Final Report Development of the Nepalese Growth Standard for the School-aged Children

Submitted to School Health and Nutrition Project (SHNP) (DOHS/DOE/JICA) Child Health Division, Department of Health Services Teku, Kathmandu, Nepal

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Summary

This cross-sectional survey has been designed to develop the national growth standard (weight for age, height for age, weight for height, and body mass index) for Nepalese school children. The survey was conducted in 15 districts representing different ecological and administrative regions. Multistage random sampling was used for the selection of schools, and students to include different ethnicity, age (5-19 years) and sex. Anthropometric measurements of 6887 sampled students were performed by asking the age and measuring and recording of height and weight. The data was entered into SPSS and descriptive analysis was done. This study determined the growth standard for Nepalese children which can be used as reference values to determine nutrition status of Nepalese population. There should be standardization of the findings of this study to use it for growth monitoring of the children and nutrition survey.

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List of Abbreviations

SHNP	School Health and Nutrition Project
DOHS	Department of Health Services
DOE	Department of Education
SD	Standard deviation
Kg	Kilogram
Cm	Centimeter
WHO	World Health Organization
UNICEF	United Nations Children's Fund
JICA	Japan International Co-operation Agency
PHIDReC	Public Health and Infectious Disease Research Center
VDC	Village Development Committee
NHRC	Nepal Health Research Council
BMI	Body mass index

Chapter-I Introduction

1.1 Background

World Health Organization (WHO) published child growth standards in 2006 to replace the previously recommended 1977 NCHS/WHO child growth reference. The 2006 growth standards were developed from the sampled children of Brazil, Ghana, India, Norway, Oman and USA. These new standards are based on breastfed infants and appropriately fed children of different ethnic origins raised in optimal conditions and measured in a standardized way (WHO, 2006).

Using weight-for-height: WHO and UNICEF, recommend the use of a cut-off for weightfor height of below -3 standard deviations (SD), of the WHO standards to identify infants and children as having severe acute malnutrition (SAM). The commonly used cut-off is the same cut-off for both the new 2006 WHO child growth standards (WHO standards) as with the earlier National Center for Health Statistics (NCHS reference).

These growth standards can be used for defining discharge criteria, monitoring therapeutic feeding programmes, planning therapeutic feeding programmes, and interpretation of nutrition surveys.

School-based nutrition education can improve dietary practices that affect young persons' health, growth, and intellectual development. Immediate effects of unhealthy eating patterns include under nutrition, iron deficiency anemia, and overweight and obesity. Even moderate under nutrition can have lasting effects on children's cognitive development and school performance. Chronically undernourished children attain lower scores on standardized achievement tests, especially tests of language ability. When children are hungry or undernourished, they have difficulty resisting infection and therefore are more likely than other children to become sick, to miss school, and to fall behind in class; they are irritable and have difficulty concentrating, which can interfere with learning; and they have low energy, which can limit their physical activity.

The nutritional deficiencies, such as protein energy malnutrition, iron deficiency anaemia, vitamin A deficiency and iodine deficiency, as well as other Public Health related diseases are very serious in Nepal. The school going children between the ages of 5 and 19 years are constituent of approximately 41% of the total population. Investigations into the health status of school children have revealed a high prevalence of anaemia (78% in preschool children), sub-clinical Iodine Deficiency (27%), helminthes infestations (66%), vitamin A deficiency and night blindness (MOHP/MOE, 2006).

Different studies have shown that protein-energy deficiencies - especially of iron, iodine and Vitamin A are just destructive to health, even though they may not be associated with overall deficiency of food intake. Micro-nutrient deficiencies may not be limited to the poor, but may reflect inadequate knowledge or attitudes. There exist a growing body of empirical findings which show that i) school age children of lower socio-economic groups perform substantially worse in tests of cognitive development than children from higher income groups, ii) a large part of this difference can be attributed to malnutrition, lack of sanitation, low levels of psychological stimulation, and other environmental deficits surrounding the children at home and at school, and iii) early ability has both an independent effect on future earnings and a synergistic effect on the marginal product of additional schooling. Therefore, it is important that adequate attention be given to the improvement of nutrition status of school children. School-based programs can play an important role in promoting lifelong healthy eating. Schools are a critical part of the social environment that shapes young persons' eating behaviors and can therefore play a large role in helping improve their diet. However, schools cannot achieve this goal on their own when the cultural milieu has a large influence on food-related beliefs, values, and practices. Besides there is a need of full support and active participation of school teachers, community leaders, and parents without whose commitment nutrition education programs may not be successful and there may be large gap between knowledge and practice.

The high drop-out and low enrolment ratio is caused by poor physical infrastructure of the schools, lack of structures for proper excreta disposal in particular. The schools are not child friendly. Absence of the primary health care facilities at schools does not attract the young children to attend classes.

Similarly, health sector has perceived various challenges that include lacking of trained health personnel, essential drugs, other encouraging facilities and proper coordination. The situation is further triggered by lack of education and awareness, misbelieves, social stigma and other socio-economic problems. Preventive and promotive health components need to be given the importance. A synergic exertion of health service sector and the education sector from the central to the community level is necessary in improving the child health.

1.2 Rationale of the Project as in TOR

Integration of education and health services to ensure improved health and qualitative education, it is essential to create healthy children. As the children under five years are highly vulnerable in terms of their health, school-aged children (5 to 19 years) are not given a priority in Nepal. Education and Health sector has still to make efforts for inclusion of health for the school-aged children. Many of the international and national commitments made on education and health sectors prioritized the school health to ensure better future of the new generation.

Ministry of Health and Population and Ministry of Education, Government of Nepal jointly prepared the National School Health and Nutrition Strategy in June, 2006. The goal of the Strategy is to improve the present status of the health and nutrition of the students. The strategy proposes different indicators to assess the improvement in health and nutritional status of the school children.

The status of health and nutrition of the school-aged children in Nepal is not well recognized. Health and nutrition services for the school-aged population do not come under the priority of the health workers. Not because the school is concerned with children's health, but of their priority in academic matters. The impact of health and nutritional status are given less attention than to the learning achievement.

Through comprehension and coordination in education and health services, it could generate an enabling environment to ensure better learning achievement and improved health of the school-aged children. School Health and Nutrition Programme can be the cost effective and easiest way in improving students' health and academic performance. It is not only to the students and school personnel but also to the family, community and to the nation, promoting health through school is financially, socially, economically and politically desirable.

In this context, the Ministry of Health and Population and the Ministry of Education has started the School Health and Nutrition Project in June 2008 to improve health and nutrition status of school-aged children in Nepal with the Japan International Cooperation Agency (JICA). The purposes of the project are to increase utilization of school health services among school-aged children in the target districts, to strengthen implementation system of the National School Health and Nutrition Strategy in the Ministry of Health and Population and the Ministry of Education.

Until now, there is no growth standard for Nepalese school-aged children (5-19 years). Therefore, comparison of growth of Nepalese school-aged children with the international standard developed by the WHO is not possible. Therefore, School Health and Nutrition Project (SHNP) DOHS/DOE/JICA and Public Health and Infectious Disease Research Center (PHIDReC) have agreed to conduct research to determine the growth standard of Nepalese children.

1.3 Objectives

The main objective of the study was to develop the national growth standard of body (weight for age, height for age, weight for height, and body mass index) for Nepalese school children. The specific objectives were to:

- a) Describe growth standard according to sex, age, geographical and ecological regions.
- b) Identify the standard growth curve of the school-aged children through the WHO growth reference data for 5-19 years.

Chapter II Methodology

2.1 Study design

This was a cross-sectional survey to develop the national growth standard for the children of age 5-19 years. This survey was conducted during March-August, 2011. Anthropometric measurements (weight, height, and age) were done to develop weight for age, height for age and BMI for age for male and female separately.

2.2 Consultative meetings with experts and stakeholders

Meetings were conducted with Chief Advisor, School Health and Nutrition Project, JICA, Senior Advisor, JICA, and Project Co-ordinators of School Health and Nutrition Project, JICA to finalize the proposal and tools. In addition, the survey team together with JICA team met and discussed the issues related to the survey with the Director and Deputy Director, Department of Education. The Department of Education provided letters to District Education Offices of selected districts to help in conducting the survey. The data collection team visited District Education Offices to request for support and for the selection of schools.

2.3 Study districts

The 15 districts representing each ecological and administrative region were selected. The sampling frame of districts according to strata of ecological regions and administrative regions has been given below (Table 2.1). The districts were not selected from mountain region of western and far-western regions considering the low density of the population. The districts were selected to include ethnic diversity and geographic diversity of Nepal.

Region/Area	Eastern	Central	Western	Mid-	Far-	Total
				western	western	
Terai	Saptari (1)	Sarlahi, Parsa	Kapilvastu	Banke (1)	Kailali (1)	6
		(2)	(1)			
Hill	Dhankuta	Kathmandu,	Syangja	Dailekh	Baitadi	6
	(1)	Nuwakot (2)	(1)	(1)	(1)	
Mountain	Taplejung	Sindhupalchowk	-	Humla (1)	-	3
	(1)	(1)				
Total	3	5	2	3	2	15

Table 2.1: Regionwise distribution of districts selected for the study

2.4 Selection of supervisors and enumerators

The PHIDReC selected 12 supervisors and among them most had health education background. Among the supervisors, 3 were females. The enumerators were four school

teachers from each selected school. The school teachers were oriented about the survey and trained for the anthropometric measurements before the survey in the school.

2.5 Training of supervisors

Half day training was organized for the supervisors to orient them regarding the survey background and objectives, methods of district, school and student selection, data collection and anthropometric measurements. The training focused on the collection of quality data. The training was conducted by the research team in participation of experts from Department of Education, Child Health Division, School Health and Nutrition Project, JICA.

2.6 Selection of schools and organization of field work

The strata for the cluster sampling were Primary, Lower Secondary, Secondary, and Higher Secondary levels from Higher Secondary Schools. Schools were selected randomly in co-ordination with District Education Office reflecting half from the urban area and half from the rural area. Among 71 selected schools, 23 schools were private and 48 were community schools. In some districts to include students of higher age 18, 19, we included bachelor level campuses. Among those schools, 35 were from municipality and 36 were from Village Development Committees (VDCs). Private schools were included reflecting the ratio of school children in private schools. The details of distribution of schools have been given in annex VI.

2.7 Selection of school children in each district

The school children were selected as the cluster of a school class. Five school children of each specific sex and age from 5-19 years were selected for the survey, totalling 3435 male students and 3452 female students. In total, we collected data from 6887 students from all districts. Those children were selected proportionately from each selected schools of the district. According to ecological regionwise distribution of children, 914 were from mountain, 3219 from hill, and 2754 from Terai. Similarly, 2998 children were from rural schools and 3889 were from urban schools. Among total students selected for survey, 2149 were from private schools and 4738 were from community schools.

Class	Age distribution (years)	Male	Female	Total
1	5	5	5	10
2	6	5	5	10
3	7	5	5	10
4	8	5	5	10
5	9	5	5	10
6	10	5	5	10
7	11	5	5	10
8	12	5	5	10
9	13	5	5	10

Table 2.2: Selection model of school children from one school

10	14, 15	5, 5	5,5	10+10
11	16, 17	5, 5	5, 5	10 + 10
12	18, 19	5, 5	5, 5	10 + 10

Exclusion criteria

- 1. Student with known chronic disease and disability were excluded from the study.
- 2. A student who did not will to participate in the study.

