7	115.50	113.60	113.40	116.93
8	123.00	121.60	119.82	121.82
9	128.60	125.70	122.79	124.29
10	134.60	129.20	130.22	129.15
11	139.30	135.90	133.79	137.04
12	143.20	141.50	142.59	142.77

Table 10.1.1.2: Comparison of mean weight (kg) of the present study with regional studies

Study	NNMB Tribal Girls	NNMB Rural Girls	Nonindustrial Girls	Industrial Girls
Year	2007- 2008	2011- 2012	**Present Study**	
Study Area	West Bengal	West Bengal	Nonindustrial area	Industrial area
No. of Children	5068	4486	313	315
Age in years	0 - above 60 years	0 -above 60years	3 - 12 years	3 - 12 years
3	11.40	11.60	12.97	13.12
4	12.90	12.90	14.44	14.08
5	14.20	14.40	15.69	15.08
6	16.40	15.80	16.46	17.64
7	17.80	17.20	17.02	19.19
8	21.00	20.20	19.41	21.02
9	23.80	22.00	20.94	22.54
10	27.10	24.40	24.80	25.30
11	30.60	27.90	27.31	28.99
12	35.00	31.60	32.20	32.40

Table10.1.1. 3: Comparison of mean MUAC (cm) of the present study with regional studies

Study	NNMB Tribal Girls	NNMB Rural Girls	Nonindustrial Girls	Industrial Girls
Year	2007- 2008	2011- 2012	**Present Study**	
Study Area	West Bengal	West Bengal	Nonindustrial area	Industrial area
No. of Children	5068	4486	313	315
Age in years	0 - above 60 years	0 -above 60years	3 - 12 years	3 - 12 years
3	13.80	14.00	15.48	15.49
4	14.00	14.40	15.76	15.20
5	14.20	14.50	16.18	15.63
6	14.60	14.80	16.21	15.82
7	15.10	15.10	15.71	15.94
8	16.00	15.90	16.51	17.26
9	16.80	16.70	16.48	17.83
10	17.40	17.00	18.48	18.74
11	18.40	18.20	18.81	19.23
12	19.90	19.00	18.87	20.40

Table 10.1.1.4: Comparison of mean height (cm) of the present study with regional studies

Study	NNMB Tribal Boy	NNMB Rural Boy	Nonindustrial Boys	Industrial Boys
Year	2007- 2008	2011- 2012	**Present Study**	
Study Area	West Bengal	West Bengal	Nonindustrial area	Industrial area
No. of Children	4153	3559	308	306
Age in years	0 - above 60 years	0 -above 60years	3 - 12 years	3 - 12 years
3	90.50	92.20	98.04	101.53
4	96.80	98.80	101.41	102.02
5	104.20	104.40	109.81	109.05
6	111.80	109.30	113.35	113.53
7	117.70	115.00	115.67	116.21
8	123.40	118.50	120.22	124.16
9	126.80	124.40	125.89	128.10
10	132.70	130.70	129.14	134.14
11	139.20	135.70	135.38	138.02
12	143.50	140.30	142.34	142.25

Table 10.1.1.5: Comparison of mean weight (kg) of the present study with regional studies

Study	NNMB Tribal Boy	NNMB Rural Boy	Nonindustrial Boys	Industrial Boys
Year	2007- 2008	2011- 2012	**Present Study**	
Study Area	West Bengal	West Bengal	Nonindustrial area	Industrial area
No. of Children	4153	3559	308	306
Age in years	0 - above 60 years	0 -above 60years	3 - 12 years	3 - 12 years
3	11.60	12.40	12.42	13.60
4	13.20	13.80	13.72	14.13
5	14.90	15.10	15.99	16.20
6	17.10	16.40	16.87	18.28
7	19.30	18.00	17.93	19.00
8	21.40	19.30	19.53	21.82
9	23.20	22.30	23.92	23.68
10	26.00	24.50	24.24	27.25
11	29.30	26.80	27.25	31.18
12	32.70	29.00	31.06	32.07

Table 10.1.1.6: Comparison of mean MUAC (cm) of the present study with regional studies

Study	NNMB Tribal Boys	NNMB Rural Boys	Nonindustrial Boys	Industrial Boys
Year	2007- 2008	2011- 2012	**Present Study**	
Study Area	West Bengal	West Bengal	Nonindustrial area	Industrial area
No. of Children	4153	3559	308	306
Age in years	0 - above 60 years	0 -above 60years	3 - 12 years	3 - 12 years
3	13.80	14.10	14.99	15.94
4	14.00	14.50	15.46	15.34
5	14.30	14.60	15.58	16.03
6	14.50	14.70	15.97	17.44
7	15.10	14.80	15.95	16.57
8	15.70	15.30	16.71	18.06
9	16.10	16.30	17.82	17.08
10	16.70	16.60	18.56	18.08
11	17.80	17.30	18.56	19.58
12	18.70	17.80	19.13	20.50

10.1.2: National Studies

Table 10.1.2.1 Comparison of mean height (cm) among girls of the present study with national studies

Study	Agarwal et al.,	Fazili et al.,	Qamra et al.,	**Present Study**	
Study Area		NI(Kashmir)	MP	Nonindustrial area	Industrial area
Year	1992	2012	2012	Present Study	
No. of Children		403	342	313	315
Age in years	5-18 years	5-14 years	1-17 years	3-12 years	3-12 years
3	-	-	87.90	101.07	100.56
4	-	-	93.80	104.58	103.88
5	106.00	111.14	102.10	107.01	109.27
6	113.00	117.29	108.10	110.78	113.91
7	118.20	127.18	111.50	113.40	116.93
8	122.70	128.04	120.70	119.82	121.82
9	128.60	136.75	123.10	122.79	124.29
10	134.80	141.07	128.10	130.22	129.15
11	141.30	143.53	132.00	133.79	137.04
12	146.70	146.11	140.30	142.59	142.77

Table 10.1.2.2: Comparison of mean weight (kg) among girls of the present study with national studies

Study	Agarwal et al.,	Fazili et al.,	Qamra et al.,	**Present Study**	
Study Area		NI (Kashmir)	MP	Nonindustrial area	Industrial area
Year	1992	2012	2012	Present Study	
No. of Children		403	342	313	315
Age Group	6-18 years	5-14 years	1-17 years	3-12 years	3-12 years
3	-	-	10.70	12.97	13.12
4	-	-	12.40	14.44	14.08
5	17.00	18.05	14.60	15.69	15.08
6	18.70	20.15	16.00	16.46	17.64
7	20.50	23.08	17.10	17.02	19.19
8	23.00	23.06	21.80	19.41	21.02
9	25.80	27.03	20.60	20.94	22.54
10	29.60	30.17	23.20	24.80	25.30
11	34.30	32.25	25.70	27.31	28.99
12	38.70	34.85	31.50	32.20	32.40

MP – Madhya Pradesh, NI – North India

Table 10.1.2.3: Comparison of mean sitting height (cm) among girls of the present study with national studies

Study	Agarwal et al.,	Mitra et al.,	Qamra et al.,	**Present Study**	
Study Area		Chhattisgarh	MP	Nonindustrial area	Industrial area
Year	1992	2002	2012	Present Study	
No. of Children		314	342	313	315
Age in years		5- 18 years	1-17 years	3-12 years	3-12 years
3	-	-	50.80	49.04	55.76
4	-	-	53.90	53.03	55.83
5	-	55.13	56.70	57.86	58.95
6	61.50	57.40	56.10	61.30	61.66
7	63.10	58.71	59.50	61.85	60.78
8	65.40	61.25	63.20	63.01	64.68
9	66.90	63.94	64.10	65.47	66.83
10	69.30	66.03	65.80	66.73	69.04
11	71.90	67.41	66.90	68.01	70.51
12	74.60	68.38	70.40	71.76	71.36

MP – Madhya Pradesh

Table 10.1.2.4: Comparison of mean MUAC (cm) among girls of the present study with national studies

Study	Agarwal et al.,	Mitra et al.,	Qamra et al.,	**Present Study**	
Study Area		Chhattisgarh	MP	Nonindustrial area	Industrial area
Year	1992	2002	2012	Present Study	
No. of Children		314	342	313	315
Age in years		5- 18 years	1-17 years	3-12 years	3-12 years
3	-	-	13.10	15.48	15.49
4	-	-	13.00	15.76	15.20
5	-	10.71	13.50	16.18	15.63
6	16.00	11.26	14.20	16.21	15.82
7	16.50	12.70	14.30	15.71	15.94
8	17.20	13.64	15.80	16.51	17.26
9	17.90	14.31	15.90	16.48	17.83
10	18.80	15.14	16.10	18.48	18.74
11	19.80	16.16	16.60	18.81	19.23
12	20.70	16.64	19.80	18.87	20.40

MP – Madhya Pradesh

Table 10.1.2.5: Comparison of mean BMI (kg/m²) among girls of the present study with national studies

Study	Basu et al.,		**Present Study**	
Study Area	Assam		Nonindustrial area	Industrial area
Year	2014		Present Study	
Children	Mishing Tribal Girls	Kaibarta Caste Girls	Nonindustrial Girls	Industrial Girls
No. of Children	291	227	313	315
Age in years	3 - 10 years	3 -10 years	3- 12years	3 -12 years
3	14.75	14.75	12.59	12.99
4	14.68	14.68	13.15	13.05
5	13.8	13.80	13.67	12.55
6	13.59	13.59	13.48	13.57
7	13.75	13.75	13.24	13.90
8	13.91	13.91	13.43	14.10
9	14.47	14.47	13.67	14.53
10	14.77	14.77	14.37	15.05
11	-	-	15.04	15.27
12	-	-	15.66	15.75

Table 10.1.2.6: Comparison of mean height (cm) among boys of the present study with national studies

Study	Agarwal et al.,	Fazili et al.,	Qamra et al.,	**Present Study**	
Study Area		NI (Kashmir)	MP	Nonindustrial area	Industrial area
Year	1992	2012	2012	Present Study	
No. of Children		537	453	308	306
Age in years	6-18 years	5-14 years	1-17 years	3-12 years	3-12 years
3	-	-	89.80	98.04	101.53
4	-	-	97.00	101.41	102.02
5	107.10	109.78	106.00	109.81	109.05
6	113.70	115.40	108.60	113.35	113.53
7	118.60	125.10	115.10	115.67	116.21
8	124.10	127.76	120.30	120.22	124.16
9	130.40	134.25	125.50	125.89	128.10
10	134.70	135.00	132.10	129.14	134.14
11	139.60	139.94	134.30	135.38	138.02
12	144.70	138.98	140.90	142.34	142.25

MP – Madhya Pradesh, NI – North India

Table 10.1.2.7: Comparison of mean weight (kg) among boys of the present study with national studies

