ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL SCIENCES

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Body Mass Index and Growth Spurt in Teenage School Children of Addis Ababa - the case of Government schools

MSc Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Biology

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Acronyms

BMI = Body Mass Index

CDC = Center for Disease Control and Prevention

ECOG = European Childhood Obesity Group

GH = Growth Hormone

IGFI = Insulin- like Growth Factor I

NIH = National Institute of Health

WHO = World Health Organization

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Abstract

The objective of this study was to assess variation in mean body weight, height and BMI between age and sex cohorts of school teenage children in two government schools of Addis Ababa in grades 7 to 10 (age 13-17 years). A total of 178 male and 179 female students were recruited from the two schools for the study. Recruitment was conducted randomly and only consenting participants who were willing for the body height and weight measurements were included. The results showed that females were on the average taller than males for 13 years old while males were taller for the remaining age groups. In the combined data of males and females, mean height ranged between 1.32m and 1.79m. The highest height increment for females was 2.7% (13 to 14 years) and 4.79% for males (again 13 to 14 years). Females had higher mean weight for 13 and 14 years old but males were heavier for the rest of the age groups. The mean weight range for the combined data was 28.2kg – 67.7kg. The highest body weight increment was 6.8% in females of 13-14 year and 14-15 year categories while those of males was 13.23% (13-14 years). The BMI range was 18.64 kg/m^2 - 20.38 kg/m^2 (females) and 17.61 kg/m^2 – 18.82kg/m^2 (males). All age groups of both males and females were within the Normal weight category. Compared to similar studies, the students in the current study were shorter and lighter than those from a private school while they had a comparable height and weight with students from a rural governmental schools.

Key Words: Body Mass Index, Growth Spurt, Weight, Height, Addis Ababa, Government school

1. Introduction

Body Mass Index (BMI) was published for the first time in 1972 by Ancel Keys, which found the BMI to be the best proxy for body fat percentage among ratios of weight and height. Body Mass Index (BMI) is an anthropometric index of weight and height that is defined as body weight in kilograms divided by height in meters squared (Kg/m^2) (Keys *et al*., 1972). Body mass index (BMI) is a screening tool used to identify individuals who are underweight or overweight (Barlow and Dietz, 1998). It is widely used internationally for assessing health risks. Any adult individual with a BMI lower than 25 but higher than 18.5 is considered to have a "healthy body mass index". Values lower than 18.5 are considered underweight, 25 to 29.9 are considered overweight, and those with a BMI in excess of 30 are considered obese (Health Canada, 2003).

There are many health problems and risk factors associated with being either underweight or overweight. Being underweight may be an indication of an underlying illness or an eating disorder. It may also cause osteoporosis and infertility. Being overweight or obese has several health risks, including Type 2 diabetes, hypertension, cardiovascular disease, some types of cancer, osteoarthritis, gallbladder disease, functional limitations, and impaired fertility(Health Canada, 2003).Nutritional status in children is assessed on the basis of body composition and growth parameters. Under-nutrition and obesity are defined as a deficit or excess of body fat respectively(Rolland, 2011). Description of BMI and other anthropometric measurements were previously developed by European Childhood Obesity Group (ECOG) book (Garrow, 1981). In Ethiopia there is no adequate recorded data about the measurement of BMI as indicator of health and growth spurt in teenage school children. As a result, there are no sufficient resources to use as references for this research. Therefore, this research is one of the few that

addressed BMI and growth spurt of teenagers in Addis Ababa based on two governmental schools. The study is also intended to provide a baseline data for future Studies.

2. Objectives of the Study

2.1. General objective

To assess variation in mean body weight, height and BMI between age and sex cohorts of school teenage children in two governmental schools of Addis Ababa in grades 7 to 10.

2.2. Specific objectives

The specific objectives were to:

- determine the rate of chronological increase in mean body height, weight and BMI.
- determine sex-specific chronological variation in mean height, weight and BMI.
- compare the age and sex-specific mean body weight, height and BMI of governmental school teenage children with that of private and rural schools.

3. Literature review

3.1. Historical background of BMI

In 1972, a researcher by the name of Ancel Keys coined the term "Body Mass Index" in a paper he published entitled Indices of Relative Weight and Obesity (Keys et al., 1972). In the study, he looked at about 7400 men from five different countries, and analyzed their adiposity body density and subcutaneous fat thickness using a weight to height index devised by Adolph Quetelet back in 1832 called the "Quetelet Index". Keys keep up with the body mass index as a straightforward way to measure body weight in relation to height. As people became more overweight and health associated with overweight became clearer, epidemiologists across the world began using Key's BMI as a way to track disease risk factors in the general population. In 1985, the National Institute of Health (NIH) started using BMI to define obesity in the United States. At first, the thresholds were more conservative, but by 1998 the NIH started using the aforementioned easier categories we know today to encompass all ages, both sexes and every culture. The NIH set that standard in 1998 (Komaroff, 2016).

3.2. The uses of BMI

As the United States continues to search for answers to the growing problem of obesity among children and adolescents, much attention has focused on BMI measurement programs in schools. The BMI is the ratio of weight to height squared (Kg/m^2). It is often used to assess weight status because it is relatively easy to measure and it correlates with body fat. Body mass index measurement programs in schools may be conducted for surveillance and screening purposes. Body mass index surveillance programs assess the weight status of a specific population (e.g., students in an individual school, school district, or state) to identify the percentage of students

who are potentially at risk for weight related health problems. Body mass index screening programs assess the weight status of individual students to identify those at risk and provide parents with information to help them take appropriate action (Nihiser *et* al., 2007).