2.8 Supervision of field work

The supervisors together with enumerators collected data and did the anthropometric measurements. The central level team supervised the data collection process in some sites. The supervisions were done by the PHIDReC team, SHNP/JICA, and officials from Child Health Division, Department of Health Services and Department of Education on the schools of Nuwakot, Sindhupalchowk, Kailali, Saptari, Parsa, Sarlahi, Kathmandu, and Syangja. The supervision schedule was as below:

District	School
Nuwakot	Shree Bhawani Higher Secondary School, Ranipauwa
Sindhupalchowk	Private Paradise Secondary School, Seti Devi Higher
	Secondary School, Seti Devi Sharada Higher Secondary
	School, Sunkoshi Multiple Campus, Shree Kishna
	Ratnaganga Higher Secondary School
Kailali	Phulbari Higher Secondary School, Trinagar Higher
	Secondary School
Parsa	Jilla Uchchanjal Higher Secondary School
Saptari	Sarbodaya Higher Secondary School, World Vision Higher
-	Secondary School, Shree Masilal Janata Higher Secondary
	School, Unique Education Academy, Shree Chandra Higher
	Secondary School, Shree Jiyalal Primary School
Sarlahi	Gyanoday Higher Secondary School, Shree Panch Mahendra
	Higher Secondary School, Shreemati Krishna Devi Higher
	Secondary School, Chatur Bhujeshwar Janata Multiple
	Campus, Shree Janajyoti Technical School
Kathmandu	New Arunodaya English Higher Secondary School, Orbit
	MBBS, Koteshwar Saraswati Higher Secondary School,
	Canvas Boarding School, Sangla Balkumari Higher
	Secondary School

Table 2.3: List of supervised schools

2.9 Anthropometric measurements

The anthropometric measurement was based on the method as described in Physical Check up part of "School Health Service Minimum Package Guideline, April 2010" developed by SHNP. Anthropometric measurement of all 6887 sample students of primary, lower secondary, secondary and higher secondary levels was made by asking the age and measuring and recording of height and weight. Age of the student was verified by reviewing the school record. The age of the students was taken in completed years. The height of the student was measured by using a height measuring tape Stature meter (BioPlusTM). The height measuring tape was fixed on the wall having flat surface after calibration with zero. After removing the shoes, the students were asked to stand on the flat surface by the scale with feet parallel and with heels, buttocks, shoulders and back of the head touching the upright. The head would be comfortably erect with the lower boarder of the orbit of the eye in the same horizontal plane as the external canal of the ear. The arms would be hanging loosely at the sides. The measuring tape was gently lowered, crushing the hair and making contact with the top of the head. The height was measured upto one decimal point in centimeter (cm). The weight of the students was measured by using a digital weighing scale (Seca, Germany) on which the students were asked to stand. Before taking the weight, students were asked to remove heavy cloths such as sweater, jacket if any. The apparatus used was readable to a one decimal point in Kg.

2.10 Quality assurance

An advisory committee and a technical working group under the committee, covering such fields as the public health, epidemiology, paediatrics, health statistics, anthropometry, education, etc. for the study and the Japanese experts in Nepal as well as in Japan were consulted regarding the method of the survey and the quality of the analysis.

The following measures were adopted to ensure accuracy, reliability and validity of data collected from the field. The tool proposed to collect the information was pre-tested in Kathmandu in similar school. In the pre-test of questionnaire all the professionals and the field supervisors were involved. The tool and survey procedure were finalized in the light of feedback received from the pre-test. The pre-test results were discussed among the survey team members.

2.11 Ethical approval

The proposal was submitted to Nepal Health Research Council (NHRC) for ethical approval. The study received approval from NHRC on 6 May 2011 (see annex V). The survey team consulted to the school before selection of school students and taking their measurements. The school students were explained about the objectives of the survey and consent was taken for anthropometric measurements.

2.12 Data management and analysis

Database was prepared in Epidata 3.3.2. The collected data were edited, coded and entered into Epidata and imported to SPSS version 13.0 for analysis.

For each category of data, the descriptive statistics means and standard deviation of weight for age, height for age, and BMI for age by sex were calculated. Those analysis were further stratified according to mountain, hill and terai. Similarly, median, ± 1 Standard deviation, ± 2 Standard deviation, ± 3 Standard deviation were computed for height for age, weight for age and body mass index for age. Further, different percentiles also were computed as nonparametric of standard values for different range of the values. Standard growth curve of the school-aged children through the WHO growth reference data (WHO, 1995) for 5-19 years were plotted.

During data analysis, for some values, linear relation of weight, height and BMI for age was not obtained. In such case, linear interpolation was done using the following formula.



Solving for y2

$$y_2 = \frac{(x_2 - x_1)(y_3 - y_1)}{(x_3 - x_1)} + y_1$$

Similarly, for the two data points at the end of the nearest the point x * were similar, linear extrapolation was done (x_{k-1}, y_{k-1}) and (x_k, y_k) , using the function:

$$y(x_*) = y_{k-1} + \frac{x_* - x_{k-1}}{x_k - x_{k-1}} (y_k - y_{k-1}).$$

Chapter III Results

3.1 Weight for age

Weight for age for male and female children shows that mean weight is 17Kg for 5 year male children whereas 16.3Kg for female children. The weight for age was found linearly increased and at the age 19 year, it is 56 Kg for male and 48.3 Kg for female.

Age	M	Male		Female
(years)	Mean	SD	Mean	SD
5	17.0	2.4	16.3	2.4
6	18.6	3.6	17.8	2.6
7	19.9	3.4	19.1	2.9
8	22.0	4.1	21.4	4.2
9	24.4	4.2	24.5	4.3
10	26.8	4.7	26.4	5.1
11	29.3	4.9	30.5	5.9
12	33.2	6.5	34.7	6.8
13	37.8	7.1	39.4	6.0
14	43.8	7.4	43.1	5.7
15	48.1	7.2	45.2	6.6
16	51.0	7.4	45.9	5.9
17	51.9	5.9	47.5	6.2
18	53.9	6.4	47.6	5.9
19	56.0	6.2	48.3	6.0

Table 3.1: Weight (Kg) for age according to sex

The weight for age for male was found similar for ages according to ecological regions. However, at the higher ages like 18, 19, there was comparatively lower weight in Terai males than that of mountain and hills.

Table 3.2: Weight for age for male according to ecological regions

Age (years)	Mean weight (SD)			
	Mountain	Hill	Terai	
5	16.9(2.6)	16.9(2.2)	17.2(2.6)	
6	18.9(2.3)	18.2(3.0)	19.0(4.6)	
7	19.6(2.4)	19.3(2.7)	20.5(4.3)	
8	24.1(7.0)	21.5(3.0)	21.8(3.5)	
9	25.5(3.7)	23.7(3.2)	25.0(5.1)	
10	27.3(3.7)	26.6(4.7)	26.9(4.9)	
11	30.0(3.4)	29.0(5.3)	29.4(4.8)	
12	34.3(7.7)	32.4(5.7)	33.8(6.8)	
13	39.9(7.2)	38.7(6.5)	36.1(7.4)	

14	45.0(6.4)	44.5(7.5)	42.6(7.5)
15	47.2(8.3)	48.3(7.6)	48.1(6.4)
16	47.5(6.4)	52.2(7.4)	50.7(7.2)
17	52.6(6.3)	53.2(5.2)	51.5(6.2)
18	54.1(6.1)	55.2(7.0)	52.4(5.4)
19	59.5(4.8)	56.2(6.5)	54.8(6.0)



Figure 3.1: Weight for age by sex

In case of female, the weight for age in terai (mean weight 45.8Kg at age 19) was slightly lower at higher ages than that of hill (mean weight 49.6Kg at age 19) and mountain (mean weight 53.8Kg at age 19) ecological regions.

Age (years)	Mean weight (SD)			
	Mountain	Hill	Terai	
5	16.6(2.8)	16.1(2.2)	16.6(2.5)	
6	18.8(2.3)	17.5(2.4)	17.8(2.8)	

Table 3.3: Weight for age for female according to ecological regions

7	18.9(1.8)	19.0(3.1)	19.4(2.9)
8	22.8(5.4)	21.0(3.4)	21.6(4.6)
9	25.1(3.6)	24.2(4.2)	24.6(4.6)
10	26.7(4.6)	27.1(5.3)	25.5(4.9)
11	31.4(4.9)	30.2(6.4)	30.6(5.6)
12	34.9(7.0)	34.9(7.2)	34.4(6.4)
13	40.8(5.6)	40.3(6.5)	38.0(5.2)
14	44.9(5.4)	43.7(5.9)	41.7(5.2)
15	45.0(9.2)	46.6(6.4)	43.8(5.6)
16	46.4(6.0)	47.3(5.7)	43.9(5.6)
17	49.6(5.3)	48.5(6.3)	45.6(6.1)
18	51.0(6.3)	48.6(4.8)	45.6(6.2)
19	53.8(5.3)	49.6(6.2)	45.8(5.0)

3.2 Height for age

The height for age analysis reveals that mean heights of male ranged from 107.6 cm to 164.7 cm for age 5 and 19 respectively. Similarly, the mean heights of female ranged from 106.8 cm to 153.4 cm for age 5 and 19 respectively. The heights of female of age 5-13 years is closer to the heights of male of similar age; however, differences in height for age is observed between males and females after the age 14 years.

Age	M	ale	I	Semale
(years)	Mean	SD	Mean	SD
5	107.6	6.9	106.8	7.3
6	112.7	8.4	111.3	6.9
7	116.8	8.1	115.7	7.2
8	121.5	7.6	120.9	6.9
9	126.8	7.6	127.3	7.2
10	131.2	7.5	131.3	8.1
11	136.6	7.8	137.5	8.4
12	141.9	9.2	143.1	7.6
13	149.0	9.1	147.5	6.0
14	156.5	8.0	151.0	5.4
15	159.5	7.1	151.8	7.0
16	161.9	6.6	152.0	5.3
17	162.9	6.4	152.2	5.4
18	163.6	6.9	152.9	6.1
19	164.7	5.8	153.4	6.3

Table 3.4: Height (cm) for age according to sex

The height for age for male was slightly higher in Terai ecological region upto age 7; however, the heights were similar in all three ecological regions with increasing age after 7 years.