Study	Agarwal et al.,	Fazili et al.,	Qamra et al.,	**Present Study**	
Study Area		NI (Kashmir)	MP	Nonindustrial area	Industrial area
Year	1992	2012	2012	Present Study	
No. of Children		537	453	308	306
Age in years	6-18 years	5-14 years	1-17 years	3-12 years	3-12 years
3	-	-	11.40	12.42	13.60
4	-	-	13.20	13.72	14.13
5	17.40	18.35	14.80	15.99	16.20
6	19.20	18.72	16.30	16.87	18.28
7	21.00	23.36	18.40	17.93	19.00
8	23.50	23.18	21.90	19.53	21.82
9	26.50	25.33	22.40	23.92	23.68
10	28.70	28.12	25.20	24.24	27.25
11	31.90	30.17	26.30	27.25	31.18
12	35.40	35.25	31.60	31.06	32.07

MP – Madhya Pradesh, NI – North India

Table 10.1.2.8: Comparison of mean sitting height (cm) among boys of the present study with national studies

Study	Agarwal et al.,	Mitra et al.,	Qamra et al.,	**Present Study**	
Study Area		Chhattisgarh	MP	Nonindustrial area	Industrial area
Year	1992	2002	2012	Present Study	
No. of Children		341	453	308	306
Age in years		5- 18 years	1-17 years	3-12 years	3-12 years
3	-	-	50.80	49.04	55.76
4	-	-	53.90	53.03	55.83
5	-	55.13	56.70	57.86	58.95
6	61.50	57.40	56.10	61.30	61.66
7	63.10	58.71	59.50	61.85	60.78
8	65.40	61.25	63.20	63.01	64.68
9	66.90	63.94	64.10	65.47	66.83
10	69.30	66.03	65.80	66.73	69.04
11	71.90	67.41	66.90	68.01	70.51
12	74.60	68.38	70.40	71.76	71.36

MP – Madhya Pradesh

Table 10.1.2.9: Comparison of mean MUAC (cm) among boys of the present study with national studies

Study	Agarwal et al.,	Mitra et al.,	Qamra et al.,	**Present Study**	
Study Area		Chhattisgarh	MP	Nonindustrial area	Industrial area
Year	1992	2002	2012	Present Study	
No. of Children		341	453	308	306
Age in years	6- 18 years	5- 18 years	1-17 years	3-12 years	3-12 years
3	-	-	12.90	14.99	15.94
4	-	-	13.40	15.46	15.34
5	-	10.80	14.10	15.58	16.03
6	16.00	12.00	13.70	15.97	17.44
7	16.20	13.76	14.30	15.95	16.57
8	16.60	14.83	15.40	16.71	18.06
9	17.10	15.26	15.40	17.82	17.08
10	17.80	16.14	16.80	18.56	18.08
11	18.50	17.06	16.70	18.56	19.58
12	19.30	17.93	17.90	19.13	20.50

MP – Madhya Pradesh

Table 10.1.2.10: Comparison of mean BMI (kg/m²) among boys of the present study with national studies

Study	Basu et al.,		Present Study	
Study Area	Assam		Nonindustrial area	Industrial area
Year	2014		Present Study	
Children	Mishing Tribal Boys	Kaibarta Caste Boys	Nonindustrial Boys	Industrial Boys
No. of Children	313	225	308	306
Age in years	3 - 10 years	3 -10 years	3- 12years	3 -12 years
3	15.50	12.71	12.88	13.22
4	14.60	13.00	13.22	13.55
5	13.76	13.62	13.25	13.53
6	13.71	13.74	13.10	14.14
7	14.25	13.56	13.37	13.99
8	14.27	13.86	13.50	14.14
9	15.25	13.76	15.00	14.36
10	14.75	14.39	14.38	15.06
11	-	-	14.79	16.07
12	-	-	15.22	15.72

10.1.3: International studies

Table 10.1.3.1: Comparison of mean height (cm) among girls of the present study with international studies

Study	CDC	Jeroen et al.,	Eze et al.,	Nonindustrial Girls	Industrial Girls
Study Area		Netherland	Nigeria	Nonindustrial area	Industrial area
Year	2009	2014	2017	**Present Study**	
No. of Children	NHANES III		1311	313	315
Age in years	2-19 years	0- 20 years	6- 12 years	3- 12 years	3 -12 years
3	98.20	95.00	-	101.07	100.56
4	105.10	102.80	-	104.58	103.88
5	112.20	110.10	-	107.01	109.27
6	117.90	116.70	124.20	110.78	113.91
7	124.30	122.90	127.80	113.40	116.93
8	131.10	129.10	132.30	119.82	121.82
9	136.60	135.50	137.50	122.79	124.29
10	142.70	141.70	142.70	130.22	129.15
11	150.20	147.50	147.00	133.79	137.04
12	155.50	152.40	150.10	142.59	142.77

Table 10.1.3.2: Comparison of mean weight (kg) among girls of the present study with international studies

Study	CDC	Eze et al.,	Nonindustrial Girls	Industrial Girls
Study Area		Nigeria	Nonindustrial area	Industrial area
Year	2009	2017	**Present Study**	
No. of Children	NHANES III	1311	313	315
Age in years	2-19 years	6- 12 Years	3- 12 years	3 -12 years
3	15.40	-	12.97	13.12
4	17.90	-	14.44	14.08
5	20.20	-	15.69	15.08
6	22.60	23.10	16.46	17.64
7	26.40	25.70	17.02	19.19
8	29.90	27.10	19.41	21.02
9	34.40	30.20	20.94	22.54
10	37.90	33.60	24.80	25.30
11	44.20	35.80	27.31	28.99
12	49.00	38.00	32.20	32.40

Table 10.1.3.3: Comparison of mean BMI (kg/m^2) among girls of the present study with international studies

Study	CDC	Eze et al.,	Nonindustrial Girls	Industrial Girls
Study Area		Nigeria	Nonindustrial area	Industrial area
Year	2009	2017	**Present Study**	
No. of Children	NHANES III	1311	313	315
Age in years	2-19 years	6- 12 Years	3- 12 years	3 -12 years
3	15.90	-	12.59	12.99
4	16.00	-	13.15	13.05
5	15.90	-	13.67	12.55
6	16.10	14.90	13.48	13.57
7	16.90	15.60	13.24	13.90
8	17.30	15.40	13.43	14.10
9	18.20	15.90	13.67	14.53
10	18.40	16.40	14.37	15.05
11	19.40	16.50	15.04	15.27
12	20.20	16.80	15.66	15.75

Table 10.1.3.4: Comparison of mean height (cm) among boys of the present study with international studies

Study	CDC	Jeroen et al.,	Eze et al.,	Nonindustrial Boys	Industrial Boys
Study Area		Netherland	Nigeria	Nonindustrial area	Industrial area
Year	2009	2014	2017	**Present Study**	
No. of Children	NHANES III		1305	308	306
Age in years	2-19 years	0- 20 Years	6- 12 Years	3- 12 years	3 -12 years
3	98.80	95.80	-	98.04	101.53
4	105.20	103.90	-	101.41	102.02
5	112.30	110.70	-	109.81	109.05
6	118.90	116.90	123.50	113.35	113.53
7	125.90	123.10	128.60	115.67	116.21
8	131.30	129.40	133.00	120.22	124.16
9	137.70	135.20	136.90	125.89	128.10
10	142.00	140.80	141.30	129.14	134.14
11	147.40	146.80	145.40	135.38	138.02
12	155.50	153.10	147.30	142.34	142.25

Table 10.1.3.5: Comparison of mean weight (kg) among boys of the present study with international studies

Study	CDC	Eze et al.,	Nonindustrial Boys	Industrial area Boys
Study Area		Nigeria	Nonindustrial area	Industrial area
Year	2009	2017	**Present Study**	
No. of Children	NHANES III	1305	308	306
Age in years	2-19 years	6- 12 Years	3- 12 years	3 -12 years
3	15.80	-	12.42	13.60
4	17.70	-	13.72	14.13
5	20.10	-	15.99	16.20
6	23.30	22.70	16.87	18.28
7	26.30	25.40	17.93	19.00
8	30.20	27.60	19.53	21.82
9	34.40	29.80	23.92	23.68
10	37.30	32.00	24.24	27.25
11	42.50	33.70	27.25	31.18
12	49.10	34.40	31.06	32.07

Table 10.1.3.6: Comparison of mean BMI (kg/m^2) among boys of the present study with international studies

Study	CDC	Eze et al.,	Nonindustrial Boys	Industrial Boys
Study Area		Nigeria	Nonindustrial area	Industrial area
Year	2009	2017	**Present Study**	
No. of Children	NHANES III	1305	308	306
Age in years	2-19 years	6- 12 Years	3- 12 years	3 -12 years
3	16.10	-	12.88	13.22
4	15.90	-	13.22	13.55
5	15.90	-	13.25	13.53
6	16.30	14.80	13.10	14.14
7	16.50	15.20	13.37	13.99
8	17.30	15.40	13.50	14.14
9	18.00	15.80	15.00	14.36
10	18.40	15.90	14.38	15.06
11	19.40	15.90	14.79	16.07
12	20.10	15.80	15.22	15.72

Table 10.2.1: Comparison of prevalence of undernutrition among children of the present study with regional studies

Studied Children	Study Area	n	Age (Years)	Underweight (%)	Stunting (%)	Wasting (%)	Using Standard References Value	References
Santal Children	Puruliya District, West Bengal, India.	442	5 - 12	149 (33.70)	79(17.90)	130(29.40)	NCHS, 1983.	Chowdhury et al., 2008.
School Going Children	Arambag, Hoogly District, West Bengal	1012	2 - 6	641(63.30)	269(26.60)	506(50.00)	NCHS, 1983.	Bose and Mondal., 2010
Slum Children (Urban)	Chetla, Kolkata, West Bengal.	120	0 - 18	38(31.70)	30(25.00)	49(41.05)	WHO Anthro & WHO Anthro Plus	Mandal et al., 2014
Primary School Children	Burdwan, West Bengal.	430	5 - 9	173(40.23)	85(19.76)	-	WHO, 2007.	Pramanik et al., 2015
Bengalee Muslim Children	North Bengal, India	1143	5 - 11	537(47.00)	440(38.50)	199(17.40)	NCHS, 1983.	Sen et al., 2011
Not mention	Bankura, West Bengal, India.	485	<5	199(41.00)	247(51.00)	107(22.00)	WHO, 2006.	Sarkar., 2016
Bengalee preschool children	Sundarban, South 24 Parganas, West Bengal	656	3 - 5	335(51.07)	172(26.22)	232(35.37)	WHO, 2006.	Giri et al., 2017
Bengalee School Going Children	**Nonindustrial area**	**621**	**3 - 12**	**277(44.61)**	**176 (28.34)**	**191(30.76)**	**NCHS, 1983**	**Present Study**
	Industrial area	**621**		**201(32.37)**	**143 (23.03)**	**136(21.90)**		