3.3. Growth at puberty

Puberty is a dynamic period of development marked by rapid changes in body size, shape, and composition, all of which are sexually dimorphic. One of the hallmarks of puberty is the adolescent growth spurt. Body compositional changes, including the regional distribution of body fat are especially large during the pubertal transition and markedly sexually dimorphic. The hormonal regulation of the growth spurt and the alterations in body composition depend on the release of the gonadotropins, leptins, the sex-steroids and growth hormone. It is very likely the alterations in body composition and the regional distribution of body fat actually are signals to alter the neuroendocrine and peripheral hormone axes. These processes are magnified during pubertal development but likely are pivotal all along the way from fetal growth to the aging process (Alan *et* al., 2002). All of the events of puberty can be ascribed to pulsatile gonadotropin-releasing hormone stimulation causing pulsatile gonadotropin stimulation of sex steroids. The sex steroids explain the development of the pubertal characteristics: the fact that girls have an earlier growth spurt than boys is explained by the differential effects of estradiol and testosterone on hypothalamic control of pituitary growth hormone secretion (Brook, 1999). In puberty the growth spurt and the appearance of secondary sexual characteristics occur together with an increase of sex steroids, Growth Hormone (GH) and Insulin-like Growth Factor I (IGFI) (Caufriez, 1997).

3.4. Factors Influencing Somatic Growth

Somatic growth and maturation are influenced by a number of factors that act independently or in concert to modify an individual's genetic potential. These may be broadly defined as nutritional, genetic, and hormonal (Alan *et* al., 2002).

Nutrition, including energy and specific nutrient intake is a major determinant of growth. Under nutrition is the single most important cause of growth retardation worldwide, although in the United States the causes are typically self-induced food restriction or systemic disease, rather than poverty-related. In addition to effects on overall growth, malnutrition secondary to avoidance of certain foods or mal-absorption can lead to serious disorders such as osteopenia anemia, and syndromes related to deficiencies of vitamins, minerals, essential fatty acids and amino acids, and trace elements. Under-nutrition affects the most vital growth first and most intensely. Growth and development of muscle are affected more than bones, which in turn are influenced to a greater degree than teeth. Brain cell hyperplasia is affected more than myelination, and during puberty vital tissues and organs are affected to a greater degree than the gonads (Sinclair, 1978). Nutritional status also has a significant modulating effect on the timing of adolescent sexual development. Under-nutrition is associated with later age of menarche and secondary amenorrhea, where a moderate degree of obesity is associated with early sexual maturation (Epstein *et* al., 1985; Forbes, 1987).

There is also evidence that not all genes are actively expressed at the time of birth. This likely account for the observation that the correlation between the size of the parents and child is weak during the first year of life (Tanner, 1989).Growth in a number of dimensions shows a significant familial resemblance. Adult stature, tempo of growth, timing and rate of sexual development,

skeletal maturation, and dental development are all significantly influenced by genetic factors (Sinclair, 1978).The overall contribution of heredity to adult size and shape varies with environmental circumstances, and the two continuously interact throughout the entire period of growth. Children with similar genotypes, who would reach the same adult height under optimal conditions, may be affected by adverse circumstances (Tanner *et* al., 1994).

Adequate levels of several hormones are essential to normal growth and development, although deficiencies of these are much less common causes of growth disturbances than genetic factors and nutrition. Prepubertally, GH and thyroid hormone are the primary hormones essential to growth. Growth hormone promotes the synthesis of protein, inhibits the formation of fat and carbohydrates, and is necessary for the proliferation of cartilage cells at the epiphyseal plate permitting linear growth. Thyroid hormone is essential to normal growth and development of the central nervous system and works in combination with GH to promote cartilage and bone formation. In addition, Insulin plays an important role in the regulation of growth through the supply of metabolic substrate to cells and interaction with other growth factors to influence fetal growth. Rarely, excess levels of certain hormones such as cortisol (e.g., in Cushing disease or syndrome, or high doses of exogenous glucocorticoids) can result in growth failure. Although hormones exert independent effects during puberty, the interaction of gonadal and adrenal steroid hormones with growth hormone becomes essential for the normal adolescent growth spurt and sexual maturation (Roemmich *et* al., 1997).

The normal functioning of the epiphyseal growth plate is an important clinical aspect of growth. Much of the physiology of the epiphyseal growth plate in response to exercise includes the important mechanical components. Growth hormones, insulin- like growth factor I, estrogen, androgen, vitamin D, and leptin are seen as key physiological factors while there is a need for

children to participate in physical activity. Mechanical loading of the bone is important for epiphyseal plate physiology. Exercise has a health function on the normal growth of this important biomechanical feature. Clinically, over exertion in the form of increased bearing on the epiphyseal growth plate creates an injury (Timothy *et* al., 2011)

3.5. Racial Variation in Growth Rate

The mean heights of different races all over the world differ. Growth in height is dependent on the genes of the parents. Asians do not grow as tall as the Europeans (James, 2018).The review of worldwide variation in preadolescent and adolescent growth indicates that some differences in achieved linear growth exists across a broad group of human populations that could be considered healthy. However, these patterns are not uniform across all ages. The average linear growth up to the onset of puberty is similar across populations that experience favorable growing environments. Potential population differences in the initiation and progression of puberty may account for the large differences seen in achieved height during and after puberty. The large differences between the heights of healthy young adults in Japan and Northern Europe compared with heights in the rest of the world's populations suggest very different growth patterns during puberty and the possibility that unique environments and genetic factors may account for these growth differences (Haas and Campirano, 2006).Difference in size and shape between children of different populations have the same causes, the two populations may reach an average identical adult size but, the children of one population may be larger than those of the other simply because they have a faster speed of growth , enter puberty earlier, and cease growing earlier. Differences in speed of growth are subject to both genetic and environmental influences. One of the first effects of an environmental challenge is malnutrition slowing down the overall rate of growth. Children store fat during the first year, when famine, infection, and maladaptive