Age (years)	Mean height (SD)			
	Mountain	Hill	Terai	
5	104.7(6.9)	106.4(5.5)	110.2(7.7)	
6	112.2(7.3)	110.9(6.5)	115.1(10.2)	
7	114.2(6.5)	115.2(6.5)	119.6(9.3)	
8	123.8(11.3)	119.9(5.5)	122.7(7.7)	
9	128.4(5.4)	124.6(5.9)	128.9(9.2)	
10	129.6(5.0)	130.2(6.7)	133.0(8.5)	
11	135.9(5.9)	135.2(8.0)	138.6(7.7)	
12	141.9(10.8)	139.7(7.5)	144.5(10.0)	
13	148.5(8.8)	149.5(8.5)	148.6(9.9)	
14	152.8(8.0)	157.0(7.2)	157.2(8.6)	
15	156.7(9.0)	159.6(7.7)	160.4(5.3)	
16	157.2(7.8)	161.9(6.6)	163.2(5.6)	
17	163.0(6.9)	163.2(6.5)	163.6(6.1)	
18	164.5(5.2)	163.8(8.0)	164.1(5.8)	
19	166.1(4.6)	165.0(5.9)	165.5(5.8)	

Table 3.5: Height for age for male according to ecological regions

In case of height for age for female, slightly greater height was found in female of Terai ecological region as compared to that of mountain and hill upto age 12. At higher ages like 18, 19 years, there was no such variation.

Age (years)	Mean height (SD)			
	Mountain	Hill	Terai	
5	105.3(7.7)	105.3(5.8)	109.3(8.2)	
6	112.1(5.6)	109.4(6.6)	113.0(7.1)	
7	113.4(5.0)	114.3(7.0)	118.1(7.5)	
8	121.0(8.1)	119.5(5.8)	122.6(7.4)	
9	127.0(5.7)	125.8(6.2)	129.2(8.3)	
10	129.6(7.8)	131.4(7.7)	131.7(8.6)	
11	136.8(6.6)	136.0(9.4)	139.5(7.4)	
12	141.7(8.4)	141.9(7.3)	145.0(7.4)	
13	147.2(4.4)	147.1(6.8)	148.1(5.4)	
14	151.0(5.4)	150.9(5.5)	151.1(5.5)	
15	151.3(5.7)	151.8(5.7)	151.3(6.4)	
16	151.7(6.1)	152.5(5.6)	151.5(4.5)	
17	152.6(4.4)	152.8(5.3)	151.8(5.7)	
18	153.5(6.1)	154.1(5.7)	152.1(6.3)	
19	155.3(5.9)	154.3(6.4)	152.4(6.4)	

Table 3.6: Height for age for female according to ecological regions



Figure 3.2: Height for age by sex

3.3 Body mass index (BMI) for age

The body mass index (BMI) for age indicates that males and females have almost equal body mass index. It was 14.6 for male and 14.3 for female at the age of 5 years. It is in increasing order with age and it was 20.6 for male and 20.5 for female at the age of 19 years.

Age	M	lale	J	Female
(years)	Mean	SD	Mean	SD
5	14.6	1.2	14.3	1.3
6	14.6	1.4	14.3	1.1
7	14.7	1.2	14.4	1.2
8	14.8	1.4	14.6	1.6
9	15.1	1.5	15.0	1.7
10	15.5	1.6	15.2	1.7
11	15.6	1.8	16.0	1.8
12	16.3	1.8	16.8	2.3

Table 3.7: Body mass index for age by sex

13	16.9	2.1	18.1	2.4
14	17.8	2.1	18.8	2.2
15	18.8	2.3	19.5	2.3
16	19.4	2.3	19.8	2.1
17	19.5	2.0	20.5	2.6
18	20.1	2.1	20.5	2.2
19	20.6	2.2	20.5	2.4



Age in completed years

Figure 3.3: Body mass index (BMI) for age by sex

Ecological regionwise distribution of BMI for age reveals similar trend of BMI for age in all three ecological regions.

	<u> </u>	<u> </u>		
Age (years)	Mean BMI (SD)			
	Mountain	Hill	Terai	
5	14.7 (0.9)	14.2 (1.3)	14.1 (1.0)	
6	14.8 (1.3)	14.3 (1.4)	14.2 (1.3)	
7	15.0 (0.9)	14.5 (1.1)	14.3 (1.3)	
8	15.4 (1.3)	14.9 (1.3)	14.4 (1.5)	
9	15.7 (1.3)	15.2 (1.3)	14.9 (1.7)	
10	16.1 (1.9)	15.6 (1.7)	15.1 (1.6)	

Table 3.8: BMI for age for male according to ecological regions

11	16.2 (1.2)	15.8(1.9)	15.2(1.6)
12	16.8 (1.7)	16.5(1.8)	16.0(1.7)
13	17.9 (2.0)	17.2(1.8)	16.2(2.3)
14	19.1 (1.6)	17.9(2.2)	17.1(2.1)
15	19.1 (2.0)	18.9(2.4)	18.6(2.2)
16	19.1 (1.6)	19.8(2.3)	19.0(2.4)
17	19.7 (1.7)	20.0(2.1)	19.2(2.0)
18	20.6 (1.5)	20.5(2.2)	19.4(1.9)
19	21.5 (1.8)	20.9(2.1)	20.0(2.1)

In case of female, BMI for age in Terai was slightly lower as compared to that of mountain and hill. The BMI for age is slightly higher in mountain than hills and Terai.

Table 2 0. DMI for any	a for famale according to apple sized regions
-1 able 5.9. Bivit for age	e for remaie according to ecological regions

Age (years)	Mean BMI (SD)			
	Mountain	Hill	Terai	
5	14.8(0.8)	14.5(1.3)	13.8(1.3)	
6	14.9(1.2)	14.5(1.0)	13.8(1.1)	
7	15.1(0.8)	14.5(1.2)	13.8(1.1)	
8	15.4(1.5)	14.6(1.5)	14.2(1.5)	
9	15.5(1.4)	15.2(1.8)	14.6(1.6)	
10	15.8(1.7)	15.5(1.7)	14.6(1.6)	
11	16.7(1.5)	16.2(1.9)	15.6(1.8)	
12	17.2(2.1)	17.1(2.4)	16.2(2.2)	
13	18.8(2.0)	18.5(2.6)	17.3(2.1)	
14	19.7(1.9)	19.1(2.3)	18.2(2.1)	
15	19.8(2.6)	20.2(2.4)	18.8(2.0)	
16	20.1(1.9)	20.3(1.9)	19.1(2.3)	
17	21.3(2.2)	20.7(2.6)	19.4(2.6)	
18	21.6(2.2)	20.7(2.1)	19.8(2.2)	
19	21.6(2.0)	20.8(2.3)	20.6(2.4)	

3.4 Weight for age and height for age according to rural urban distribution

In comparison of the mean height and weight for age in rural and urban areas, the urban area male had slightly more weight and height for age. The weight and height at age 5 years were 16.4 kg and 106.4 cm respectively in rural area whereas these were 17.4 kg and 108.5 cm in urban area. During early adult stage, there was no difference in height and weight.

Table 3.10: Weight for age and height for age of male according to rural urban distribution

Age (years)	Rural		Urban	
	Weight, Kg (SD)	Height, cm (SD)	Weight, Kg (SD)	Height, cm (SD)
5	16.4 (2.2)	106.4 (6.7)	17.4 (2.4)	108.5 (6.9)

6	18.4 (4.1)	110.7 (9.7)	19.1 (3.2)	114.1 (7.2)
7	19.8 (4.1)	116.8 (9.8)	19.9 (2.9)	116.8 (6.6)
8	21.9 (5.0)	120.8 (9.3)	22.1 (3.1)	122.1 (5.8)
9	23.6 (3.8)	124.8 (7.2)	25.0 (4.3)	128.2 (7.6)
10	26.2 (4.7)	130.2 (6.9)	27.3 (4.6)	132.0 (7.8)
11	28.4 (4.5)	134.9 (8.3)	30.0 (5.1)	138.1 (7.1)
12	31.8 (5.9)	139.3 (7.7)	34.3 (6.7)	143.8 (9.9)
13	36.8 (6.8)	146.7 (9.1)	38.7 (7.2)	150.9 (8.6)
14	43.2 (7.2)	155.3 (8.5)	44.3 (7.5)	157.4 (7.5)
15	47.6 (6.5)	159.3 (6.6)	48.5 (7.8)	159.6 (7.6)
16	49.9 (6.7)	161.2 (6.8)	52.1 (7.9)	162.5 (6.4)
17	50.6 (5.2)	162.2 (7.1)	53.0 (6.3)	163.5 (5.7)
18	53.1 (6.5)	163.5 (6.4)	54.3 (6.3)	163.7 (7.1)
19	56.6 (6.7)	164.2 (6.0)	55.6 (5.9)	165.0 (5.6)

The rural urban differences in weight and height for female are also not so significant.

Age (years)	Ru	ral	Urban	
	Weight, Kg (SD)	Height, cm (SD)	Weight, Kg (SD)	Height, cm (SD)
5	15.9 (2.2)	105.6 (7.2)	16.7 (2.5)	107.7 (7.3)
6	17.9 (3.0)	111.7 (7.8)	17.6 (2.2)	110.9 (6.2)
7	19.1 (3.3)	115.4 (8.5)	19.2 (2.6)	115.9 (6.1)
8	21.3 (4.0)	120.2 (7.1)	21.6 (4.3)	121.4 (6.8)
9	23.9 (4.1)	126.3 (7.3)	24.9 (4.4)	128.2 (7.0)
10	25.8 (4.9)	130.3 (7.7)	26.8 (5.2)	132.1 (8.3)
11	28.9 (5.1)	135.0 (8.4)	31.9 (6.2)	139.6 (7.9)
12	33.2 (5.7)	140.7 (7.2)	35.8 (7.4)	145.0 (7.4)
13	38.4 (5.2)	146.6 (6.5)	40.3 (6.5)	148.3 (5.4)
14	42.5 (5.5)	150.4 (5.4)	43.5 (5.8)	151.5 (5.4)
15	45.8 (5.6)	152.5 (5.5)	44.5 (7.4)	151.9 (8.2)
16	46.5 (5.4)	152.8 (5.3)	46.1 (6.4)	152.3 (5.3)
17	47.2 (5.8)	153.2 (5.6)	47.7 (6.6)	152.6 (5.1)
18	47.7 (6.0)	153.3 (6.8)	48.3 (5.8)	153.0 (5.5)
19	48.3 (6.3)	153.4 (6.4)	49.5 (5.8)	153.3 (6.3)

Table 3.11: Weight for age and height for age of female according to rural urban distribution

The weight and height of male from community schools were slightly lower as compared to that of private schools. However, with higher age there was no such differences.

Table 3.12:	Weight for	age and	height for	age of m	ale according to	type of school
						· / · · · · · · · · · · · · · · · · · ·

Age (years)	Communi	ty school	Private	e school
	Weight, Kg (SD)	Height, cm (SD)	Weight, Kg (SD)	Height, cm (SD)
5	16.4 (2.1)	106.2(6.8)	17.9 (2.5)	110.0 (6.4)

6	18.2 (3.7)	111.8 (8.7)	19.3 (3.4)	114.0 (7.9)
7	19.6 (3.7)	116.3 (8.8)	20.3 (2.9)	117.9 (6.6)
8	21.6 (4.4)	120.7 (8.1)	22.8 (3.1)	123.3 (6.1)
9	23.8 (4.1)	125.9 (7.7)	25.7 (3.9)	128.4 (7.1)
10	26.2 (4.3)	130.1 (6.7)	28.2 (5.3)	133.8 (8.6)
11	28.5 (4.1)	135.3 (7.7)	31.3 (5.9)	140.0 (7.1)
12	31.5 (5.3)	139.4 (7.9)	37.2 (7.1)	147.7 (9.5)
13	36.8 (6.7)	147.7 (9.0)	40.3 (7.3)	152.1 (8.3)
14	42.7 (6.5)	155.3 (7.6)	46.3 (8.5)	159.2 (8.3)
15	47.8 (7.5)	158.9 (7.6)	48.9 (6.3)	161.2 (4.9)
16	50.4 (7.3)	161.2 (6.6)	52.7 (7.2)	164.0 (6.3)
17	51.5 (5.5)	162.6 (6.5)	53.0 (7.0)	164.0 (6.1)
18	54.1 (6.7)	163.4 (7.4)	53.4 (5.7)	164.1 (5.6)
19	56.6 (6.3)	164.2 (5.8)	55.1 (6.0)	165.5 (5.6)

Similarly, the differences in weight for age and height for age between females of community and private schools were observed at lower ages.