Table 10.2.2: Comparison of prevalence of undernutrition among children of the present study with national studies

Studied Children	Study Area	n	Age (Years)	Underweight (%)	Stunting (%)	Wasting (%)	Using Standard References Value	References
Primary and Middle level School Children	North India (Kashmir Rural Block)	940	5 - 14	104(11.10)	87(9.25)	116(12.30)	WHO Growth Standards, 2007.	Fazili et al., 2012.
Different sub-groups of Tripura	Tripura	9498	0 - 18	-	2982(31.40)	-	WHO Growth Standards, 2006.	Ray et al., 2013.
School Going Children	Hospital Based Study (Rural India)	561	5 - 18	230(41.00)	131(23.28)	-	WHO, Anthro Plus software.	Singh et al., 2014.
Rural School Children	Maharastra, India.	470	5 - 15	170(36.20)	108(23.00)	-	NCHS, 1977.	Vaidya et al., 2015.
Not mention	Thrissur district, Kerala, India.	360	<5	102(28.30)	-	50(14.00)	WHO Growth Standards, 2007.	Priyanka et al., 2016
Primary school Children	Urban School in Pune, India	760	5 - 11	38(5.00)	48(6.30)	34(4.50)	NCHS/WHO Standards, 2015.	Yadav et al., 2016.
Primary School Children (Rural & Urban)	Karimangar city, Telangana, India	410	6 - 11	120(29.30)	-	8(21.50)	Not mention	Shaikh et al., 2016.
		410		91(22.20)	-	66(16.00)		
Preschool children	Urban Area in Kerala, India.	120	3 - 6	18(15.00)	32(26.70)	13(10.80)	WHO Growth Standards, 2006.	Chellamma et al., 2017.
Bengalee School Going Children	**Nonindustrial area**	**621**	**3 - 12**	**277(44.61)**	**176(28.34)**	**191(30.76)**	**NCHS, 1983**	**Present Study**
	Industrial area	**621**		**201(32.37)**	**143(23.03)**	**136(21.90)**		

Table 10.2.3: Comparison of prevalence of undernutrition among children of the present study with international studies

Studied Children	Study Area	n	Age (Years)	Underweight (%)	Stunting (%)	Wasting (%)	Using Standard References Value	References
School Going Children	Kaski District, western Region, Nepal.	786	4 - 14	204(26.00)	102(13.00)	94(12.00)	WHO, 1995.	Joshi et al., 2011
School Aged Children	Rural & Urban Sitting of Fogera & Libo Kemkem Dist. Ethiopia.	443	4 - 15	-	189(42.70)	-	WHO, 2007	Herrador et al., 2014
		443		-	129(29.20)	-		
Urban & Rural Areas Children	Fars Province in Iran	15278	0 - 6	1476(9.66)	1456(9.53)	1251(8.19)	NCHS, 1983	Kavosi et al., 2014
School Going Children	Nikhet High School, Dhaka, Bangladesh	110	6 - 12	21(19.10)	13(11.80)	20(18.20)	Not mention	Haque et al., 2014
School Aged Children	Addis Abada, Ethiopia.	459	5 - 14	73(15.90)	90(19.60)	-	WHO Anthro Plus	Degarege et al., 2015
Rural School Going Children	Cavre District, Nepal.	428	4 - 16	132(30.85)	105(24.54)	-	WHO, 2006.	Mansur et al., 2015
Pakisthani Children	Demographic Health Survey Pogram	3071	<5	820(26.70)	1385(45.10)	319(10.40)	WHO, 2010	Abbasi et al., 2018
School Aged Children	Asella Luther Child Project, Oromiyaa, Ethiopia.	384	3 - 12	180(47.00)	131(34.00)	73(19.00)	NCHS, 1983	Elema., 2018
Bengalee School Going Children	**Nonindustrial area**	**621**	**3 - 12**	**277(44.61)**	**176(28.34)**	**191(30.76)**	**NCHS, 1983**	**Present Study**
	Industrial area	**621**		**201(32.37)**	**143(23.03)**	**136(21.90)**		

Table 10.2.4: Comparison of prevalence of Thinness among the children of different studies with present study

Studied Children		Study Area	n	Age (Years)	Thinness (%)	Using Standard References Value	References
Regional Study	Pre-school Children (Barui Caste)	Nituria Block, Purulia District, west Bengal	219	2 - 6	106(48.40)	Cole et al., 2000 & 2007	Das, 2009
	Pre-school Children (Bangalee Hindu)	Bali Gram Panchyat, Arambag, Hooghlly Dist, West Bengal	1012	2 - 6	562(85.16)	Cole et al., 2000 & 2007	Mandal et al., 2009
	School Children	Haldia, Purba Medinipur Dist. west Bengal	302	9 - 13	72(23.84)	Cole et al.,2000 & 2007	Banik and Chatterjee., 2010
	Pre-school & School Children (Urban)	Slum area, Chetla, Kolkata, west Bengal	120	0 - 14	52(43.30)	WHO Anth & WHO Anth Plus Soft.	Mandal et al., 2014
	Pre-school Children	Sagar Block, South 24 Parganas, West Bengal	656	3 - 5.5	533(81.25)	Cole et al.,2000 & 2007	Giri et al., 2017
National Study	School Children (Sonowal Kachari Tribal)	Dibrugarh District, Assam, India	1343	6 - 18	349(25.99)	Cole et al., 2000 & 2007	Singh and Mondal. 2013
	School Children	Dhaura Tanda Bareilly District U.P. India	561	5 - 18	203(36.18)	WHO Plus (WHO Standard value. 2007)	Singh et al., 2014
	School Children	Zilla Parishad School, Pune, India	470	5 - 15	151(32.10	NCHS. 1977	Vaidya et al., 2015
	School Children(Semi Urban area)	Southern part of India, India	2100	9 - 17	376(17.90)	WHO Standard value. 2007	Selvaraj et al., 2016
International Study	School Children(Garo)	Sherpur District, Bangladesh	324	5 10	100(30.88)	Cole et al., 2000&2007	Rana et al., 2012
	School Children(Rural Area)	Kavre District, Nepal	428	4 - 16	43(10.50)	WHO Standard value. 2007	Mansur et al., 2015
	School Children(Rural & urban area)	Arusha Region, Tanzania	1379	5 - 19	156(11.30)	WHO Standard value. 2007	Teblick et al., 2017
	School Children	Enugu, Naigeria	2616	6 - 12	243(9.29)	WHO Standard value. 2007	Eze et al., 2017
Bengalee School Going Children in Purba Medinipur (WB)		**Nonindustrial area**	**621**	**3 - 12**	**437(70.37)**	**Cole et al.,2000 & 2007**	**Present Study**
		Industrial area	**621**		**386(62.16)**		

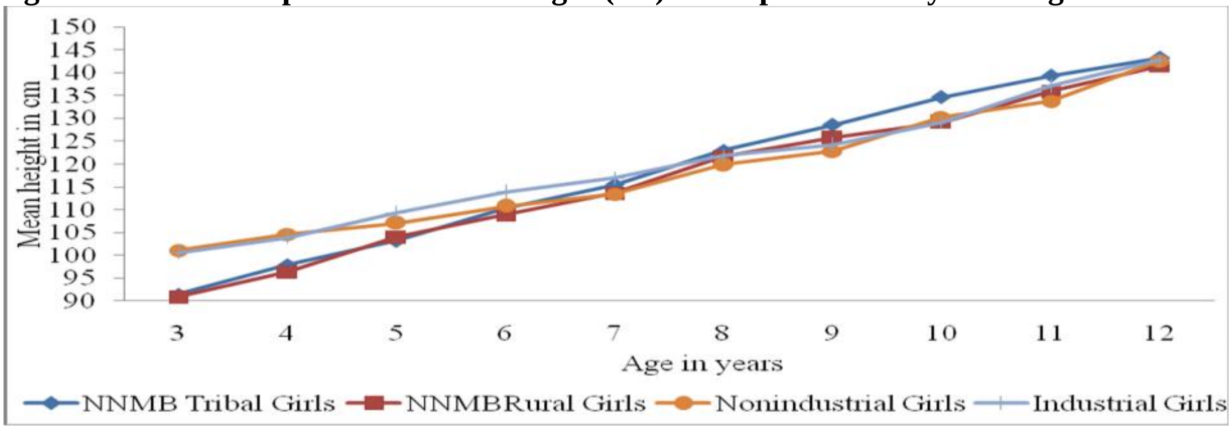
Table 10.2.5: Comparison of prevalence of CIAF among the children of different studies with present study

Studied Children		Study Area	n	Age (Years)	CIAF (%)	Using Standard References Value	References
Regional Study	ICDS Children	Bali,Arambag, Hooghly district, West Bengal	1012	2 - 6	740(73.10)	Nandy et al., 2005	Bose and Mondal. 2010
	Tribal Children	Bankura, West Bengal.	188	<5	130(69.10)	Nandy et al., 2005	Mukhopadhyay and Biswas. 2011
	Rural Preschool children	Purba Mediniur, West Bengal, India	225	3 - 6	113(50.20)	Nandy et al., 2005	Acharya et al., 2013
	Preschool Children	Sagar Block, South 24 Parganas, West Bengal India	656	3 - 5	402(61.30)	Nandy et al., 2005	Biswas et al., 2018
	Rural Children	Singur, West Bengal, India	142	<5	51(36.10)	Nandy et al., 2005	Roy et al., 2018
	Bengali Muslim Population	North Bengal, India.	1143	5 - 11	658(57.60)	Nandy et al., 2005	Sen et al., 2011
National Study	Slum Children	Nagpur, Central India.	256	<5	150(58.59)	Nandy et al., 2005	Dhok & Thakre. 2016.
	Bhumij Children	Northern Odisha, India.	136	1 - 6	74(54.40)	Nandy et al., 2005	Goswami. 2016
	Not Mention	Chennai, Tamil Nadu, India.	357	<5	132(37.00)	Nandy et al., 2005	Ramesh et al., 2017
	Karbi Tribal Children	Anglong District, Assam, North East India.	400	2 - 5	204(51.00)	Nandy et al., 2005	Kramsapi et al., 2018
International Study	Malawian Children	Malawi Demographic and Health Surveys, 1992.	3174	<5	1873(59.00)	Nandy et al., 2005	Ziba et al., 2018.
		2000	10102		5778(57.20)		
		2004	8934		5119(57.30)		
		2010	4586		2321(50.60)		
Bengalee School Going Children		**Nonindustrial area**	**621**	**3 - 12**	**369(59.40)**	**Nandy et al., 2005**	**Present Study**
		industrial area	**621**		**296(47.70)**		