cultural custom hit them they both use this fat for fuel and slow down their growth. In starvation the somatomedin level in the blood drops and the growth hormone level rise. The first diminishes bone growth; the second causes fat catabolism. The fall of somatomedin is responsible for the rise in growth hormone. When conditions improve the catch-up phenomenon occurs. The previously starved children grow faster than well-nourished ones. Japanese born and reared in California grew to be taller than Japanese in Japan. Since environmental and social conditions in Japan have changed rapidly and present-day Japanese children are as large in Tokyo as in Los Angeles. Even in size, genetic differences exist between Asians (Chinese, Japanese, and Indo-Malays) and Europeans. No such differences exist between Europeans and Africans. African-descended groups living under identical conditions to European-descended ones, show that the children of African origin are as tall as or taller than present day British children. The boys closely resemble London boys throughout their growth. The girls are a little taller but they have a faster speed, with menarche on average at 12.5 years as opposed to 13.0 in London. In adulthood the average stature is practically the same (Tanner, 1976).

3.6. Period of Growth

Growth plates are the joints which facilitate growth and are located in both the wrists and the knees. Growth takes place through the growth plates. The lower body stops growing in height before the upper body because it has solid bones which do not allow growth once fused. Whereas the upper part of the body is formed of cartilages and bones so the growth stops later. There is no exact age at which human beings stop growing in height. But in case of women once they attain puberty between ages 15 and 16, they do not grow any more. In case of men they hardly grow in height after attaining 20 to 22 years. Human beings are known to grow in height right from birth to around 20 to 22 years. Although growth of human beings is dependent on many

factors like genes, weather conditions, food and health conditions, biologically men grow taller than women. There are certain reasons for the difference in height. Women stop growing in height after 15 to 16 years because after puberty the long bones stop growing in height due to closing of epiphyseal plates. Although endocrine glands have functions in respect of determining height of human beings, sometimes over-secretion or under-secretion of hormones can lead to gigantism or dwarfism (James, 2018).

4. Materials and Methods

4.1. Study Area and period

The study was conducted in Ewketlefre Secondary School and Addis Hiwot Elementary School in Addis Ababa kolfe Keranyo Sub City Woreda 5 around Zenebework. In Ewketlefre Secondary School, the students' weight and height were measured in biology laboratory class, whereas in Addis Hiwot Elementary School, the students' weight and height were measured in the sport field. Measurements of height and weight were completed within 5 days in May 2018.

4.2. Sample Size of the Study

A total of 178 male and 179 female students were recruited from the two governmental schools of Addis Ababa for the study (Table 1). Recruitment was conducted randomly for each age category (13-17 years) and only consenting participants who were willing for the body height and weight measurements were included.

Table 1 The total number of participants from the two schools

Age	**Addis Hiwot Elementary School**		**EwketLefre Secondary School**		**Total**
	M	**F**	**M**	**F**	
13	20	8	-	-	28
14	33	30	-	2	65
15	19	34	10	9	72
16	23	16	35	35	109
17	3	9	35	36	83
Total	**98**	**97**	**80**	**82**	**357**

4.3. Data Collection Procedures and Instrument

Personal scale model -2003B measuring capacity 150Kgs weight and Tape Meter which can measure 3 meters length were used to measure the students' weight and height in barefoot and light clothing (Fig. 1). During data collection, the students' sex, age, height, weight, and grade were recorded and the measurements were performed with the help of biology and sport teachers.

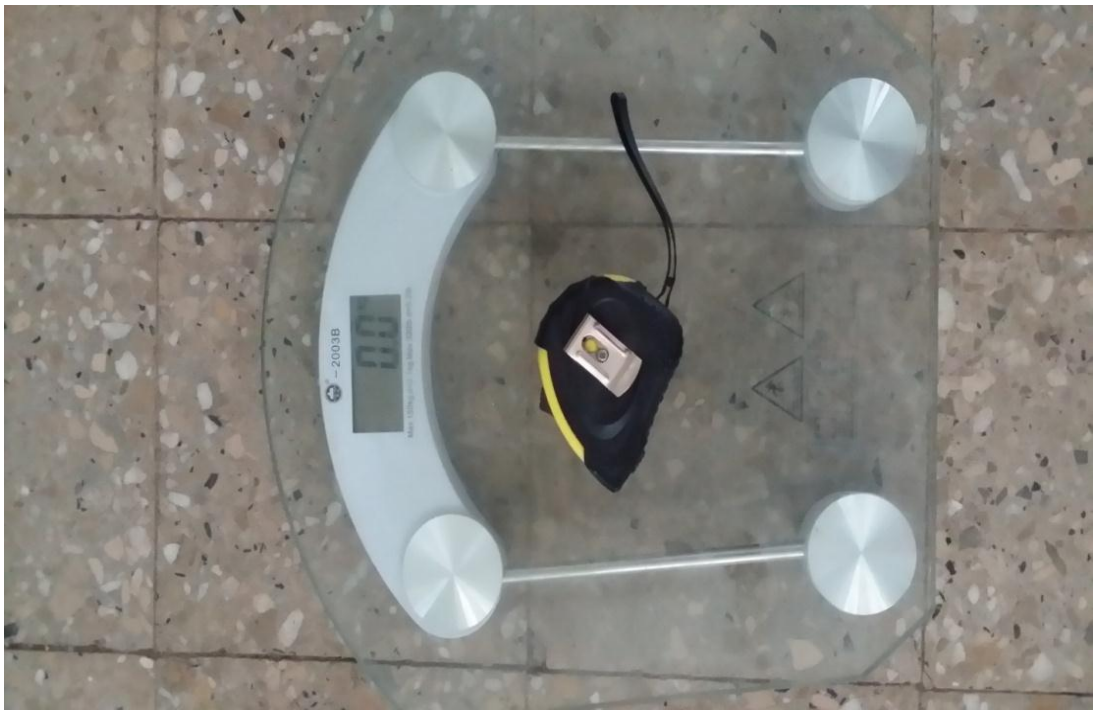

Figure 1 Personal weight scale and tape meter (mounted) used for measurements of body weight and height