Age (years)	Communi	Community school		e school
	Weight, Kg (SD)	Height, cm (SD)	Weight, Kg (SD)	Height, cm (SD)
5	15.9 (2.3)	105.5 (7.2)	17.1 (2.4)	108.9 (7.1)
6	17.8 (2.8)	111.2 (7.4)	17.8 (2.1)	111.4 (6.1)
7	18.5 (3.0)	114.6 (7.8)	20.3 (2.4)	117.5 (5.7)
8	21.2 (4.2)	120.0 (7.1)	22.1 (4.0)	122.7 (6.2)
9	24.0 (4.1)	126.7 (7.2)	25.5 (4.4)	128.6 (6.9)
10	25.7 (4.7)	130.4 (7.7)	27.8 (5.6)	133.3 (8.6)
11	29.5 (5.5)	135.9 (7.9)	33.5 (6.0)	142.1 (8.2)
12	33.1 (5.7)	140.9 (7.3)	38.2 (7.8)	147.8 (6.1)
13	38.8 (5.8)	146.7 (6.1)	41.0 (6.3)	149.4 (5.4)
14	42.9 (5.7)	150.7 (5.5)	43.5 (5.8)	152.0 (5.2)
15	45.3 (5.8)	152.0 (5.8)	44.8 (8.7)	152.5 (10.1)
16	45.7 (5.6)	152.1 (5.3)	46.3 (7.0)	153.1 (5.3)
17	47.2 (5.5)	152.3 (5.4)	46.7 (8.1)	153.1 (5.2)
18	47.8 (5.7)	152.8 (6.3)	47.2 (6.4)	153.2 (5.8)
19	48.4 (5.9)	153.2 (6.3)	48.0 (6.1)	153.6 (6.4)

Table 3.13: Weight for age and height for age of female according to type of school

3.5 Comparison of results with WHO growth standard

Regarding comparison of results of height for age (stunting) with WHO growth standard, it reveals that the proportion of severe malnutrition is lower and about 5%. Taking median of this survey as a standard, only 0.3% is severely malnourished.

Z-score	Comparison with WHO standard		Comparison with Survey standard	
	Male (%)	Female (%)	Male (%)	Female (%)
-3	5.5	5.2	0.3	0.3
-2	18.7	19.3	1.3	1.5
-1	34.6	34.9	10.7	11.6
0	36.0	36.5	73.6	71.7
+1	3.8	2.7	11.2	12.1
+2	0.8	0.6	2.3	2.3
+3	0.7	0.7	0.5	0.4

Table 3.14: Comparison for height for age

Similarly, comparison of findings of weight for age with WHO standard reveals that the proportion of severely underweight children is very low.

Z-score	Comparison with WHO standard		Comparison with	Survey standard
	Male (%)	Female (%)	Male (%)	Female (%)
-3	0.1	0.0	0.1	0.1
-2	1.5	0.5	0.7	0.5
-1	36.6	27.1	9.6	10.7
0	59.7	70.5	73.8	72.8
+1	1.7	1.4	12.2	11.6
+2	0.2	0.2	2.5	3.2
+3	0.2	0.2	1.1	1.1

Table 3.15: Comparison for weight for age

Chapter- IV Conclusion

This survey has several strengths despite few limitations. This is the first national survey to determine growth standard and included large sample size. This study included samples from all three ecological regions and five administrative regions. Various ethnic groups included and covered children from rural and urban area. Healthy school children were included. More importantly, validation with WHO standard reveals that proportion of SAM is very low.

Regarding limitations, the survey was conducted during the admission period of the school and examination period of higher secondary school, it was difficult to get the students of specific age for required sample size. Date of birth was not found in school record in most of the schools. Age record in this survey was mostly verbal.

This study determined the growth standard for Nepalese children which can be used as reference values to determine nutrition status of Nepalese population after standardization. There should be standardization of the findings of this study to develop growth curve and set growth monitoring criteria of the children in Nepal.

References

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Annex I School Health and Nutrition Project (SHNP) (DOHS/DOE/JICA/PHIDReC) Data Collection Tool

Serial Number: Name of the enumerator:	Date:
A) Information of school	
District:	
Zone:	
Ecological region: a) Mountain b) Hill c) Terai	
Administrative region: a) Eastern b) Central c) Western d)	Mid-western e) Far-
Name of the school:	
Type of school: a) Public b) Private	
Address of the school:	
Location of the school: a) Rural b) Urban	
B) Demographic information	
Name of the children:	
Class (Grade):	
Caste:	
Ethnicity:	
Sex: a) Male b) Female	
Date of birth (according to verbal report of children):	
Date of birth (according to school register):	
C) Anthropometric measurements	
Height (cm):	
Weight (Kg):	
Verified by (Name of the supervisor):	
Signature: Da	ite:

Annex II Ethical Issues

A) Information sheet

Name of Team Leader: Dr. Megha Raj Banjara Name of Organization: Public Health and Infectious Disease Research Center (PHIDReC), New Baneshwor, Kathmandu, Nepal Name of Sponsor: School Health and Nutrition Project (SHNP) (DOHS/DOE/JICA) Research title: Development of the Nepalese Growth Standard for the School-aged Children

(I am and I work at the PHIDReC Kathmandu. We are doing research on determining the Nepalese growth standard for the school aged children. The growth standard of Nepalese children has not been determined yet and researchers are using the WHO reference value until now.)

Purpose of the research

The status of health and nutrition of the school-aged children in Nepal is not well recognized. Health and nutrition services for the school-aged population do not come under the priority of the health workers. Not because the school is concerned with children's health, but of their priority in academic matters. The impact of health and nutritional status are given less attention than to the learning achievement. Until now, there is no growth standard for Nepalese school-aged children (5-19 years). Therefore, comparison of growth of Nepalese school-aged children with the international standard developed by the WHO is not possible. The main objective of the survey is to develop the national growth standard of body (weight for age, height for age, weight for height, and body mass index) for Nepalese school children.

Procedures

The survey will be conducted in 15 districts representing each ecological and administrative region. In 15 strata of districts, a total of 6750 students will be included in the study. The school children will be selected as the cluster of a school class. The strata for the cluster sampling will be Primary, Lower Secondary, Secondary, and Higher Secondary. Schools are selected randomly reflecting half from the urban area and half from the rural area. From the selected districts, minimum one school will be from the municipality from each region to compare the urban and rural area. Private schools will also be included reflecting the ratio of school children in private schools. School children of specific sex and age from 5-19 years will be selected for the survey, totalling 450 children in each district.

Anthropometric measurement of all 6750 sample students of primary, lower secondary, secondary and higher secondary schools selected for survey will be made by asking the age and measuring and recording of height and weight.

Risks and discomforts

There is no any risk and discomfort while taking height and weight. The anthropometric measurements will be taken in the school of school children at appropriate convenient place.

Benefits

There is no direct benefit to the participant children by giving anthropometric measurements. However, your participation helps us to determine the growth standard of Nepalese children which is still lacking.

Incentives

You will not be provided any incentive to take part in the research.

Confidentiality

The information that we collect from this research will be kept confidential and will not be divulged to anyone except the researchers, and research sponsors.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so, and this will not affect your business in any way. You will still have all the benefits that you would otherwise have. You may stop participating in the research at any time that you wish to, without losing any of your rights as a participant student or otherwise.

Who to contact

If you have any questions you may ask those now or later. If you wish to ask questions later, you may contact: (Public Health and Infectious Disease Research Center, Kathmandu, Phone: +977-1-4494254).

B) Certificate of consent

I have read/has been read to me the foregoing information. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this study and understand that I have the right to withdraw from the study at any time without in any way affecting me and my family.

Name of the student: Signature: Name of school: District: Date:

Witness (Name): Signature: Date:

Annex III
Participants of the Training for Supervisors

1. Guests and trainers

S.N	Name	Designation and Organization
1	Mr Hari Prasad Bashyal	Director, Department of Education
2	Mr Raj Kumar Pokharel	Chief, Nutrition Section, Child Health Division
3	Mrs Rajya Laxmi Nakarmi	Deputy Director, Department of Education
4	Mr Mitsukuni Sugimoto	Chief Advisor, School Health and Nutrition
		Project, JICA
5	Mr Arun Khanal	National Project Co-ordinator, School Health and
		Nutrition Project, JICA
6	Prof. Chitra Kumar Gurung	Chairman, PHIDReC
7	Dr Suresh Prasad Bastola	Nutrition Expert, Institute of Medicine, Tribhuvan
		University
8	Mr Krishna Raj Pant	Administrator, PHIDReC
9	Dr Megha Raj Banjara	Team Leader of the survey

2. Supervisors of the survey

S.N	Name	District
1	Mr. Mahesh Pant	Kailali
2	Mr. Binod Pant	Baitadi
3	Mr. Bishnu Ghimire	Syangja
4	Mr. Hari Prasad Ghimire	Kapilvastu
5	Mr. Madhav Adhikari	Nuwakot
6	Mr. Bal Kumar Ojha	Dhankuta
7	Mr. Yograj Ghimire	Taplejung
8	Mr. Jyotee Kuwar	Dailekh
9	Prof. Chitra Kumar Gurung, Dr. Megha Raj	Sindhupalchowk
	Banjara, Mr. Krishna Raj Pant, Ms. Pramila	
	Karki	
10	Mr. Nav Raj Bist	Banke, Humla, Sarlahi
11	Ms Shova Gurung	Parsa
12	Prof. Chitra Kumar Gurung, Dr. Megha Raj	Saptari
	Banjara, Mr. Krishna Raj Pant	
13	Dr. Aditya Joshi, Ms. Anjita Khanal	Kathmandu

Annex IV Agenda of Training for Supervisors

Date: Sunday 20 March, 2011 (6 Chaitra, 2067) Venue: PHIDReC Office, New Baneshwor