Figures

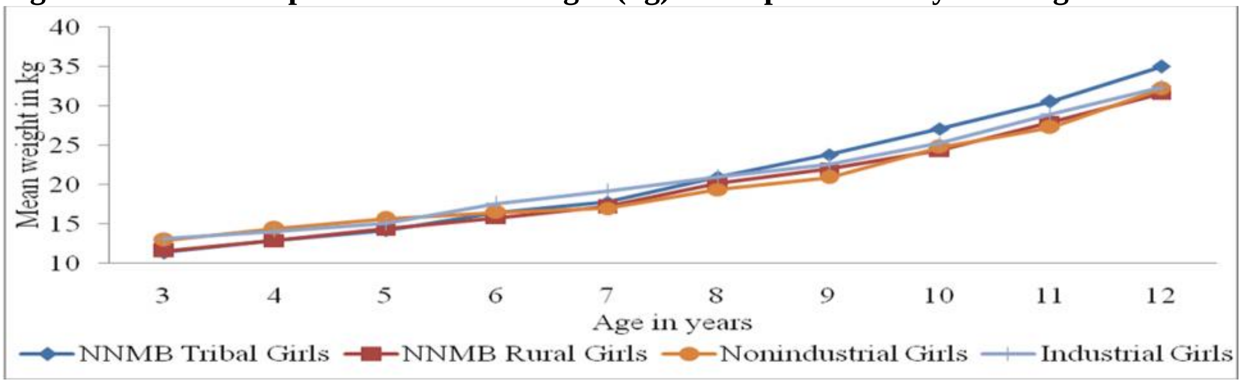
10.1.1: Regional studies

Figure 10.1.1.1: Comparison of mean height (cm) of the present study with regional studies



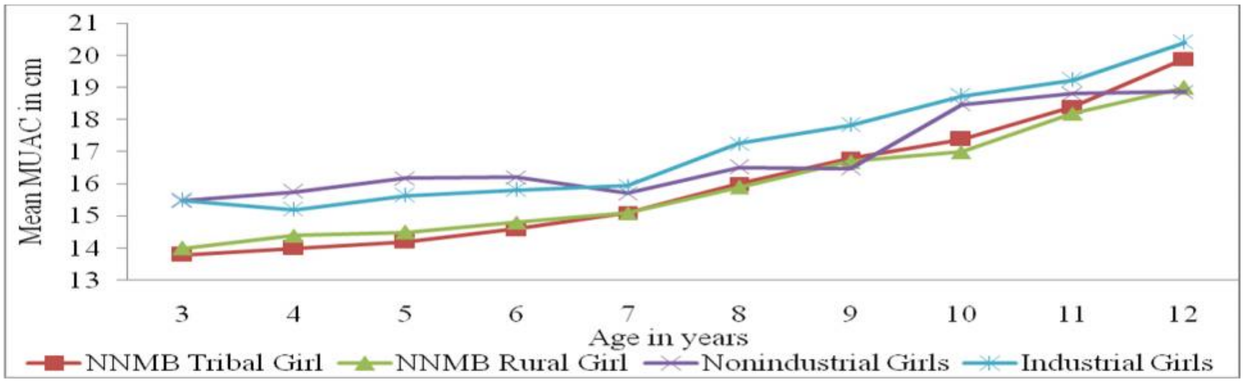
NNMB Tribal Boys (2007-2008) West Bengal, NNMB Rural Boys (2011-2012) West Bengal, **Nonindustrial and Industrial Girls (Present study).**

Figure 10.1.1.2: Comparison of mean weight (kg) of the present study with regional studies



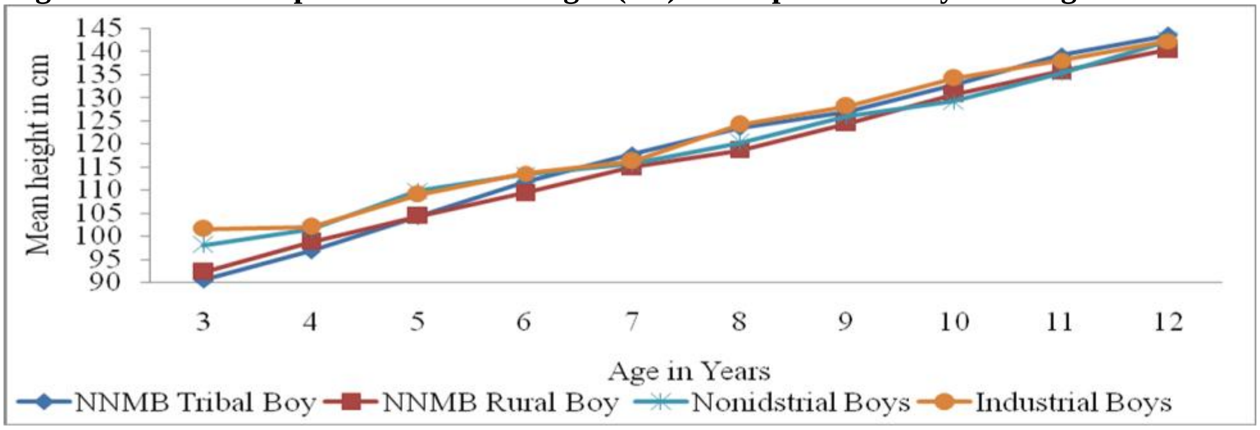
NNMB Tribal Boys (2007-2008) West Bengal, NNMB Rural Boys (2011-2012) West Bengal, **Nonindustrial and Industrial Girls (Present study).**

Figure 10.1.1.3: Comparison of mean MUAC (cm) of the present study with regional studies



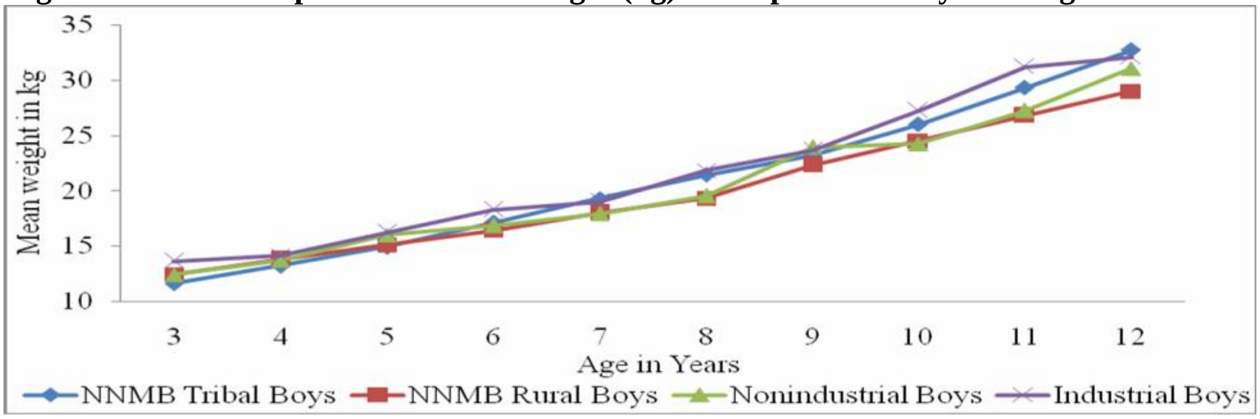
NNMB Tribal Boys (2007-2008) West Bengal, NNMB Rural Boys (2011-2012) West Bengal, **Nonindustrial and Industrial Girls (Present study).**

Figure 10.1.1.4: Comparison of mean height (cm) of the present study with regional studies



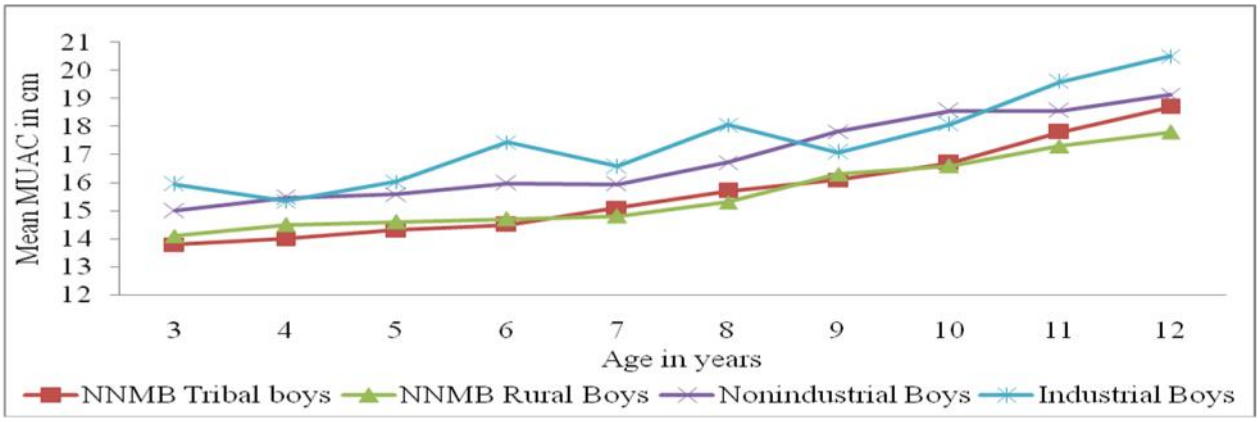
NNMB Tribal Boys (2007-2008) West Bengal, NNMB Rural Boys (2011-2012) West Bengal, **Nonindustrial and Industrial Girls (Present study).**

Figure 10.1.1.5: Comparison of mean weight (kg) of the present study with regional studies



NNMB Tribal Boys (2007-2008) West Bengal, NNMB Rural Boys (2011-2012) West Bengal, **Nonindustrial and Industrial Girls (Present study).**

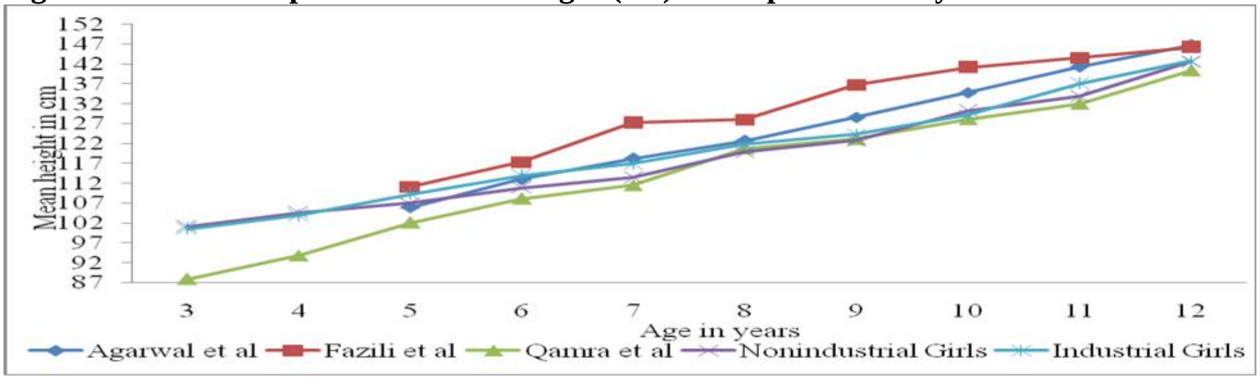
Figure 10.1.1.6: Comparison of mean MUAC (cm) of the present study with regional studies