Note: This personal weight scale is not sensitive to measure very light materials like Tape meter mounted on it which is shown on the figure above.

4.4. Method of Data Analysis

Microsoft Excel Program 2010 was used to calculate mean height, mean weight, mean BMI and standard deviation (SD). Percentage increments of height, weight and BMI between consecutive age groups were statistically compared using Chi-square test. Comparison between males and females for the three variables were done using independent samples t-test while One way ANOVA was used to compare height and weight between the present study and those from Rural and Private schools. The 95% confidence interval was used to determine level of significance. The statistical analysis was conducted on the SPSS statistical software ver. 17.

Body mass index values were categorized as underweight, normal, overweight and obese based on age-specific percentile growth charts developed by Centers for Diseases Control (CDC) in the USA. Based on the percentile growth chart, BMI greater than 95^{th} percentile is considered to be obese, BMI greater than 85^{th} percentile but less than 95^{th} percentile is considered to be overweight, BMI greater than 5^{th} percentile but less than 85^{th} percentile was considered to be normal, BMI less than 5^{th} percentile was considered to be underweight.

5. Results

5.1. Height

Females were slightly taller than males among 13 years old. However, this was changed for the remaining age groups where males were taller. The overall height range for females was 1.38m (14 years) -1.7m (15 and 17 years). The height range for males was 1.32 (13 years) – 1.79 (16 and 17 years) (Table 2).

Table 2 Mean height (m) and height ranges (for combined sexes, females and males)

Age	Combined	Females	Males
13	1.47 (1.32- 1.58)	1.48 (1.46-1.58)	1.46 (1.32-1.58)
14	1.52 (1.37-1.64)	1.52 (1.38-1.61)	1.53 (1.37-1.64)
15	1.56(1.44-1.73)	1.53 (1.44-1.70)	1.60 (1.44-1.73)
16	1.59 (1.43-1.79)	1.54 (1.43-1.68)	1.64 (1.50-1.79)
17	1.61 (1.45-1.79)	1.57 (1.45-1.70)	1.66 (1.52-1.79)

The highest percentage increment between consecutive age groups in females was 2.7% (13-14 years) and the lowest was 0.65% (15-16 years). The difference in height increment was not statistically significant (p=0.736) (Table 3)

Table 3 Percentage increase in height for consecutive age groups of females

Age groups	Mean height with SD (m)	Height percentage increase between consecutive age groups in females
13	1.48 ± 0.04	Between 13 and 14 =2.7%
14	1.52 ± 0.05	Between 14 and 15 =0.66%
15	1.53 ± 0.06	Between 15 and 16 =0.65%
16	1.54 ± 0.06	Between 16 and 17 = 1.95%
17	1.57 ± 0.06	

For males too, the highest percentage increment was highest for 13-14 years (4.79%) followed by 14-15 years (4.58%). The lowest increment was 1.22% for 16-17 years. The difference was statistically insignificant (p=0.51) (Table 4)

Table 4 Percentage increase in height for consecutive age groups of males

Age groups	Mean height with SD	Height percentage increase between consecutive age groups in males
13	1.46 ± 0.06	Between 13 and 14 = 4.79%
14	1.53 ± 0.06	Between 14 and 15 = 4.58%
15	1.60 ± 0.07	Between 15 and 16 = 2.5%
16	1.64 ± 0.06	Between 16 and 17 = 1.22%
17	1.66 ± 0.05	

For the combined mean also, the highest percentage increment was for 13-14 years (3.4%) and the lowest for 16-17 years (1.26%). The difference in percentage increment was not statistically significant (p=0.736) (Table 5).

Table 5 Percentage increase in height for consecutive age groups of the combined data

Age groups	Combined mean height with SD	Combined mean height percentage increase between each consecutive age groups
13	1.47 ±0.06	Between 13 and 14 = 3.40%
14	1.52 ±0.06	Between 14 and 15 = 2.63%
15	1.56 ±0.07	Between 15 and 16 =1.92%
16	1.59 ±0.08	Between 16 and 17 =1.26%
17	1.61 ±0.07	

The highest percentage difference in mean height between males and females was obtained for 16 years (6.49%) and followed by 17 years (5.73%). The lowest difference was 0.66% in age group of 14 years (Table 6). The difference was not statistically significant (p=0.121) (Table 6).

Table 6. The percentage difference in mean height between males and females

Age	Females mean height (m)	Males mean height (m)	Percentage difference in mean height between males and females (numbers in absolute value)
13	1.48	1.46	1.37%
14	1.52	1.53	0.66%
15	1.53	1.6	4.58%
16	1.54	1.64	6.49%
17	1.57	1.66	5.73%

5.2. Weight

The mean weight of females was higher than males for 13 and 14 years old. For age groups 15-17 years, males had higher mean body weight. The lowest weight for females was 30.6kg (14 years) and the highest was 67.7kg (17 years). The lowest weight for males was 28.2kg observed in 14 years old. The highest weight for males was 65.6Kg observed in 15 years (Table 7).