Time	Particulars	Responsible person
1:45 pm	Registration	
2:00 pm	Opening remarks	Prof. Chitra Kumar Gurung, Chair, PHIDReC
2:05 pm	Opening remarks	Ms. Rajya Laxmi Nakarmi, Deputy Director, Department of Education
2:10 pm	Opening remarks	Mr Mitsukuni Sugimoto, Chief Advisor, School Health and Nutrition Project, JICA
2:15 pm	Opening remarks	Dr Hari Prasad Bashyal, Director, Department of Education Mr. Raj Kumar Pokhrel, Chief, Nutrition Section, Child Health Division
2:20 pm	Background and objectives of the study	Dr Megha Raj Banjara
2:30 pm	Refreshments	
2:45 pm	Child nutrition and its monitoring	Dr Suresh Prasad Bastola
3:00 pm	Selection methods of districts, schools and school children	Prof. Chitra Kumar Gurung
3:15 pm	Anthropometric measurements	Dr Suresh Prasad Bastola
3:40 pm	Informed consent and tools	Dr Megha Raj Banjara
4:00 pm	Practice on measuring height and weight	Prof. Chitra Kumar Gurung, Dr Suresh Prasad Bastola, Dr Megha Raj Banjara
4:30 pm	Administrative announcements	Mr Krishna Raj Pant
4:40 pm	Group plan for field work in Kathmandu	All

Annex V **Ethical Approval Letter**



Website: http://www.nhrc.org.np, Email : nhrc@nhrc.org.np

Annex VI List of Schools

S.N.	Name of the school	Type of School	Address	Male	Female
1. Taplejung				230	234
1.	Shree Bhanujan Higher Secondary School	Public	Fungling VDC-4	70	72
2.	Kanchanjanga Higher Secondary School	Private	Fungling VDC-3	75	74
3.	Janta Higher Secondary School	Public	Hangdeva VDC-6	85	88
2. Dhankuta				225	231
1.	Tulsi Mehar Memorial English Boarding School	Private	Dhankuta Municipality -7	80	87
2.	Shree Saraswati Higher Secondary School	Public	Parewadin VDC -5	72	78
3.	Shree Bhasa Higher Secondary School	Public	Dhankuta Municipality -2	73	66
3. Saptari				229	243
1.	Sarbodaya Higher Secondary School	Public	Kanchanpur VDC-7	39	58
2.	World Vision Higher Secondary School	Private	Rajbiraj Municipality -7	60	54
3.	Shree Masilal Janata Higher Secondary School	Public	Kusaha VDC- 5	38	47
4.	Unique Education Academy	Private	Rajbiraj Municipality - 7	27	19
5.	Shree Chandra Higher Secondary School	Public	Bodebarsaian VDC – 1	44	46
6.	Shree Jiyalal Primary School	Public	Bodebarsain VDC- 1	21	19
4.Sarlahi				229	232
1.	Gyanodaya Higher Secondary School	Private	Malangawa Municipality – 9	74	65
2.	Shree Panch Mahendra Higher Secondary School	Public	Karmaiya VDC- 5	68	68
3.	Shrimati Krishna Devi Higher Secondary School	Public	Malangawa Municipality – 9	59	66
4.	Chatur Bhujeshwar Janata Multiple Campus	Private	Harion VDC – 6	0	13
5.	Shree Janjyoti Technical School	Private	Lalbandi VDC- 8	28	20
5.Parsa				225	225
1.	Shree Ramchandra Shah	Public	Birgunj Sub-	65	65
	Pannalal Secondary School		Metripolitan City-13		
2.	Gyan Jyoti Higher Secondary School	Private	Birgunj Sub- Metripolitan City – 4	85	85
3.	Jilla Uchchangal Higher Secondary School	Public	Pokhariya VDC-4	75	75
6.Sindhupalch owk				249	248
1.	Shree Krishna Ratnaganga	Public	Chautara VDC -5	81	76

	Higher Secondary School				
2	Shrae Seti Devi Higher	Dublic	Thulogirubari VDC	<u>0</u> 2	<u>0</u> 2
2.	Sillee Sell Devi Higher	Fublic		02	02
2	Secondary School	D 11	-1	24	25
3.	Seti Devi Sharada Higher	Public	Pangretar VDC-1	24	25
	Secondary School			~ ~	
4.	Private Paradise Secondary	Private	Bahrabise VDC-8	52	53
	School				
5.	Sunkoshi Multiple Campus	Public	Pangretar VDC-1	10	12
7. Kathmandu				238	225
1.	New Arunodaya English	Private	Kathmandu	87	85
	Higher Secondary School		Metropolitan City -		
	· ·		15		
2.	Orbit MBBS	Private	Kathmandu	15	12
			Metropolitan City -	-	
			32		
3	Koteshwor Sarswati Higher	Public	Kathmandu	72	65
5.	Secondary School	1 uone	Metropolitan City -	12	05
	Secondary School		35		
4	Canyos Boarding School	Drivoto	Vathmandu	Q	0
4.	Canvas Boarding School	Filvate	Matropoliton City	0	0
			10		
		D 11			()
5.	Sangala Balkumari Higher	Public	Sangala VDC-4	56	62
	Secondary School				
8. Nuwakot				225	225
1.	Tribhuwan Trishuli Higher	Public	Bidur Municipality -	78	82
	Secondary School		11		
2.	Shree Trishuli Samudayik	Private	Bidur Municipality -	50	46
	Boarding School		10		
3.	Tribhuwan Trishuli Multiple	Public	Bidur Municipality -	17	19
	Campus		11		
4.	Shree Bhawani Higher	Public	Kakani VDC -3	50	49
	Secondary School				
5.	Langtang Snow View	Private	Kakani VDC -3	25	29
	Boarding School				
6.	Gyanodaya Secondary School	Public	Bageshwari VDC-2	0	2
7.	Svaulebhumi Higher	Public	Svaulebhumi VDC -	0	3
	Secondary School		4	÷	-
8	Miliyan Academy	Private	Svaulebhumi VDC -	5	5
0.	willy an readenly	1 II vate		5	5
0 Syangia			1	225	225
J. Syangja	Tribbuwan Adarsh Highar	Public	Dutalibaiar	60	75
1.	Secondary School	ruone	1 utanoajai Municipality 1	09	15
2	Tribbuwon Adarah Maltiral-	Dublic	Dutalibaiar	E	0
۷.	Compus	Public	rutanoajar Municipalitat 1	0	U
2		D-11	Internet in the second	75	75
5.	Bhanubhakta Adarsha Higher	Public	Jagatradevi VDC-8	15	/5
	Secondary School				
4.	Jyoti Awasiya Higher	Private	Putalibajar	75	75
	Secondary School		Municipality -1		
10. Kapilvastu				227	233
1.	Shree Siddhartha	Private	Taulihawa	76	77
	Bidhyamandir Higher		Municipality -4		
	Secondary School				
2.	Shree Ratnarajyalaxmi Higher	Public	Taulihawa	76	75
	Secondary School		Municipality -2		
3.	Shree Banganga Higher	Public	Gajehada VDC-1	75	81

	Secondary School				
11. Banke				228	227
1.	Adarsh Higher Secondary School	Private	Nepalgunj Municipality -13	79	71
2.	Anathalaya Gaushiya Secondary School	Public	Nepalgunj Municipality -5	52	22
3.	Sarswati Higher Secondary School	Public	Nepalgunj Municipality -5	0	42
4.	Bright Land College	Private	Nepalgunj Municipality -13	23	17
5.	Laxmi Higher Secondary School	Public	Rajhena VDC-4	35	47
6.	Gyanodaya Higher Secondary School	Public	Bageshwori VDC-2	28	24
7.	Ideal Public Higher Secondary School	Private	Nepalgunj Municipality -8	11	4
12. Dailekh				225	229
1.	Tribhuwan Namuna Higher Secondary School	Public	Narayan Municipality -1	88	86
2.	Tribeni Sangam Higher Secondary School	Public	Bayalpata VDC -5	62	68
3.	Janata Primary School	Public	Narayan Municipality -1	25	25
4.	Shree Sunrise English School Private Limited	Private	Narayan Municipality -1	50	50
13. Humla				225	225
1.	Malika Higher Secondary School	Public	Lali VDC-5	75	70
2.	Kala Silta Primary school	Public	Lali VDC-5	36	32
3.	Raling Higher Secondary School	Public	Bargau VDC-6	50	47
4.	Mansarober Higher Secondary School	Public	Simikot VDC- 4	19	18
5.	Bal Mandir Secondary School	Public	Simikot VDC – 4	45	58
14. Kailali				225	225
1.	Gyalexi Higher Secondary School	Private	Dhangadhi Municipality -4	75	75
2.	Phulbari Higher Secondary School	Public	Phulbari VDC -1	75	75
3.	Trinagar Higher Secondary School	Public	Dhangadhi Municipality -1	75	75
15. Baitadi				225	225
1.	Birendra Education Campus	Public	Dasharathchandra Municipality -1	3	4
2.	Birendra Higher Secondary School	Public	Dasharathchandra Municipality -1	43	41
3.	Dasharathchanda Higher Secondary School	Public	Dasharathchandra Municipality -5	1	0
4.	Saraswati English Boarding School	Private	Dasharathchandra Municipality -1	28	30
5.	Manilek Higher Secondary School	Public	Gurukhola VDC -8	75	75
6.	Bashudev Higher Secondary School	Public	Bashuling VDC -7	75	75

Annex VII Findings

Age (vears)	M-3SD	M-2SD	M-1SD	Median	M+1SD	M+2SD	M+3SD
5	86.4	93.3	100.3	107.3	114.2	121.2	128.1
6	86.4	94.9	103.4	111.9	120.3	128.8	137.3
7	91.5	99.6	107.7	115.9	124.0	132.1	140.2
8	97.9	105.5	113.1	120.8	128.4	136.0	143.6
9	102.4	110.1	117.7	125.4	133.0	140.6	148.3
10	108.3	115.8	123.3	130.9	138.4	145.9	153.4
11	113.0	120.9	128.7	136.6	144.4	152.2	160.1
12	113.0	122.3	131.6	140.9	150.2	159.5	168.8
13	121.4	130.5	139.6	148.8	157.9	167.0	176.1
14	132.6	140.7	148.7	156.8	164.8	172.8	180.9
15	138.6	145.8	153.0	160.2	167.3	174.5	181.7
16	142.6	149.3	156.0	162.7	169.3	176.0	182.7
17	144.0	150.5	156.9	163.4	169.8	176.2	182.7
18	145.4	150.5	157.4	164.4	171.3	178.2	185.1
19	146.9	152.7	158.5	164.4	174.3	182.2	189.9

Table 1: Height (cm) for age for male

Table 2: Height (cm) for age for female

Age							
(years)	M-3SD	M-2SD	M-1SD	Median	M+1SD	M+2SD	M+3SD
5	83.9	91.3	98.6	106.0	113.3	120.6	128.0
6	90.1	97.1	104.1	111.1	118.0	125.0	132.0
7	93.1	100.4	107.6	114.9	122.2	129.4	136.7
8	99.2	106.2	113.2	120.2	127.1	134.1	141.1
9	105.0	112.2	119.4	126.7	133.9	141.1	148.3
10	105.7	113.9	122.0	130.2	138.3	146.4	154.6
11	112.5	121.0	129.5	138.0	146.4	154.9	163.4
12	120.4	128.1	135.8	143.5	151.2	158.9	166.6
13	129.5	135.6	141.6	147.7	153.7	159.7	167.0
14	134.5	140.0	145.5	151.0	156.4	161.9	167.4
15	135.2	140.6	146.0	151.7	156.8	162.2	167.6
16	135.9	141.2	146.5	151.9	157.2	162.5	167.8
17	135.9	141.3	146.7	152.2	157.6	163.0	168.4
18	135.9	141.4	146.9	152.3	158.4	164.6	170.8
19	135.9	141.5	147.1	154.0	160.3	166.7	173.1