NNMB Tribal Boys (2007-2008) West Bengal, NNMB Rural Boys (2011-2012) West Bengal, **Nonindustrial and Industrial Girls (Present study).**

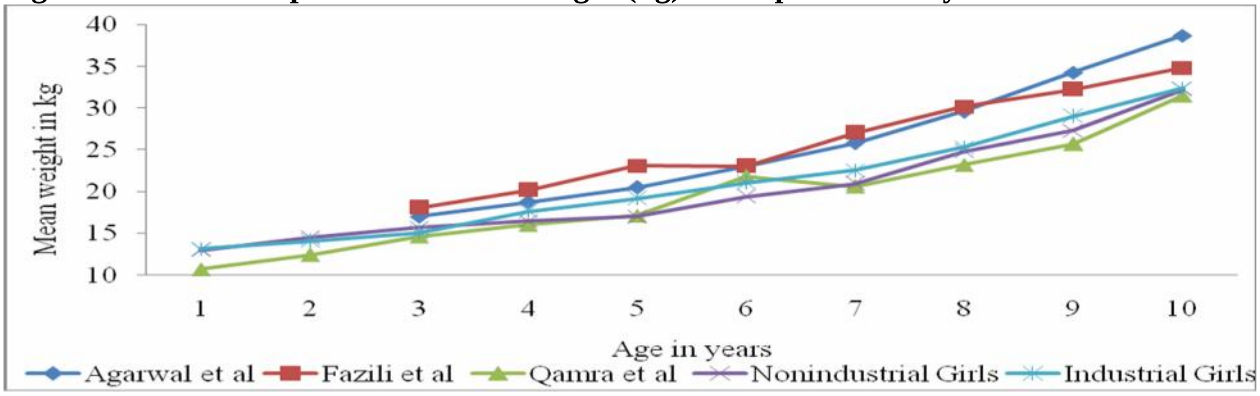
10.1.2.1: National studies

Figure 10.1.2.1: Comparison of mean height (cm) of the present study with national studies



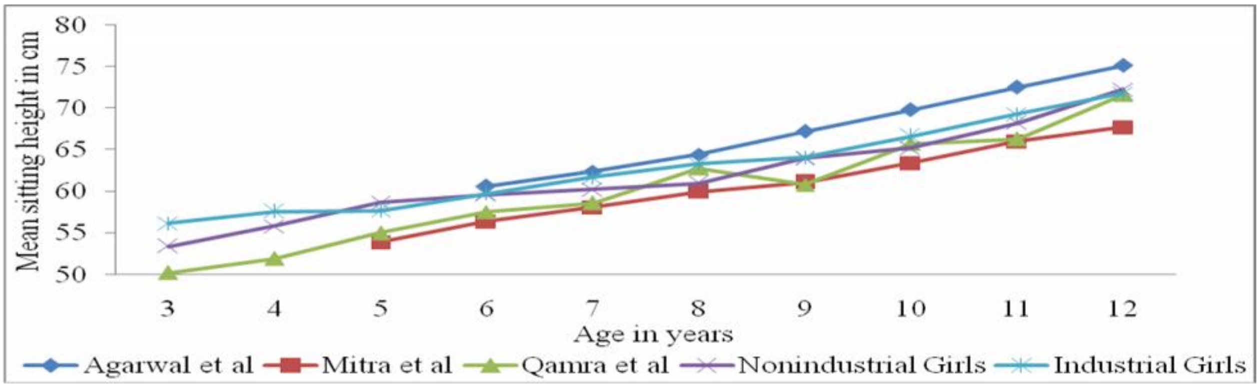
Agarwal et al., (1992) Fazili et al., (2012) North India, Qamra et al., (2012) Madhya Pradesh, **Nonindustrial and Industrial Girls (Present study).**

Figure 10.1.2.2: Comparison of mean Weight (kg) of the present study with national studies



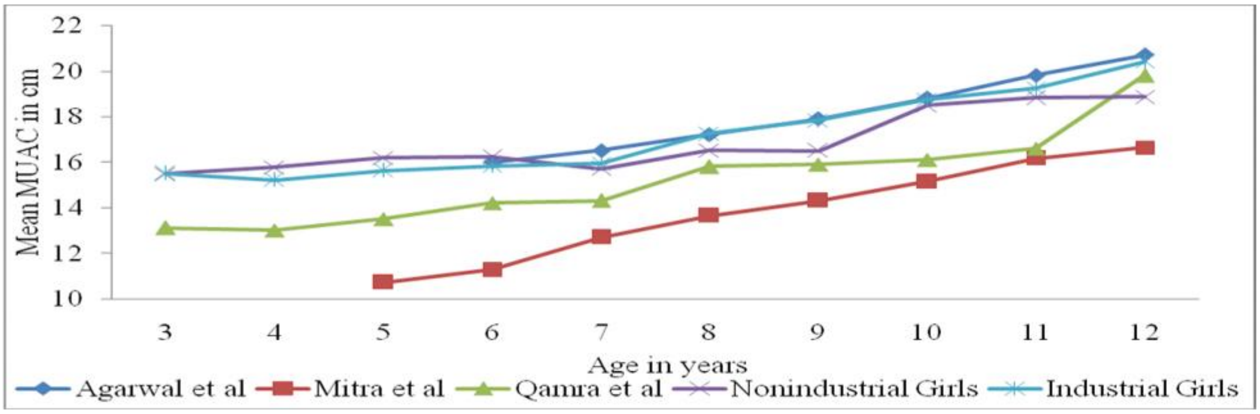
Agarwal et al., (1992) Fazili et al., (2012) North India, Qamra et al., (2012) Madhya Pradesh, **Nonindustrial and Industrial Girls (Present study).**

Figure 10.1.2.3: Comparison of mean sitting height (cm) of the present study with national studies



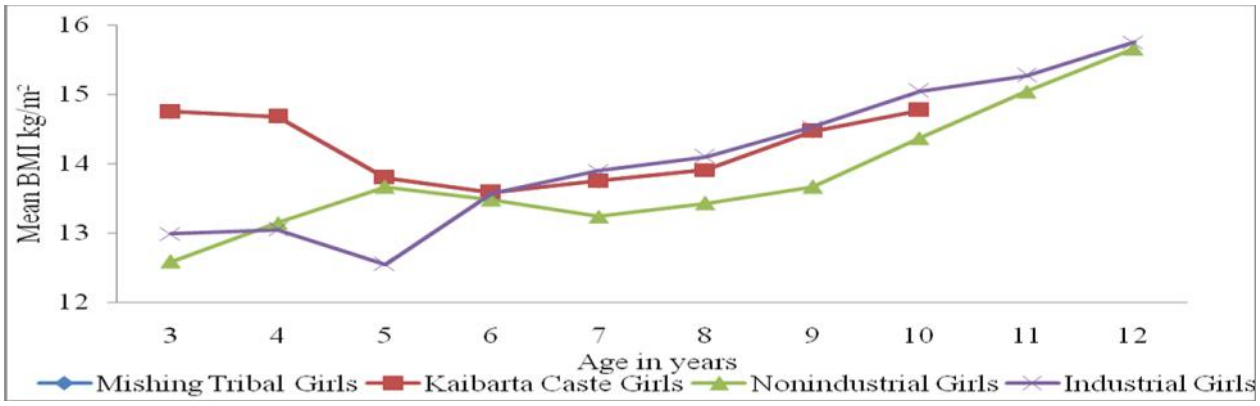
Agarwal et al., (1992), Mitra et al., (2002) Chhattisgarh, Qamra et al., (2012) Madhya Pradesh, **Nonindustrial and Industrial Girls (Present study).**

Figure 10.1.2.4: Comparison of mean MUAC (cm) of the present study with national studies



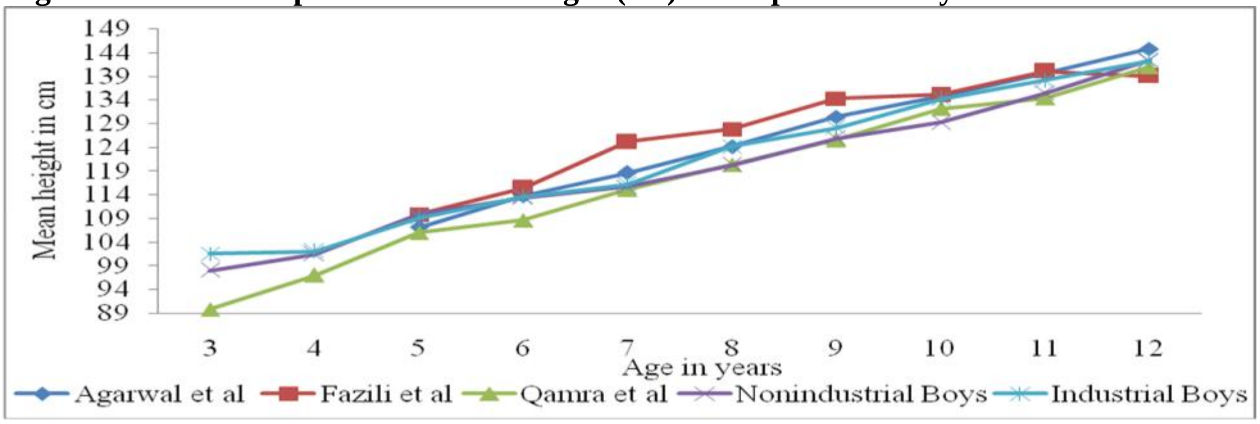
Agarwal et al., (1992), Mitra et al., (2002) Chhattisgarh, Qamra et al., (2012) Madhya Pradesh, **Nonindustrial and Industrial Girls (Present study).**

Figure 10.1.2.5: Comparison of mean BMI 9kg/m²) of the present study with national studies