Table 7. Mean weight (Kg) and weight ranges (combined sexes, females and males)

Age	Combined	Females	Males
13	38.8 (29.6 - 49)	41.2 (37.8 -45.7)	37.8 (29.6 - 49)
14	43.4 (28.2 - 60.4)	44 (30.6 - 59.3)	42.8 (28.2 -60.4)
15	47.4 (38.3 - 65.6)	47 (38.3 - 59.4)	48 (39.2 - 65 .6)
16	48.5 (37 - 62.5)	47.2 (37 -60.4)	49.7 (38- 62.5)
17	51 (37.7 - 67.7)	50.1 (37.7 - 67.7)	52 (43.2 - 63.6)

The highest percentage increment of weight for consecutive age groups in females was recorded for 14-15 years (6.82%) and followed by13-14 years (6.80%). The lowest percentage increment was observed for 15-16 years old (0.43%).The difference in percentage increment for females was statistically insignificant (p=0.60) (Table 8).

Table 8. Mean weight with SD and weight percentage increase in females

Age groups	**Mean Weight with SD**	**Weight percentage increase between consecutive age groups in females**
13	41.2 ± 2.87	Between 13 and 14 = 6.80%
14	44 ± 7.53	Between 14 and 15 = 6.82%
15	47 ± 5.28	Between 15 and 16 = 0.43%
16	47.2 ± 5.61	Between 16 and 17 = 6.14%
17	50.1 ± 7.19	

In males, the highest percentage increase in weight was 13.23% (13-14 years) followed by 12.15% (14-15 years). The lowest increment was observed for 15-16 years (3.54%). The overall difference was statistically insignificant (p=0.108) (Table 9).

Table 9. Mean weight with SD and weight percentage increase in males

Age groups	Mean weight with SD	Mean weight percentage increase between consecutive age groups in males
13	37.8 ± 4.91	Between 13 and 14 = 13.23%
14	42.8 ± 7.44	Between 14 and 15 =12.15%
15	48 ± 5.76	Between 15 and 16 = 3.54%
16	49.7 ± 5.79	Between 16 and 17 = 4.63%
17	52 ± 6.06	

For the combined mean weight, the highest increment was between 13-14 years (11.8%) followed by 14-15 years (9.22%) while the lowest was 2.32% (15-16 years). The variation in increment was statistically significant (p=0.046) (Table 10).

Table 10. Combined mean weight with SD and weight percentage increase

Age groups	Combined mean weight with SD	Combined percentage increase in each consecutive age group
13	38.8± 4.64	Between 13 and 14 = 11.86%
14	43.4± 7.45	Between 14 and 15 = 9.22%
15	47.4± 5.46	Between 15 and 16 = 2.32%
16	48.5± 5.81	Between 16 and 17 = 5.15%
17	51± 6.73	

The highest percentage difference of mean body weight between males and females was 8.99% (13 years old). The lowest difference was observed among 15 years old (2.13%) and 14 years old (2.81%) respectively. The difference was statistically insignificant (p=0.647) (Table 11).

Table 11. The percentage difference in mean body weight between males and females of the same age

Age	Females mean body weight (kg)	Males mean body weight	Percentage difference in mean body weight between males and females
13	41.2	37.8	8.99%
14	44	42.8	2.80%
15	47	48	2.13%
16	47.2	49.7	5.30%
17	50.1	52	3.79%

5.3. Body mass index (BMI)

The mean BMI for females ranged from 18.64 to 20.38 and all age groups fall under normal weight category (Table 12).

Table 12. Mean BMI (Kg/m^2) with SD and weight categories in females

Age	Mean BMI with SD in Females	Weight category
13	18.64 ± 1.22	Normal
14	19.07 ± 3.28	Normal
15	20.11 ± 2.24	Normal
16	19.93 ± 2.36	Normal
17	20.38 ± 2.99	Normal

In male students, BMI ranged between 17.61 and 18.82. Similar to females, all of the age categories of males were categorized under the normal weight (Table 13).

Table 13. Mean BMI (Kg/m^2) with SD and Status of BMI in males

Age	Mean BMI with SD in Males	Status of BMI
13	17.61 ± 2.38	Normal
14	18.22 ± 2.74	Normal
15	18.6 ± 1.59	Normal
16	18.32 ± 1.79	Normal
17	18.82 ± 1.76	Normal

Female students had higher BMI than males for all age groups. The highest percentage difference between males and females was recorded among 15 - 17 years old (8.12% - 8.79%) while the lowest was among 14 years old (4.67%). The difference in mean BMI between males and females was statistically insignificant (p=0.054) (Table 14).

Table 14. The percentage difference in mean BMI between males and females

Age	Females	Males	Percentage difference in mean BMI between males and females
13	18.64	17.61	5.85%
14	19.07	18.22	4.67%
15	20.11	18.6	8.12%
16	19.93	18.32	8.79%
17	20.38	18.82	8.29%

5.4. Comparison with similar studies

The mean height of females was compared with similar studies conducted at a private school in Addis Ababa and a governmental school in rural part of Debere Birhan (Table 15). Students from private school seemed to appear slightly taller than governmental and rural schools. The mean difference in height between the three studies was not statistically significant (p=0.717) (Table 15).