Age (years)	M-3SD	M_2SD	M-1SD	Median	M±1SD	M±2SD	M+3SD
(years)	NI-35D	11.0	14.2		10.2	21.6	24.0
3	9.5	11.9	14.5	10.0	19.2	21.0	24.0
6	9.6	12.2	15.1	17.9	21.6	25.3	28.9
7	9.8	12.5	16.0	19.5	22.9	26.4	29.9
8	10.0	13.4	17.5	21.7	25.8	29.9	34.0
9	11.0	15.3	19.5	23.7	27.9	32.1	36.4
10	11.6	16.3	21.0	25.8	30.5	35.2	39.9
11	14.0	18.9	23.8	28.8	33.7	38.6	43.5
12	15.1	19.0	25.5	32.0	38.5	45.0	51.5
13	16.2	23.3	30.4	37.5	44.6	51.7	58.8
14	21.3	28.7	36.1	43.5	50.9	58.3	65.7
15	26.8	34.1	41.4	48.7	55.9	63.2	70.5
16	28.8	36.2	43.6	51.1	58.5	65.9	73.3
17	33.5	39.5	45.5	51.5	59.5	66.4	73.3
18	34.9	41.3	47.7	54.2	60.6	67.0	73.4
19	36.6	42.9	49.2	55.5	61.7	68.0	74.3

Table 3: Weight (Kg) for age for male

Table 4: Weight (Kg) for age for female

Age							
(years)	M-3SD	M-2SD	M-1SD	Median	M+1SD	M+2SD	M+3SD
5	8.7	11.1	13.6	16.0	18.4	20.9	23.3
6	9.6	12.2	14.8	17.5	20.1	22.7	25.3
7	10.0	12.9	15.9	18.9	21.8	24.8	27.7
8	10.4	14.0	16.6	20.9	25.1	29.3	33.6
9	10.8	15.1	19.4	23.8	28.1	32.4	36.7
10	11.3	15.4	20.5	25.7	30.8	35.9	41.0
11	11.8	17.8	23.7	29.7	35.6	41.5	47.5
12	13.5	20.4	27.2	34.1	41.0	47.8	54.7
13	21.0	27.0	33.1	39.2	45.2	51.3	57.3
14	25.6	31.3	37.1	42.9	48.6	54.4	60.1
15	26.3	31.7	38.4	45.0	51.6	58.3	64.9
16	27.1	33.1	39.0	45.0	52.6	59.1	65.5
17	28.5	34.8	41.1	47.4	53.6	59.9	65.7
18	29.3	35.2	41.2	47.7	53.8	60.0	66.0
19	30.0	36.0	42.0	48.1	54.1	60.1	66.1

Age]	BMI for mal	e	B	MI for fema	le
(Years)	1 st	2 nd	3 rd	1 st	2 nd	3 rd
	Quartile	Quartile	Quartile	Quartile	Quartile	Quartile
5	13.2	14.1	15.0	13.3	14.2	15.1
6	13.3	14.2	15.1	13.5	14.2	15.1
7	13.5	14.4	15.3	13.5	14.2	15.2
8	13.9	14.7	15.7	13.5	14.4	15.4
9	14.0	14.9	15.9	13.8	14.8	16.0
10	14.4	15.2	16.3	14.0	14.9	16.4
11	14.5	15.3	16.4	14.7	15.9	16.9
12	15.1	16.1	17.2	15.1	16.4	18.0
13	15.3	16.8	18.2	16.3	17.6	19.4
14	16.3	17.6	19.0	17.2	18.7	20.1
15	17.2	18.6	20.5	17.9	19.4	21.0
16	17.6	19.3	20.8	18.2	19.8	21.3
17	17.9	19.3	20.8	18.7	20.3	22.0
18	18.5	20.1	21.6	18.9	20.3	22.1
19	19.1	20.5	22.1	18.9	20.3	22.2

Table 5: BMI for age by sex

Table 6: Height and weight for age for male by ecological region

Age	Median height			Median weight			
(Years)	Mountain	Hill	Terai	Mountain	Hill	Terai	
5	105.7	105.7	109.4	17.1	16.8	16.7	
6	111.5	110.8	113.1	18.6	17.5	18.1	
7	113.5	115.5	117.5	19.2	19.4	19.6	
8	120.9	120.0	122.8	22.1	21.5	21.6	
9	127.8	123.6	128.5	24.8	23.4	24.0	
10	129.4	130.2	132.1	26.9	25.7	25.4	
11	136.5	135.5	139.2	30.0	28.1	28.9	
12	137.6	139.3	143.2	31.7	31.8	33.1	
13	148.3	150.2	147.9	39.8	38.3	35.6	
14	153.1	156.4	158.4	44.0	43.6	43.5	
15	158.2	159.5	161.1	48.0	49.5	47.9	
16	160.5	162.6	163.8	49.5	52.3	50.6	
17	162.8	164.0	164.3	51.1	52.5	51.5	
18	164.6	164.4	164.8	54.0	55.8	52.5	
19	166.5	165.2	165.0	58.8	62.4	53.9	

Age	Μ	ledian heigh	t	Median weight			
(Years)	Mountain	Hill	Terai	Mountain	Hill	Terai	
5	105.4	105.4	108.8	16.5	15.8	16.6	
6	112.0	110.0	113.5	18.8	17.2	17.5	
7	112.7	113.7	117.3	18.9	18.7	19.0	
8	120.0	119.3	121.5	21.4	20.7	20.5	
9	126.7	125.1	128.9	25.5	23.4	23.8	
10	129.2	130.3	131.0	26.1	26.2	24.3	
11	136.0	136.6	140.0	30.2	29.6	29.7	
12	141.5	142.7	145.0	34.9	33.9	34.1	
13	147.0	147.3	148.6	40.2	40.2	37.6	
14	149.9	151.1	151.1	44.9	43.4	41.1	
15	150.6	151.3	151.4	46.6	45.8	43.7	
16	151.3	152.4	151.7	48.9	47.1	43.8	
17	151.3	153.0	151.9	51.2	47.9	45.1	
18	152.1	154.0	152.4	52.4	48.0	45.2	
19	153.0	154.4	153.0	54.8	49.7	45.4	

Table 7: Height and weight for age for female by ecological region

Table 8: Height and weight for age for male by administrative regions

Age		Ν	/Iedian	neight		Median weight					
(Years)	EDR	CDR	WDR	MWDR	FWDR	EDR	CDR	WDR	MWDR	FWDR	
5	109.9	108.2	106.6	104.3	106.3	17.9	16.7	16.7	16.2	15.7	
6	113.7	112.0	113.2	109.3	110.6	19.1	17.8	18.9	18.1	16.9	
7	116.6	116.0	117.2	112.8	117.5	19.5	19.7	20.4	19.3	19.6	
8	122.9	121.4	122.4	119.2	119.3	22.1	21.6	23.6	20.6	20.5	
9	127.3	125.4	127.4	123.4	123.7	24.3	23.8	24.8	22.5	22.6	
10	132.3	131.4	129.3	129.1	131.0	27.2	26.2	25.7	25.6	25.0	
11	137.5	136.0	138.5	137.1	136.0	30.7	27.8	29.8	29.1	26.1	
12	140.5	141.6	141.8	142.0	142.5	33.0	32.9	35.5	29.6	30.1	
13	148.9	150.8	151.5	146.9	147.2	39.4	37.7	38.5	36.1	34.4	
14	158.7	156.5	157.8	155.6	156.9	44.5	43.6	44.7	42.6	41.3	
15	160.0	161.3	160.3	157.0	160.5	47.7	49.0	51.2	48.0	46.2	
16	164.0	163.5	162.4	158.9	164.3	50.4	50.4	57.5	50.9	47.3	
17	164.4	164.0	163.5	163.4	164.3	50.4	51.0	58.5	52.0	50.2	
18	164.9	164.0	164.6	164.4	165.6	53.8	53.6	59.5	52.0	54.7	
19	165.9	165.9	166.8	165.4	168.2	56.9	57.8	61.5	54.5	63.7	

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Age		Ν	Aedian l	height		Median weight					
(Years)	EDR	CDR	WDR	MWDR	FWDR	EDR	CDR	WDR	MWDR	FWDR	
5	109.0	106.0	105.7	102.9	107.0	16.7	16.5	16.7	15.4	15.8	
6	114.4	110.5	108.6	110.8	112.0	18.5	17.1	17.5	17.5	17.1	
7	116.6	114.9	111.7	114.0	116.4	19.7	19.4	18.1	18.1	18.7	
8	121.2	120.0	119.0	121.0	120.1	21.0	20.9	21.5	20.3	20.8	

9	129.6	127.5	126.9	124.0	124.6	25.1	24.7	24.3	22.6	22.1
10	131.5	131.1	129.3	129.2	130.5	27.6	25.4	26.2	24.4	24.3
11	139.8	136.7	140.3	135.8	137.6	30.2	29.5	32.8	29.1	28.2
12	147.3	143.0	144.2	141.6	143.3	35.5	35.0	33.3	32.2	32.5
13	148.7	148.0	147.9	147.2	147.4	40.1	40.1	37.9	39.1	35.9
14	150.3	151.5	151.3	150.1	151.5	43.2	43.0	45.3	42.1	40.7
15	150.8	151.8	152.9	150.6	152.7	45.0	44.6	45.9	46.1	43.0
16	151.4	152.2	153.0	151.2	154.5	46.5	46.1	46.6	46.4	43.1
17	151.4	153.0	153.0	151.9	155.2	47.8	46.5	47.1	47.1	43.2
18	151.5	154.6	153.1	154.0	156.3	48.8	47.0	47.4	47.8	45.1
19	153.0	157.8	153.4	154.0	157.5	49.8	47.1	50.4	47.8	45.6

Table 10: Height and weight for age for male by type of school

Age	Median	height	Medi	an weight
(Years)	Community	Private	Community	Private
5	106.0	109.6	16.3	17.9
6	111.0	112.6	17.3	18.8
7	115.0	117.5	19.0	20.0
8	120.0	122.7	21.0	22.4
9	124.9	127.6	22.7	25.2
10	129.8	132.7	25.3	26.8
11	135.6	139.4	28.0	30.0
12	138.5	146.4	30.3	36.8
13	147.6	152.0	36.9	39.6
14	156.0	160.5	42.4	46.3
15	159.5	161.0	48.4	48.7
16	162.1	162.5	50.6	52.7
17	162.9	164.0	51.3	53.1
18	164.3	164.5	54.7	53.5
19	167.1	164.9	55.9	55.0

Table 11: Height and weight for age for female by type of school

Age	Median	height	Medi	an weight
(Years)	Community	Private	Community	Private
5	105.3	108.2	15.7	16.8
6	111.0	111.2	17.9	17.3
7	114.0	117.0	18.2	20.1
8	119.4	122.4	20.4	21.4
9	125.9	128.9	23.6	24.5
10	129.2	132.1	25.0	27.5
11	135.8	142.3	29.0	33.9
12	142.0	148.0	32.4	37.2
13	147.2	150.1	38.7	40.6
14	150.5	152.8	43.0	42.6
15	151.5	153.4	45.0	45.2