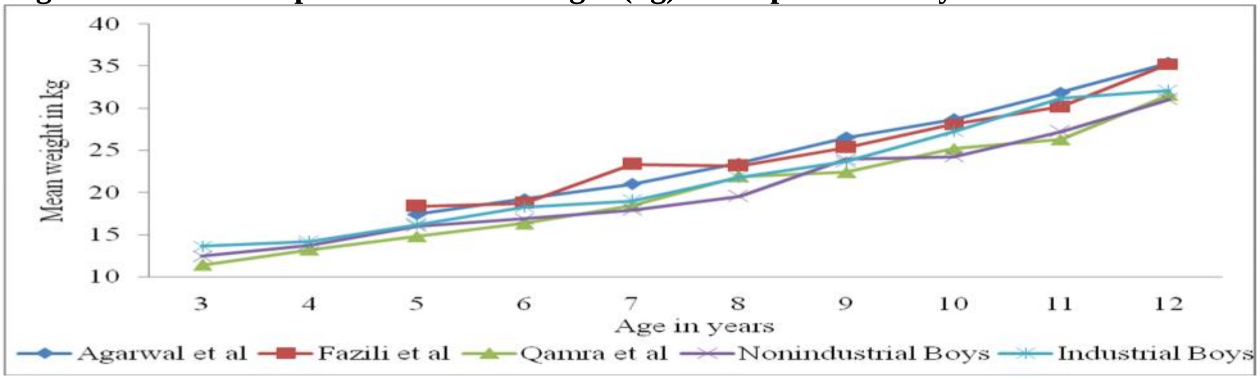
Basu et al., (2014) Mishing Tribal and Kaibarta Caste Girls (Assam), **Nonindustrial and Industrial Girls (Present study)**

Figure 10.1.2.6: Comparison of mean height (cm) of the present study with national studies



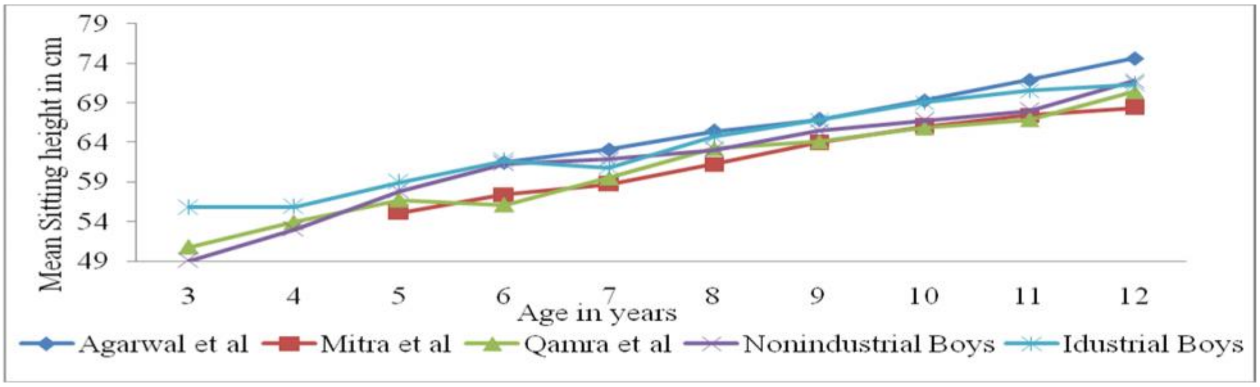
Agarwal et al., (1992) Fazili et al., (2012) North India, Qamra et al., (2012) Madhya Pradesh, **Nonindustrial and Industrial Girls (Present study)**

Figure 10.1.2.7: Comparison of mean weight (kg) of the present study with national studies



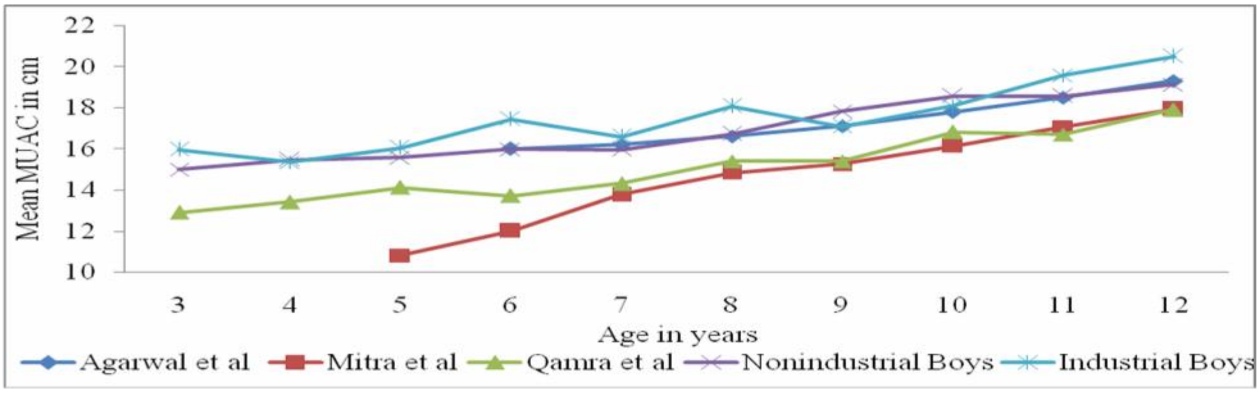
Agarwal et al., (1992) Fazili et al., (2012) North India, Qamra et al., (2012) Madhya Pradesh,
Nonindustrial and Industrial Girls (Present study)

Figure 10.1.2.8: Comparison of mean sitting height (cm) of the present study with national studies



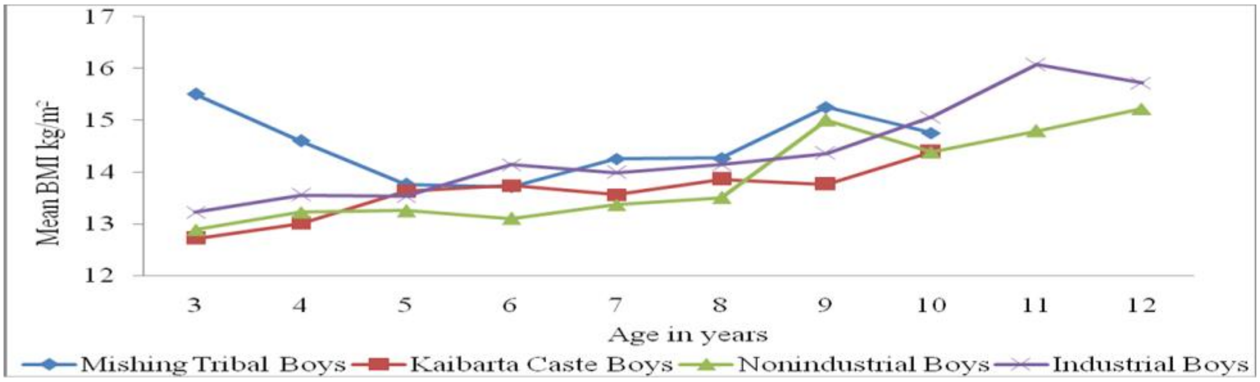
Agarwal et al., (1992), Mitra et al., (2002) Chhattisgarh, Qamra et al., (2012) Madhya Pradesh,
Nonindustrial and Industrial Girls (Present study).

Figure 10.1.2.9: Comparison of mean MUAC (cm) of the present study with national studies



Agarwal et al., (1992), Mitra et al., (2002) Chhattisgarh, Qamra et al., (2012) Madhya Pradesh,
Nonindustrial and Industrial Girls (Present study).

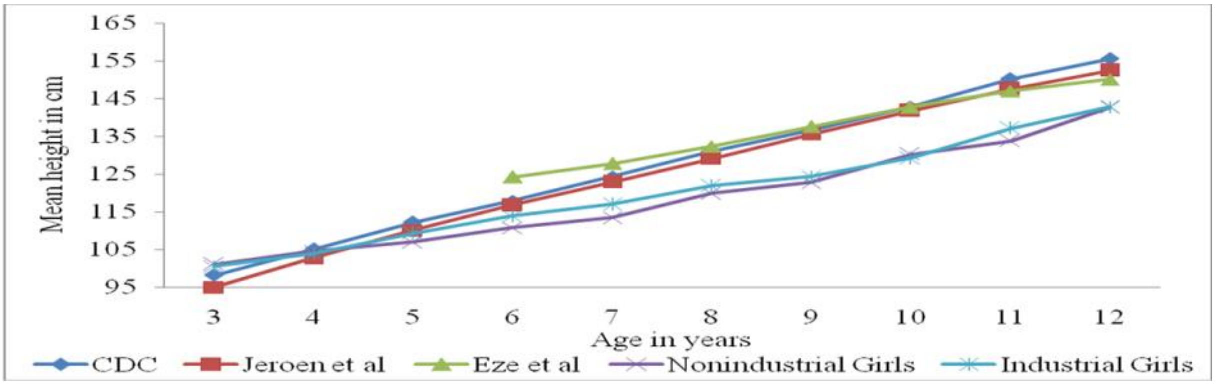
Figure 10.1.2.10: Comparison of mean BMI (kg/m²) of the present study with national studies



Basu et al., (2014) Mishing Tribal and Kaibarta Caste Girls (Assam), **Nonindustrial and Industrial Girls (Present study)**

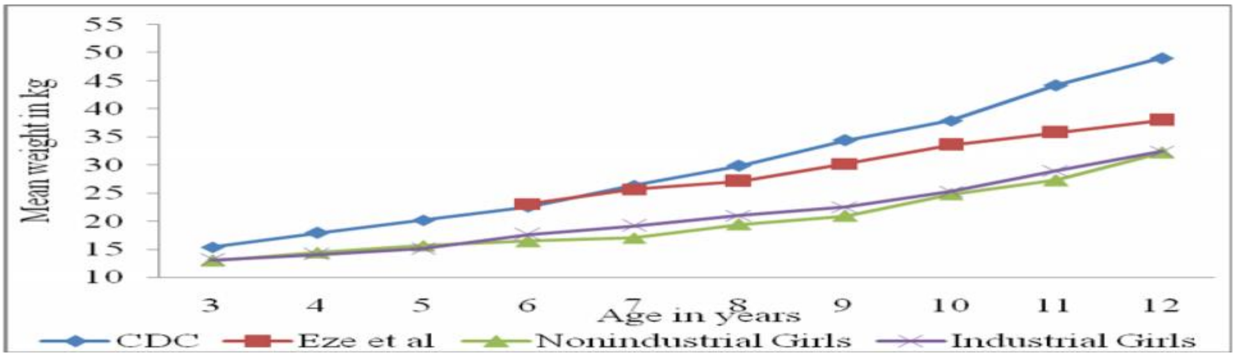
10.1.3: International studies

Figure 10.1.3.1: Comparison of mean height (cm) of the present study with international studies