Table 15. Comparison of females' Mean height between Governmental, Rural and Private

Age	Governmental Schools females mean height with SD (Present study, n=179)	Rural Schools females Mean height with SD n=190	Private Schools females mean height with SD n=249
13	1.48±0.04	1.49 ± 0.05	1.50±0.07
14	1.52±0.05	1.51 ± 0.07	1.52±0.06
15	1.53±0.06	1.52 ± 0.05	1.54±0.07
16	1.54±0.06	1.54 ± 0.05	1.56±0.06
17	1.57±0.06	1.55 ± 0.04	1.59±0.7

The mean height of males is compared with similar studies. Students from private school in Addis Ababa were slightly taller than Governmental and Rural schools. The difference in mean height between the three studies was statistically insignificant (p=0.954) (Table 16).

Table 16. Comparisons of males' mean height between Governmental, Rural and Private Schools

Age	Governmental Schools males mean height with SD (Preset study, n=178)	Rural Schools males mean height with SD, n=175	Private Schools males mean height with SD, n=228
13	1.46 ± 0.06	1.5 ± 0.08	1.5 ± 0.09
14	1.53 ± 0.06	1.53 ± 0.06	1.56 ± 0.09
15	1.6 ± 0.07	1.59 ± 0.09	1.61 ± 0.09
16	1.64 ± 0.06	1.61 ± 0.11	1.65 ± 0.09
17	1.66 ± 0.05	1.65 ± 0.04	1.69 ± 0.08

Females from the private school had higher mean body weight than the other two schools. This difference was statistically significant (p=0.001) (Table 17).

Table 17. Comparisons of females' mean weight between Governmental, Rural and Private Schools

Age	Governmental Schools females mean weight with SD	Rural Schools females mean weight with SD	Private Schools females mean weight with SD
13	41.2 ± 2.87	40.71±5.9	51.11 ± 8.58
14	44 ± 7.53	45.95±6.49	58.11 ± 10.15
15	47 ± 5.28	48.32±5.48	62.07 ± 9.62
16	47.2 ± 5.61	49.29±5.49	66.8 ± 10.7
17	50.1 ± 7.19	54.43±5.18	71.07 ± 9.30

Similar to females, male students from private school had higher mean body weight for each age group than the other two schools and this difference was statistically significant (p=0.003) (Table 18).

Table 18. Comparison of males' mean weight between Governmental, Rural and Private Schools

Age	Governmental Schools males mean weight with SD	Rural Schools males mean weight with SD	Private Schools males mean weight with SD
13	37.8 ± 4.91	40.14±5.6	49.81 ± 10.05
14	42.8 ± 7.44	43.09±4.99	58.73 ± 10.33
15	48 ± 5.76	46.77±6.36	67.28 ± 11.76
16	49.7 ± 5.79	50.02±5.94	73.65 ± 7.36
17	52 ± 6.06	54.2±5.86	77.98 ± 3.89

All of the females from the current study and the rural school at Debere Birhan are within the Normal body weight range while those from the private school were all Overweight (Table 19).

Table 19. Comparison of females' Mean BMI between Governmental, Rural and Private Schools

Age	Governmental Schools females mean BMI with SD (Present study)	Rural Schools females mean BMI with SD	Private Schools females mean BMI with SD
13	18.64 ± 1.22 (Normal)	18.15±1.81 (Normal)	23 ± 2.88 (Overweight)
14	19.07 ± 3.28 (Normal)	20.12±2.37 (Normal)	25 ± 3.74 (Overweight)
15	20.11 ± 2.24 (Normal)	19.79±2.31 (Normal)	26.21 ± 3.92 (Overweight)
16	19.93 ± 2.36 (Normal)	20.7±1.99 (Normal)	27.25 ± 4.30 (Overweight)
17	20.38 ± 2.99 (Normal)	22.59±2.26 (Normal)	28.5 ± 3.18 (Overweight)

Similar to females, males from the current study and the rural school at Debere Birhan are within the Normal body weight range while those from the private school were all Overweight except 13 age groups of males (Table 20).

Table 20. Comparison of males' Mean BMI between Governmental, Rural and Private Schools

Age	Governmental Schools males mean BMI with SD	Rural Schools males mean BMI with SD	Private Schools males mean BMI with SD
13	17.61 ± 2.38 (Normal)	17.97 ± 1.51 (Normal)	22 ± 3.49 (Normal)
14	18.22±2.74 (Normal)	18.28 ±1.64 (Normal)	24 ± 3.60 (Overweight)
15	18.6 ± 1.59 (Normal)	18.08±1.85 (Normal)	25.79 ± 3.64 (Overweight)
16	18.32 ± 1.79 (Normal)	18.55±1.75 (Normal)	27.14 ± 2.84 (Overweight)
17	18.82 ± 1.76 (Normal)	19.70±1.61 (Normal)	27.30 ±1.86 (Overweight)

6. Discussion

The present study assessed variation in mean body weight, height, and BMI of school teenage children (13-17 years) in two Government schools of Addis Ababa.

The results revealed that females were slightly taller than males among 13 years old. The possible reason is girls start puberty about 1 to 2 years earlier than boys, and they generally finish more quickly (Nordqvist, 2016). Similar study was conducted in Northern Ethiopia that the mean height of boys was shorter than girls in 13 age groups (Melaku *et al*., 2015). However, this was changed for the remaining age groups where males were taller because of the late growth spurt actually helps boys to grow more taller and stronger than girls who have their growth spurt at an early stage. By delaying the onset of growth, nature actually raises the base height over which the growth would occur (Vamsee, 2013). The highest percentage increment between consecutive age groups in females was 2.7% (13-14 years). This might be due to the fact that girls reach adult height within 4 years after the first physical signs of puberty and their puberty can span from the age of 9 to 14 years (Nordqvist, 2016). And the lowest was 0.65% (15-16years). The possible reason is once females attain puberty between ages 15 and 16, they do not grow any more (James, 2018). For males too, the highest percentage increment was between 13 and 14 years (4.79%) followed by 14-15 years (4.58%) due to boys continue to grow for about 6 years after the first visible signs and puberty lasts from the ages of 10 to 17 years (Nordqvist, 2016).