16	151.5	154.0	45.3	46.4
17	152.3	155.2	47.3	47.7
18	153.1	157.6	47.4	47.8
19	153.9	162.4	48.2	47.9

Table 12: Height and weight for age for male by area of school

Age	Median	height	Medi	an weight
(Years)	Rural	Urban	Rural	Urban
5	106.1	108.3	16.2	17.3
6	109.3	113.0	17.0	18.6
7	115.5	116.2	19.3	19.6
8	119.5	121.7	21.0	22.0
9	124.0	127.2	22.7	24.2
10	129.8	132.1	25.3	26.3
11	135.0	138.3	28.1	29.1
12	138.4	142.6	30.3	33.5
13	146.2	151.5	36.6	38.4
14	156.0	157.7	42.8	44.1
15	159.9	160.3	48.5	48.7
16	162.3	163.4	50.4	52.2
17	163.0	163.4	51.7	53.5
18	164.4	164.4	53.1	54.8
19	164.6	166.4	56.3	55.4

Table 13: Height and weight for age for female by area of school

Age	Median	height	Medi	an weight
(Years)	Rural	Urban	Rural	Urban
5	105.3	106.9	15.8	16.6
6	111.8	110.9	17.9	17.3
7	114.3	115.3	18.6	19.2
8	119.3	121.0	21.1	20.7
9	125.8	127.8	23.5	24.4
10	129.1	131.5	24.6	26.2
11	135.4	140.2	29.0	31.0
12	141.2	145.0	32.6	35.0
13	147.2	148.5	38.8	39.4
14	150.9	151.5	42.8	43.3
15	152.0	152.2	45.6	44.6
16	152.4	152.9	46.3	44.8
17	152.8	153.1	47.1	47.5
18	153.3	153.5	47.6	47.6
19	153.8	154.0	48.1	48.0

Age	3 rd	5 th	10 th	20 th	30 th	40 th	50 th	60 th	70 th	80 th	90 th	95 th	97 th
5	95.5	98.0	99.3	101.5	103.9	105.2	107.3	109.3	110.5	113.4	117.0	119.0	123.8
6	98.9	100.6	103.0	106.5	108.5	110.6	111.9	113.4	115.5	118.6	122.3	126.2	129.5
7	103.9	105.9	108.3	111.0	112.8	114.4	115.9	117.6	120.0	121.9	126.4	130.0	131.6
8	109.1	110.5	113.7	116.3	118.0	119.6	120.8	122.3	123.5	125.7	132.2	134.8	137.2
9	115.3	117.0	118.8	121.3	122.4	123.9	125.4	127.0	129.9	132.6	136.6	141.7	142.6
10	120.0	121.4	122.5	126.0	127.8	128.9	130.9	132.2	133.3	135.7	140.3	145.3	149.9
11	121.5	122.2	127.0	130.3	132.6	135.5	136.6	138.7	139.9	142.3	146.4	149.9	152.8
12	126.7	128.0	130.9	134.6	136.1	138.6	140.9	142.6	145.5	150.0	155.0	159.3	161.6
13	131.0	135.5	137.5	140.6	144.3	146.9	148.8	151.5	153.7	156.7	160.6	163.5	165.9
14	140.0	140.9	145.0	150.5	152.9	155.3	156.8	158.7	160.8	163.0	166.3	169.4	171.8
15	145.8	148.5	153.0	154.8	156.8	158.4	160.2	161.7	163.3	164.7	167.4	170.7	172.2
16	148.5	150.5	153.5	156.9	158.8	160.5	162.7	164.0	165.9	167.7	169.9	172.1	172.7
17	149.9	153.0	156.0	157.8	159.8	161.4	163.4	164.5	165.9	168.1	170.9	174.5	175.3
18	152.4	154.0	157.1	158.8	160.5	162.4	164.4	165.2	167.0	168.6	171.7	174.9	175.9
19	153.1	155.0	158.2	160.6	161.7	163.0	164.4	166.0	168.0	169.3	172.0	175.4	176.5

Table 14: Percentiles of height for age of male

Table 15: Percentiles of height for age of female

Age	3 rd	5 th	10 th	20 th	30 th	40 th	50 th	60 th	70 th	80 th	90 th	95 th	97 th
5	93.1	95.0	98.5	101.1	103.0	104.9	106.0	107.8	109.8	112.4	116.8	121.6	123.3
6	98.3	100.0	102.5	105.6	107.3	109.9	111.1	113.5	114.7	115.9	119.2	123.1	124.7
7	103.9	104.5	107.2	110.0	111.8	113.6	114.9	117.0	118.4	121.0	124.4	128.5	131.7
8	108.1	110.4	112.2	115.5	117.5	119.0	120.2	121.8	123.5	125.9	129.2	132.8	136.5
9	114.0	115.9	118.5	121.8	123.5	125.0	126.7	129.0	130.7	133.2	136.7	141.0	142.6
10	116.7	119.9	122.5	125.3	127.5	128.5	130.2	132.4	135.0	138.0	141.4	144.8	146.9
11	122.0	124.1	126.8	130.0	133.1	135.2	138.0	140.1	142.3	145.2	148.0	150.8	152.9
12	128.9	130.3	132.0	136.2	138.9	141.9	143.5	145.1	147.5	149.6	153.2	155.7	156.7
13	136.1	138.0	140.1	142.7	145.5	146.7	147.7	149.2	150.8	152.3	154.1	155.7	157.3
14	141.0	142.0	143.8	146.0	147.9	149.2	151.0	152.6	154.4	155.8	158.8	160.3	161.4
15	141.5	142.8	144.5	146.9	149.0	150.4	151.7	152.8	154.6	156.3	159.6	160.5	161.8
16	142.5	143.3	145.4	148.1	149.5	150.5	151.9	153.7	154.9	156.8	159.9	160.7	162.2
17	144.5	143.5	145.7	148.2	149.8	151.1	152.2	154.0	155.7	156.9	160.5	161.5	162.9
18	148.5	143.7	145.8	148.3	149.9	151.4	152.3	154.3	156.5	158.3	161.1	163.1	164.2
19	156.5	144.1	146.0	148.5	150.0	151.7	154.0	155.4	157.2	159.4	161.9	163.3	164.9

Table 16: Percentiles of weight for age of male

Age	3 rd	5 th	10 th	20 th	30 th	40 th	50 th	60 th	70th	80 th	90 th	95 th	97 th
5	13.1	13.3	14.2	15.0	15.4	16.1	16.8	17.5	18.2	19.2	20.4	21.5	21.8
6	14.2	14.9	15.4	16.1	16.7	17.2	17.9	18.8	19.5	20.7	22.6	23.9	25.3
7	14.9	16.0	16.4	17.3	18.0	18.7	19.5	20.1	20.9	22.0	23.4	25.5	26.5
8	16.3	17.0	18.1	19.0	20.0	21.0	21.7	22.4	23.0	24.5	26.1	28.8	29.9
9	18.7	19.4	20.0	21.2	22.2	22.6	23.7	24.6	25.4	27.3	30.3	32.5	35.1
10	20.5	21.6	22.3	23.4	24.3	25.0	25.8	26.8	27.9	29.7	32.5	36.4	40.6
11	21.6	22.4	24.0	25.4	26.6	27.7	28.8	29.9	31.1	32.6	35.0	37.5	44.7
12	23.9	24.5	26.0	28.0	29.1	30.4	32.0	33.7	35.4	38.7	41.7	44.5	48.9
13	26.0	26.6	28.3	32.0	34.0	35.9	37.5	39.4	41.1	43.2	47.8	50.7	51.9
14	30.2	32.0	34.7	37.2	40.3	42.0	43.5	45.1	47.2	49.4	53.3	56.9	57.9

15	34.5	35.9	38.7	42.1	44.4	46.8	48.7	50.2	51.7	53.8	56.8	59.4	60.9
16	38.0	39.9	42.3	44.3	46.6	49.1	51.1	52.5	55.1	57.4	60.0	61.7	64.5
17	41.6	42.7	44.7	46.8	48.2	49.9	51.5	52.8	56.0	58.3	60.8	62.4	65.0
18	43.5	43.1	45.8	49.1	50.8	52.4	54.2	55.3	56.9	59.2	61.6	64.0	65.6
19	45.5	46.6	48.4	50.8	52.0	53.8	55.5	57.8	59.2	61.0	64.7	67.9	68.8

Table 17: Percentiles of weight for age of female

Age	3 rd	5 th	10 th	20 th	30 th	40 th	50 th	60 th	70 th	80 th	90 th	95 th	97 th
5	12.0	12.5	13.7	14.4	15.1	15.6	16.0	16.7	17.3	18.2	19.4	20.7	21.5
6	13.5	13.9	14.4	15.8	16.6	17.0	17.5	18.4	19.0	19.4	20.8	22.3	23.2
7	14.8	15.0	16.0	16.8	17.5	18.2	18.9	19.6	20.2	21.1	22.3	24.2	25.8
8	16.2	16.5	17.7	18.6	19.3	20.1	20.9	21.5	22.4	23.4	25.6	28.8	31.7
9	17.5	18.0	19.5	21.2	21.9	23.1	23.8	24.9	26.3	27.8	30.4	33.0	34.7
10	19.1	19.8	20.8	22.4	23.5	24.3	25.7	27.0	28.6	29.6	32.1	35.9	37.8
11	21.4	22.2	23.2	25.2	27.1	28.5	29.7	31.1	33.7	35.2	38.9	42.3	44.8
12	24.0	25.5	27.5	29.0	30.8	32.2	34.1	35.6	37.3	39.6	43.6	47.3	50.0
13	28.8	30.1	32.0	34.7	36.3	37.9	39.2	40.4	41.8	43.9	46.4	51.4	53.8
14	33.2	34.2	35.9	38.3	39.6	41.5	42.9	44.3	45.5	47.9	49.9	53.2	54.9
15	34.2	35.2	37.7	40.2	42.2	43.3	45.0	46.4	47.8	49.9	52.9	56.1	56.8
16	35.8	36.6	38.7	41.1	42.4	44.1	45.0	47.0	48.6	50.4	54.0	57.3	58.7
17	36.8	37.9	40.5	42.3	43.7	45.6	47.4	48.4	50.5	51.8	55.4	57.9	59.3
18	37.7	38.7	41.0	43.3	44.9	46.3	47.7	49.1	50.7	52.7	55.4	58.6	59.8
19	38.7	39.5	42.0	45.3	47.3	47.7	48.1	49.8	51.0	53.4	56.6	59.4	60.3