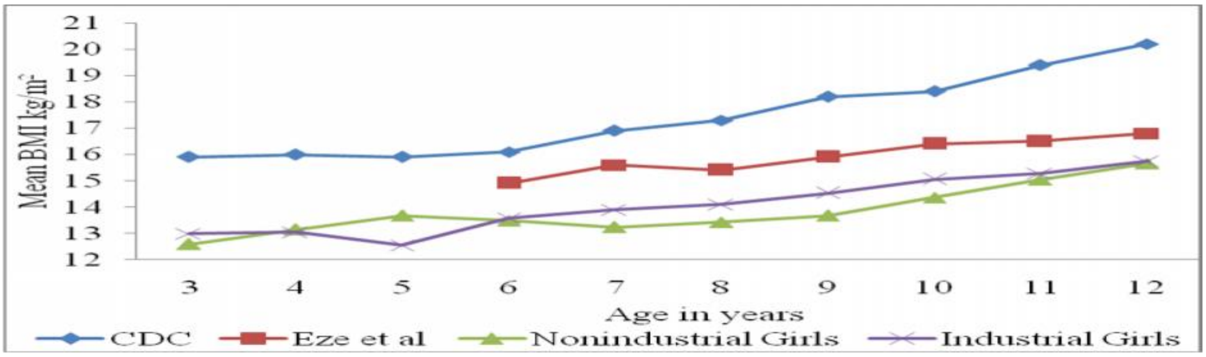
CDC (2009), Jeroen et al., (2014) Netherland, Eze et al., (2017) Nigeria, **Nonindustrial and Industrial Girls (Present study)**

Figure 10.1.3.2: Comparison of mean weight (kg) of the present study with international studies



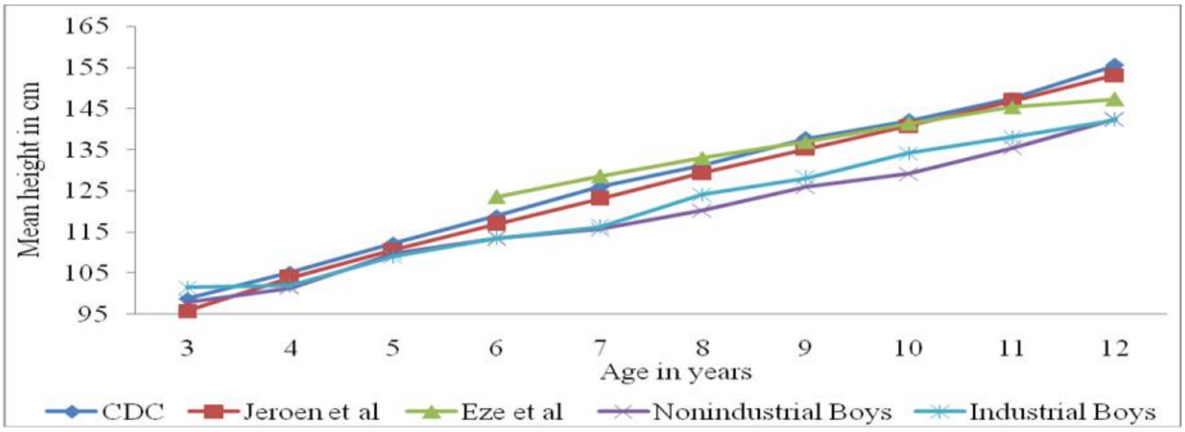
CDC (2009), Eze et al., (2017) Nigeria, **Nonindustrial and Industrial Girls (Present study)**

Figure 10.1.3.3: Comparison of mean BMI (kg/m²) of the present study with international studies



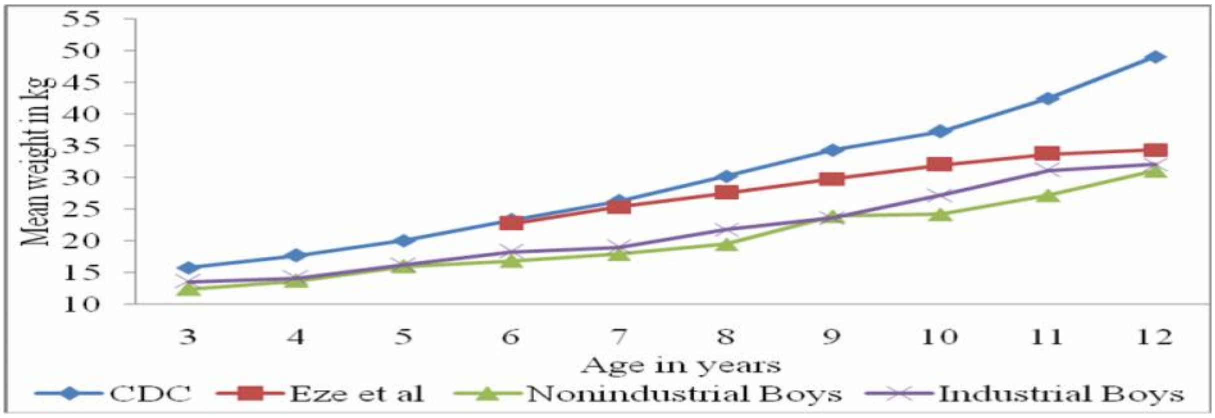
CDC (2009), Eze et al., (2017) Nigeria, **Nonindustrial and Industrial Girls (Present study)**

Figure 10.1.3.4: Comparison of mean height (cm) of the present study with international studies



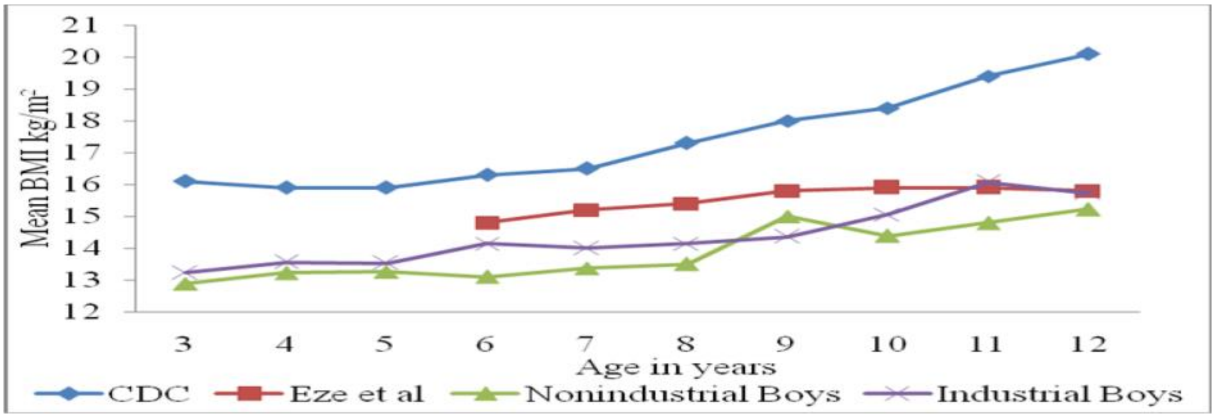
CDC (2009), Jeroen et al., (2014) Netherland, Eze et al., (2017) Nigeria, **Nonindustrial and Industrial Girls (Present study)**

Figure 10.1.3.5: Comparison of mean weight (kg) of the present study with international studies



CDC (2009), Eze et al., (2017) Nigeria, **Nonindustrial and Industrial Girls (Present study)**

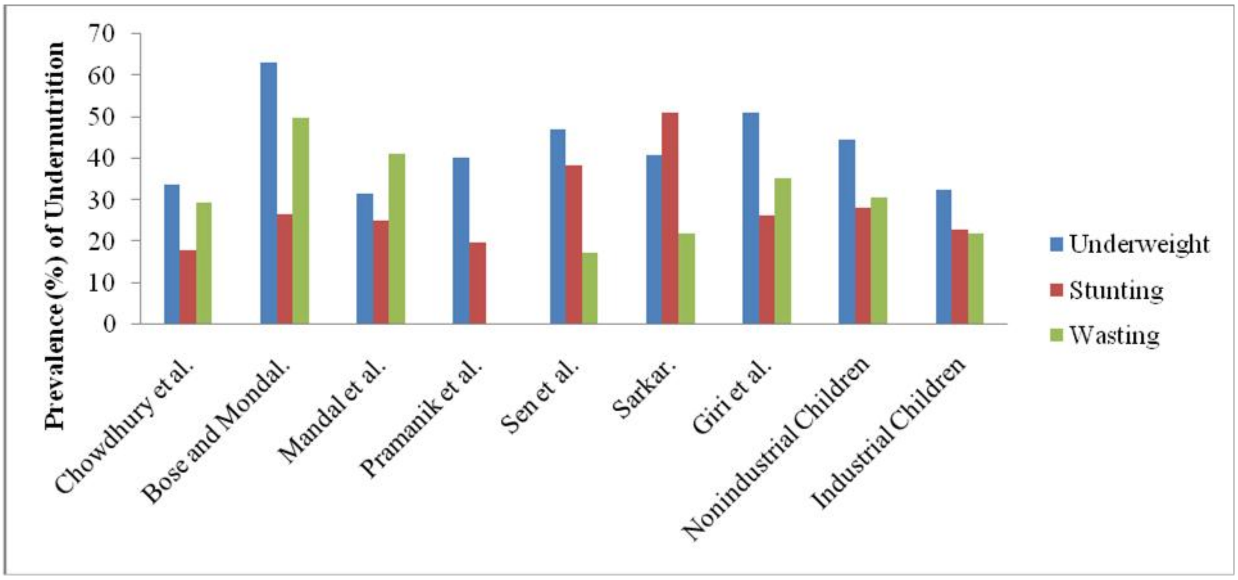
Figure 10.1.3.6: Comparison of mean BMI (kg/m²) of the present study with international studies



CDC (2009), Eze et al., (2017) Nigeria, **Nonindustrial and Industrial Girls (Present study)**

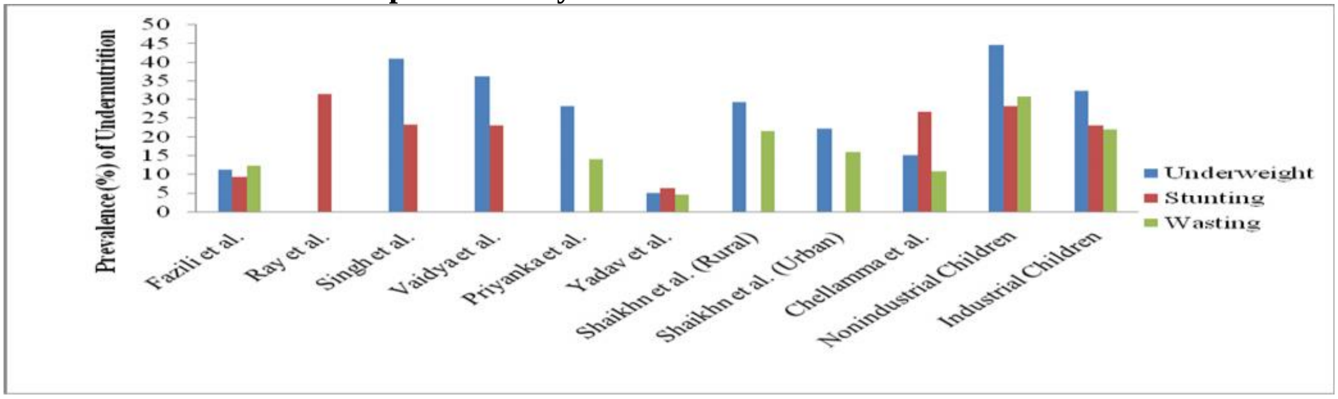
10.2: Comparison of prevalence of undernutrition among children of the present study with others studies