The highest percentage difference in mean height between males and females was obtained for 16 years old (6.49%) and followed by 17 years (5.73%). The lowest percentage difference was

0.66% in age group of 14 years. Girls usually start and finish puberty sooner than boys and most girls have reached their adult height by the time they are 15 years old (Barrell, 2018).

The mean weight of females was higher than males for 13 and 14 years old. For age groups 15-17 years, males had higher mean body weight. After about eight years of age, girls begin gaining fat mass at a greater rate than boys. During the adolescent growth spurt, the rate of fat increase in girls almost doubles than that of boys. Fat cells are mostly seen in the gluteal-femoral areas such as pelvis, buttocks, and thigh and to a lesser extent in the breasts because of changes in female hormone levels. The highest percentage increment of weight for consecutive age groups in females was recorded for 14-15 years (6.82%) and 13-14 years (6.80%) apparently due to fat increment during the adolescent growth spurt (Patrick, 2002). In males, the highest weight percentage increment was between 13 and 14 age groups (13.23%) followed by 14-15 years (12.15%). The lowest increment was observed for 15-16 years (3.54%). The average weight of a teenager can fluctuate quite a bit from one year to the next, finally stabilizing around 18-20 years of age (Jennifer, 2017).

The mean BMI for females ranged from 18.64Kg/m^2 to 20.38Kg/m^2 and all age groups fall under Normal weight category. In males, BMI ranged between 17.61 Kg/m^2 to 18.82Kg/m^2 and similar to females all age groups of males were categorized under Normal weight. Female students had higher BMI than males for all age groups. This is because there may be an increase in the weight of females due to hormonal influence during puberty. Similar result was reported by Oyewale et al., (2010).

The mean height of males and females was compared with similar studies conducted at private school in Addis Ababa (Zeritu, 2010) and Government school in rural parts of Debere Berhan

(Meklit, 2010). Students from private school seemed to appear slightly taller than government and rural schools. The mean weight of males and females was also compared with private schools in Addis Ababa (Zeritu, 2010) and Government school in rural parts of Debere Berhan (Meklit, 2010). Both male and female students from Private school had higher mean body weight for each age group than Governmental and Rural Schools.

All males and females from the current study and from the rural school at Debre Berhan were within normal body weight (Meklit, 2010) while those from Private school all were overweight except 13 age groups of males (Zeritu, 2010). These variations might be related to the factors that are affected by economic status of private and government students. In the case of the former, students have access to high fat diet and junk food more frequently. In addition they are more likely to be less physically active due to access to family vehicle reducing their chances of walking to and from school. Other similar studies with the current study, the prevalence of thinness among adolescents in Jimma Zone was 80.8% (Assefa *et al*., 2013), in Northern Ethiopia 26.1% thinness (Melaku *et al*., 2015), and in Ambo 27.2%thinness was reported (Yetubie *et al*., 2010), and in Portuguese from 742 school children 31% boys and 18% girls were overweight with many factors contributing for the weight of school children such as genetics, family, environment, education, food habits, physically active or sedentary life styles (television, computers, mobile phones etc) (Guine *et al*., 2016).

7. Conclusion

The current study shows that weight and height increases with increasing age. Males were slightly taller and heavier than females. When combined, the higher height and weight percentage increase is recorded between 13 and 14 age groups. The higher percentage difference in mean height was seen in 16 years old. But, the higher percentage difference in mean body weight between males and females was seen in 13 years old. Body Mass Index of female teenagers was higher than that of males. In Governmental and Rural schools, both males and females had normal body weight while those from private schools were all overweight except 13 age groups of males.

8. Recommendations

The early detection of body weight programs in teenage school children can help to prevent body weight related diseases and mortality. Schools should initiate BMI measurement programs for students of all body sizes and a comprehensive set of science-based strategies to promote physical activity and healthy nutrition. Governmental and Rural schools teenagers should maintain their normal body weight. Parents from private schools should help their children to have normal body weight through lifestyle adjustments such as good food habits, physical activity and by avoiding sedentary lifestyles (television, computers, mobile phones etc).