Table 18: Percentile of weight for height for male

Height	3 rd	5 th	10 th	20 th	30 th	40 th	50 th	60 th	70 th	80 th	90 th	95 th	97 th
in cm													
92	12.0	12.0	12.0	12.0	12.0	12.2	12.6	12.9	13.2	13.2	13.2	13.2	13.2
94	12.4	12.4	12.4	12.4	12.4	12.4	12.6	13.6	13.9	13.9	14.0	14.0	14.0
96	12.6	12.6	13.1	13.2	13.7	13.9	14.0	14.4	14.7	14.7	14.8	14.8	14.8
98	12.9	12.9	13.1	14.0	14.3	14.2	14.4	15.0	15.4	15.5	16.4	16.7	16.7
100	12.9	13.0	13.7	14.1	14.6	14.5	14.8	15.3	15.4	16.0	16.8	17.5	19.1
102	13.1	13.3	13.8	14.2	14.9	15.1	15.3	15.7	16.1	16.3	17.2	17.8	19.1
104	13.3	13.7	14.2	15.0	15.3	15.6	16.0	16.3	16.6	16.8	17.6	18.2	19.1
106	14.1	14.6	14.9	15.3	15.7	16.1	16.5	17.0	17.4	17.8	18.5	18.6	19.5
108	14.1	14.7	15.0	15.5	16.2	16.6	16.8	17.1	17.7	17.9	19.0	19.0	19.9
110	14.5	15.0	15.6	16.1	16.7	17.0	17.4	17.7	18.0	18.4	19.5	20.2	21.0
112	14.8	16.0	16.1	16.8	17.1	17.7	18.1	18.4	19.1	19.5	20.8	21.7	22.1
114	15.4	16.4	16.6	17.3	18.1	18.4	18.8	19.2	19.6	20.4	21.1	21.8	22.1
116	16.5	16.9	17.6	18.2	18.7	19.2	19.9	20.3	20.6	21.3	21.8	22.0	22.5
118	17.3	17.0	17.7	18.4	18.9	19.6	20.0	21.1	20.8	21.6	22.1	23.1	23.2
120	18.2	18.4	19.1	19.7	20.2	20.8	21.4	22.0	22.4	23.0	23.6	24.5	25.4
122	18.7	19.0	19.6	20.4	21.1	21.8	22.0	22.5	22.9	23.6	24.6	26.1	28.0
124	19.2	19.3	19.6	20.7	21.6	22.2	22.6	23.0	23.4	24.5	25.2	27.3	30.8
126	20.3	20.5	21.3	22.4	22.7	23.5	24.0	24.7	25.1	25.7	27.1	27.7	31.2
128	20.4	21.1	21.6	22.6	23.2	23.9	24.4	25.1	25.5	26.3	28.0	29.1	31.6
130	20.9	21.3	22.4	23.4	24.2	24.6	25.3	25.8	26.4	27.2	29.3	31.4	33.2
132	21.5	22.3	23.6	24.2	25.0	25.4	26.0	26.7	27.6	28.2	30.1	31.7	33.6
134	23.4	23.5	24.4	25.4	26.2	27.3	27.7	28.2	28.7	29.7	30.9	32.1	34.0

136	23.4	23.8	25.1	26.4	27.2	27.7	28.1	29.2	30.1	31.2	32.5	38.0	34.8
138	24.7	24.4	25.8	27.2	27.7	28.3	29.8	31.4	32.2	34.2	34.0	41.5	37.5
140	26.1	26.8	27.8	28.8	29.3	29.9	30.8	31.9	32.4	34.5	35.6	43.0	40.2
142	27.6	27.8	28.8	29.9	30.3	31.2	32.1	32.8	33.8	34.9	37.3	44.5	42.8
144	28.2	28.4	30.0	31.6	32.2	33.2	33.7	34.1	35.2	37.1	39.8	46.7	45.5
146	28.8	29.0	30.1	32.3	32.5	34.3	35.4	36.5	37.9	39.8	45.8	48.9	47.5
148	30.3	29.2	30.3	33.1	34.0	35.3	36.9	37.6	39.0	41.1	45.9	49.2	49.5
150	31.8	32.0	33.0	35.0	36.2	37.3	39.0	41.0	41.8	42.7	46.1	49.5	51.1
152	32.7	33.1	34.1	35.9	38.1	38.8	40.4	42.3	43.8	46.8	52.9	53.4	54.3
154	34.6	35.9	36.8	39.8	40.9	42.0	43.0	44.5	46.8	48.9	53.1	54.2	55.4
156	34.9	37.4	36.8	40.9	41.4	42.7	44.3	46.3	48.7	50.5	53.4	55.1	56.5
158	37.3	38.9	40.3	42.0	44.0	45.7	48.1	50.2	51.4	52.4	54.6	56.7	57.8
160	38.0	39.1	42.4	44.4	46.5	48.2	50.6	51.7	53.5	55.5	58.8	60.2	60.4
162	40.3	41.4	43.3	45.8	47.6	48.9	50.8	51.9	54.4	57.3	59.3	60.8	61.2
164	43.5	43.8	45.3	47.4	49.6	51.6	51.4	54.4	55.5	57.7	59.8	61.5	62.1
166	44.0	45.1	46.7	48.6	50.4	52.3	52.0	55.7	55.6	57.9	60.8	62.7	64.7
168	44.6	46.4	48.2	49.9	51.2	53.0	53.2	57.0	59.4	60.9	62.5	64.2	65.3
170	45.8	47.7	48.5	51.4	51.5	53.2	53.6	57.5	59.9	62.4	63.5	67.4	68.8
172	47.0	47.7	48.5	51.5	52.0	53.5	54.3	58.7	60.5	64.0	68.2	68.4	69.8
174	47.6	47.7	48.5	51.7	52.6	53.9	55.0	58.7	61.4	64.6	69.2	69.5	70.8
176	48.0	48.1	48.5	51.7	53.9	55.6	56.9	58.7	62.4	65.3	70.2	69.5	71.0
178	48.5	48.5	48.5	53.5	54.8	56.3	58.0	59.1	62.5	68.8	71.0	69.5	71.4
180	53.3	53.3	53.3	55.4	55.7	57.0	59.1	59.6	62.7	68.8	71.9	71.9	71.9

Table 19: Percentile of weight for height for female

Height	3 rd	5 th	10 th	20 th	30 th	40 th	50 th	60 th	70 th	80 th	90 th	95 th	97 th
in cm													
92	11.7	11.7	11.7	11.7	11.8	11.9	12.1	12.2	12.4	12.4	12.5	12.5	12.5
94	11.8	11.8	11.9	11.8	12.4	12.4	13.3	13.4	14.2	13.5	13.6	13.6	13.6
96	12.1	12.1	12.2	11.9	13.1	13.8	14.2	14.2	14.4	14.7	14.8	14.8	14.8
98	12.4	12.4	12.5	13.2	13.4	13.9	14.3	14.4	14.5	15.1	15.1	15.2	15.2
100	12.5	12.8	12.5	13.2	14.1	14.3	14.4	14.6	15.4	15.6	15.8	16.5	16.8
102	12.7	13.2	13.7	14.0	14.3	14.9	15.2	15.3	15.5	16.2	16.5	17.8	18.5
104	12.7	13.7	14.0	14.6	14.9	15.2	15.8	16.4	16.7	17.0	17.5	17.9	18.7
106	13.3	14.2	14.4	15.0	15.4	15.8	16.3	16.5	16.9	17.5	18.6	19.2	19.7
108	14.1	14.3	14.8	15.4	15.8	16.3	16.7	17.1	17.4	17.9	19.0	19.6	19.9
110	14.4	14.8	15.5	16.0	16.4	16.8	17.2	17.8	18.1	19.0	19.5	20.1	20.2
112	15.0	15.4	15.9	16.8	17.0	17.4	17.9	18.2	18.6	19.1	19.8	20.1	21.1
114	15.9	16.0	16.4	17.1	17.4	18.0	18.5	18.8	19.4	20.5	20.9	21.5	22.0
116	16.4	16.7	17.7	18.2	18.7	19.0	19.4	19.6	19.9	20.5	21.7	22.5	23.5
118	16.4	17.0	17.7	18.2	18.8	19.1	19.5	20.2	20.6	21.1	22.4	23.1	24.0
120	17.1	17.4	17.7	19.0	18.9	19.8	20.1	20.6	21.2	21.9	23.3	23.7	24.5
122	18.4	18.7	19.0	19.8	20.4	20.8	21.1	21.5	22.3	22.9	25.0	26.7	27.2
124	18.6	19.2	19.7	20.9	21.4	21.8	22.1	22.8	23.5	24.6	26.0	26.7	28.4
126	19.5	20.0	20.5	21.1	21.8	22.5	22.9	23.5	24.3	25.0	26.5	28.3	29.6
128	20.0	20.8	21.5	22.3	22.9	23.5	23.9	24.4	25.5	26.5	28.6	30.4	31.7
130	20.4	21.7	22.1	22.9	23.7	24.1	24.9	25.9	26.5	27.9	28.9	32.1	32.5
132	21.5	22.7	23.4	24.5	25.1	25.5	26.1	26.9	27.7	28.5	30.4	33.8	33.8
134	22.2	23.6	24.6	25.6	26.2	27.2	28.0	28.5	28.9	29.8	32.6	34.6	35.1

136	23.5	23.7	25.8	26.9	27.9	28.5	29.2	29.7	30.8	31.8	33.9	35.4	37.4
138	23.8	24.6	27.1	27.8	28.7	29.3	29.8	30.1	31.4	34.0	37.9	44.3	47.0
140	25.2	25.8	27.4	28.6	29.7	30.8	32.0	33.2	36.4	39.7	45.5	47.7	49.1
142	26.7	27.4	29.0	31.1	32.7	34.5	35.4	36.8	38.2	41.0	46.0	48.0	49.7
144	29.0	30.1	31.8	34.0	35.5	36.6	37.8	39.5	42.0	43.9	46.6	48.3	50.3
146	30.1	31.2	32.4	34.9	37.2	39.0	40.2	41.8	43.2	45.0	47.3	49.1	52.2
148	30.9	32.1	34.7	36.2	38.2	40.1	41.6	43.0	44.6	46.8	48.7	50.4	52.8
150	33.6	34.3	35.9	38.7	41.2	43.1	44.6	45.4	46.9	48.6	51.8	55.4	56.6
152	35.4	36.3	38.5	40.5	41.8	43.7	44.8	46.6	48.5	50.2	53.0	55.9	58.1
154	36.2	37.3	38.5	40.6	42.4	44.1	46.0	47.8	48.9	51.2	53.7	56.1	58.4
156	37.0	38.3	40.4	42.3	43.8	45.3	46.5	48.3	49.9	52.2	54.4	57.0	58.8
158	37.4	38.3	42.4	44.0	45.3	46.6	48.5	49.8	51.4	53.0	55.2	57.9	59.3
160	38.0	40.0	43.1	44.2	46.2	47.6	49.4	52.1	53.9	55.6	56.8	58.2	59.4
162	40.3	40.6	43.8	45.1	47.2	49.1	50.5	52.6	53.9	56.4	56.8	58.8	59.5
164	42.5	42.5	43.9	46.3	47.6	49.5	52.1	53.1	54.0	57.3	56.9	59.4	59.7
166	43.1	43.1	44.1	47.1	47.9	49.8	53.5	54.2	55.2	58.3	59.2	59.8	59.8
168	47.6	47.6	48.1	49.6	50.0	50.5	55.0	55.4	56.5	59.0	59.9	59.9	59.9
170	52.2	52.2	52.2	52.2	52.2	54.3	57.6	57.7	58.2	59.5	59.9	59.9	59.9
172	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0