Figure 10.2.1: Comparison of prevalence (%) of undernutrition among children of the present study with regional studies



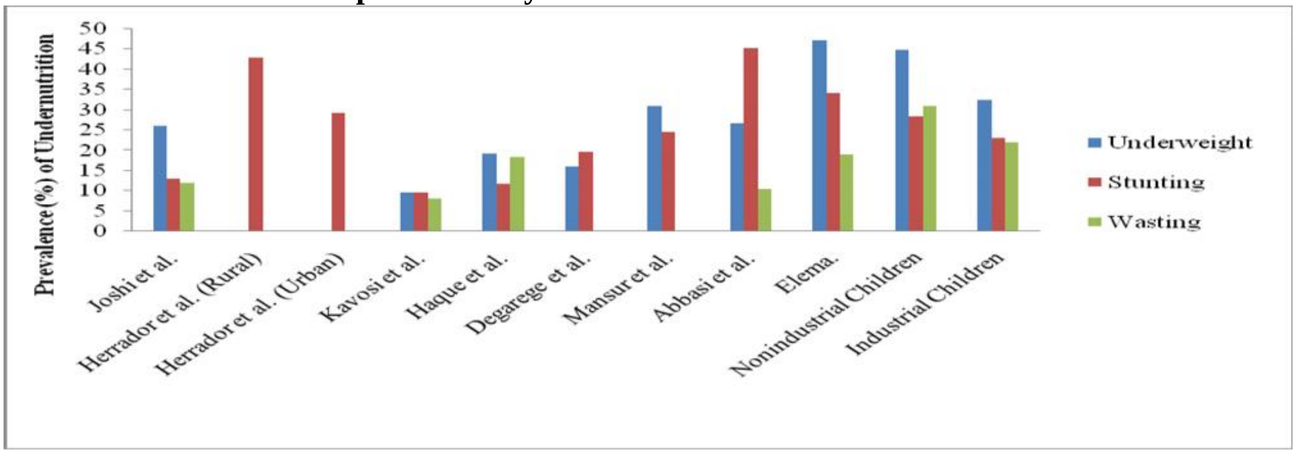
Santal Children (5-12 years) of Puruliya District, West Bengal **(Chowdhury et al., 2008.),** School Going Childrenb (2-6 years) of Arambag, Hoogly District **(Bose and Mondal., 2010),** Slum Children (0-18 years) of Chetla, Kolkata **(Mandal et al., 2014),** Primary School Children (5-9 years) of Burdwan, West Bengal **(Pramanik et al., 2015),** Bengalee Muslim Children (5-11 years) of North Bengal, India **(Sen et al., 2015),** <5 aged children of Bankura, West Bengal **(Sarkar., 2016),** Bengalee preschool children (3-5 years) of Sundarban, South 24 Parganas, West Bengal **(Giri et al., 2017)**, **Bengalee School Going Children (3-12 years) Nonindustrial and Industrial area (Present Study).**

Figure 10.2.2: Comparison of prevalence (%) of undernutrition among children of the present study with national studies



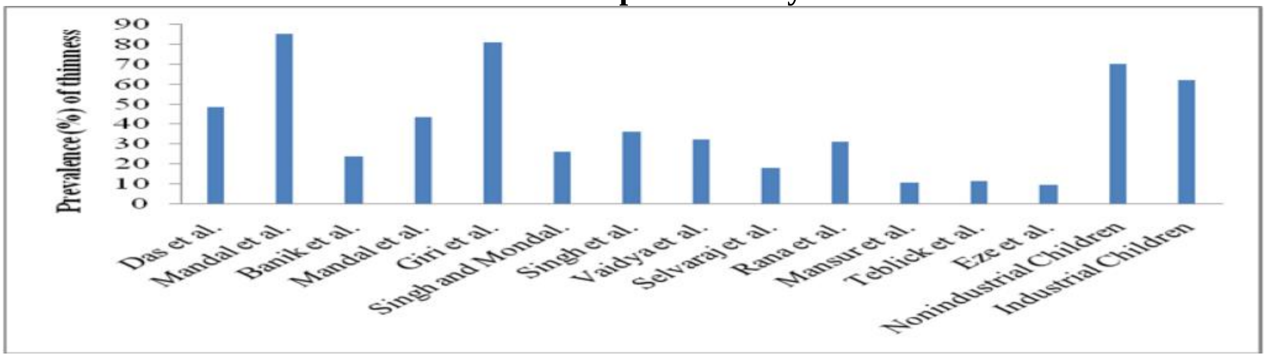
Primary and Middle level School Children (5-14 years) of North India **(Fazili et al., 2012),** Diifferent sub-groups of Tripura (0-18 years) of Tripura **(Ray et al., 2013),** School Going Children (5-18 years) of Hospital Based Study (Rural India) **(Singh et al., 2014),** Rural School Children (5-15 years) of Maharastra, India **(Vaidya et al ., 2015),** <5 years aged children of Thrissur district, Kerala, India **(Priyanka et al., 2016),** Primary school Children (5-11 years) of Urban School in Pune, India **(Yadav et al., 2016),** Primary School (6-11 years) Children (Rural & Urban)of Karimangar city, Telangana **(Shaikhn et al., 2016),** Preschool children (3-6 years) of Urban Area in Kerala **(Chellamma et al., 2017)**, **Bengalee School Going Children (3-12 years) Nonindustrial and Industrial area (Present Study)**

Figure 10.2.3: Comparison of prevalence (%) of undernutrition among children of the present study with international studies



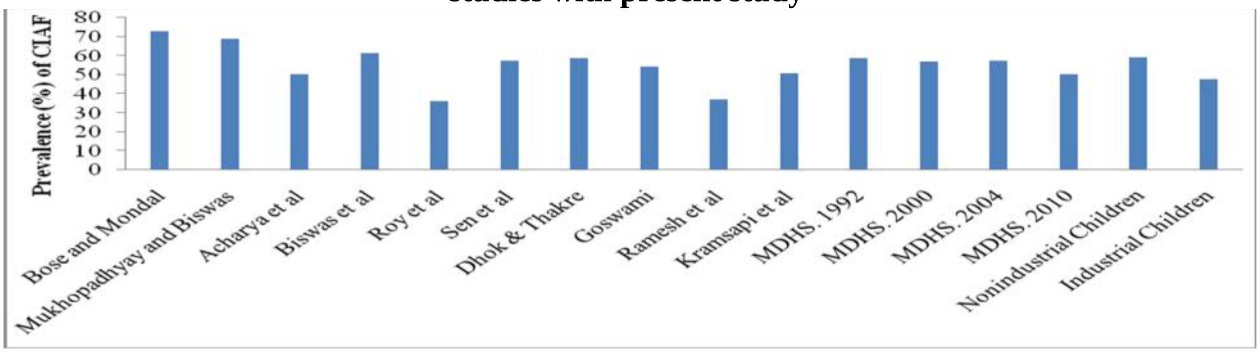
School Going Children (4-14 years) ofKaski District **(Joshi et al., 2011),** School Aged Children (4-15 years) of Rural & Urban Sitting of Fogera & Libo Kemkem Dist. Ethiopia. **(Herrador et al., 2014),** Urban & Rural Areas Children (0-6 years) of Fars Province in Iran **(Kavosi et al., 2014),** School Going Children (6-12 years) of Nikhet High School, Dhaka, Bangladesh **(Haque et al., 2014),** School Aged Children (5-14 years) of Addis Abada, Ethiopia **(Degarege et al., 2015),** Rural School Going Children (4-16 years) of Cavre District, Nepal **(Mansur et al., 2015),** Pakisthani Children (<5 years) Demographic Health Survey Program **(Abbasi et al., 2018),** School Aged Childrern (3-12 years) of Asella Luther Child Project, Oromiyaa, Ethiopia **(Elema, 2018), Bengalee School Going Children (3-12 years) Nonindustrial and Industrial area (Present Study)**

Figure 10.2.4: Comparison of prevalence (%) of thinness among the children of different studies with present study



Pre-school Children (Barui Caste, 2-6 years) of Nituria Block **(Das et al., 2009).** Pre-school Children (Bangalee Hindu, 2-6 years) of Bali Gram Panchyat, Arambag **(Mandal et al., 2009).** School Children (9-13 years) of Haldia **(Banik et al., 2010).** Pre-school & School Children (0-14 years) of Slum area, Chetla **(Mandal et al., 2014).** Pre-school Children (3-5.5 years) of Sagar Block, **(Giri et al., 2017)**. School Children (Sonowal Kachari Tribal, 6-18 years) of Dibrugarh District **(Singh and Mondal,2013)**, School Children (5-18 years) of Dhaura Tanda Bareilly **(Singh et al., 2014)**, School Children (5-15 years) of Zilla Parishad School, Pune (**Vaidya et al., 2015),** School Children(Semi Urban area, 9-17 years) of Southern part of India **(Selvaraj et al., 2016),** School Children(Garo, 5-10 years) of Sherpur District, **(Rana et al., 2012).** School Children (Rural Area, 4-16 years) of Kavre District, **(Mansur et al., 2015).** School Children (Rural & urban area, 5-19 years) of Arusha Region, Tanzania **(Teblick et al., 2017).** School Children (6-12 years) of Enugu, Naigeria **(Eze et al., 2017). Bengalee School Going Children (3-12 years) Nonindustrial and Industrial area (Present Study)**

Figure 10.2.5: Comparison of prevalence (%) of CIAF among the children of different studies with present study



ICDS Children (2-6years) of Bali,Arambag, Hooghly district **(Bose and Mondal. 2010)**. Tribal Children (<5 years) of Bankura, **(Mukhopadhyay and Biswas. 2011).** Rural Preschool children (3-6 years) of Purba Mediniur **(Acharya et al., 2013).** Preschool Children (3-5years) of Sagar Block **(Biswas et al., 2018).** Rural Children (<5years) of Singur **(Roy et al., 2018).** Bengali Muslim Population (5-11 years) of North Bengal **(Sen et al., 2011).** Slum Children (<5 years) of Nagpur **(Dhok & Thakre. 2016).** Bhumij Children (1-6 years) of Northern Odisha **(Goswami. 2016).** <5 years aged children of Chennai **(Ramesh et al., 2017).** Karbi Tribal Children (2-5 years) of Anglong District **(Kramsapi et al., 2018).** Malawi Demographic and Health Surveys (MDHS), 1992, 2000, 2004 and 2010 (<5 years) **(Ziba et al., 2018). Bengalee School Going Children (3-12 years) Nonindustrial and Industrial area (Present Study).**