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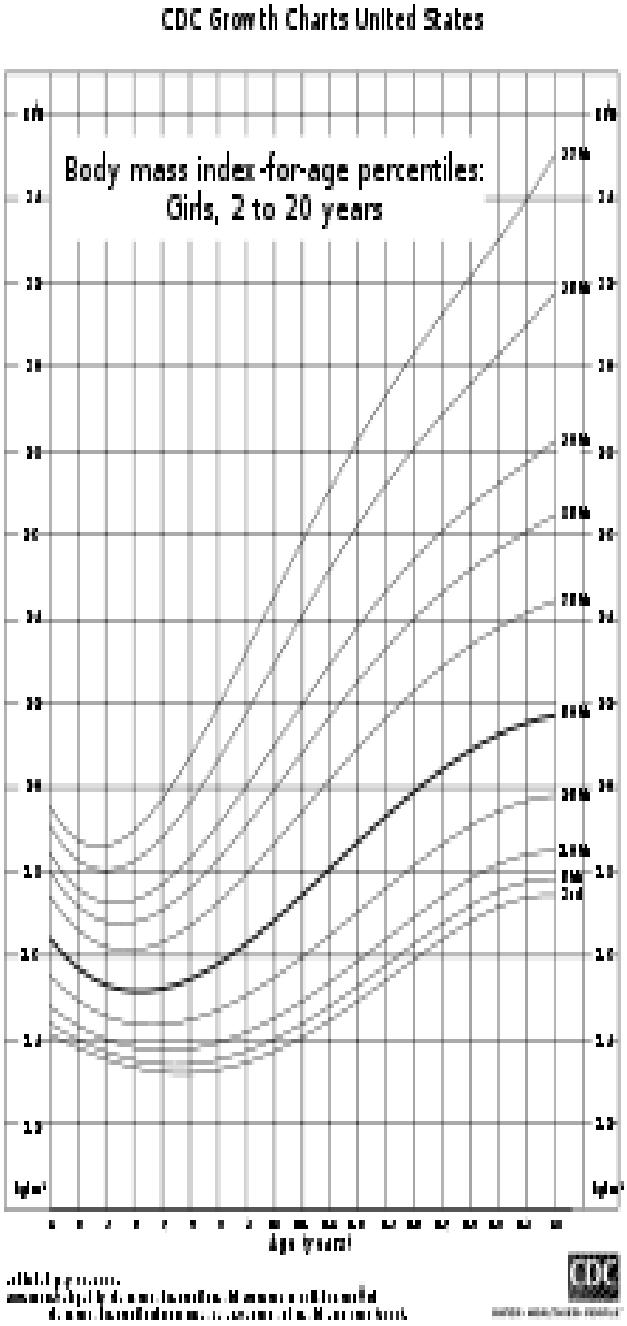
10. Appendix

BMI percentile charts for Girls and Boys



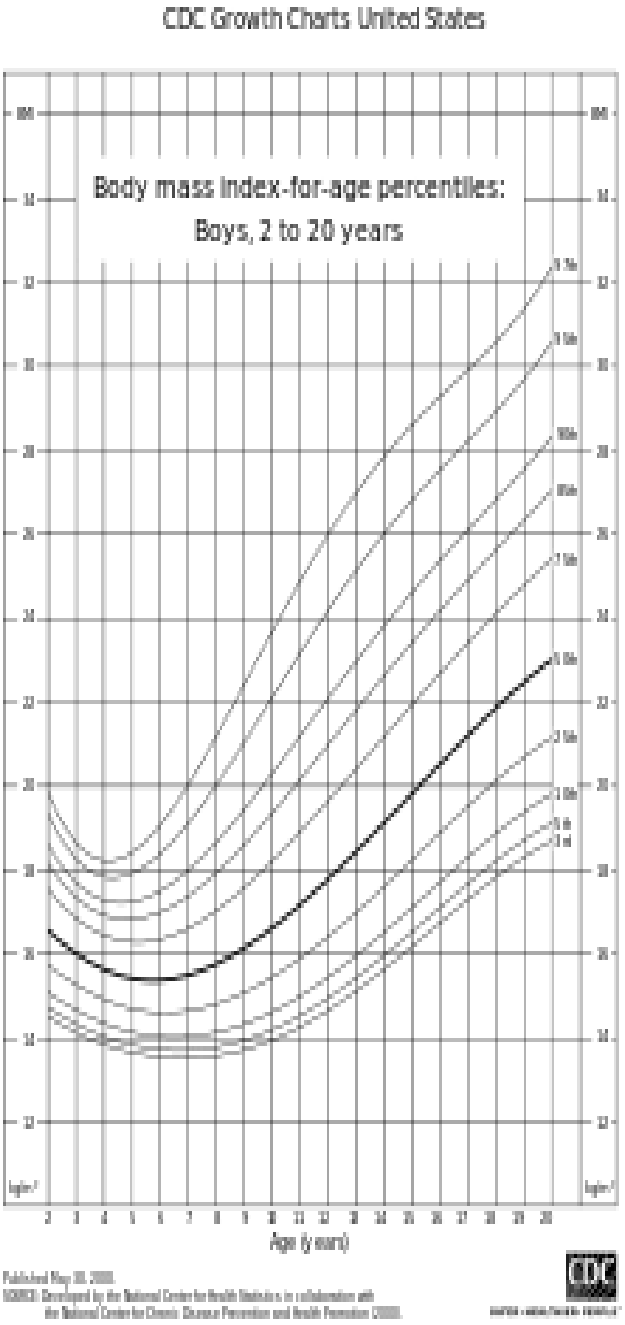


Plate 1. Measurement of height and weight of a male participant

Plate 2. Measurement of height and weight of a female participant

Raw data

No	Sex	Age	Height	Weight	BMI	Grade
1	F	13	1.47	38.7	17.92	7
2	F	13	1.47	40.8	18.89	7
3	F	13	1.48	37.8	17.26	7
4	F	13	1.47	41	18.98	7
5	F	13	1.49	38.2	17.21	7
6	F	13	1.58	45.7	18.28	7
7	F	13	1.46	43.7	20.51	7
8	F	13	1.47	43.4	20.09	8
9	F	14	1.61	43.5	16.73	7
10	F	14	1.45	36.8	17.52	7
11	F	14	1.60	50.7	19.80	7
12	F	14	1.58	47.7	19.08	7
13	F	14	1.49	41.1	18.51	7
14	F	14	1.56	38.1	15.68	7
15	F	14	1.56	44.1	18.15	7
16	F	14	1.38	39.4	20.74	7
17	F	14	1.52	54.6	23.64	7
18	F	14	1.51	39.6	17.37	7
19	F	14	1.47	59.3	27.45	7
20	F	14	1.48	30.6	13.97	7
21	F	14	1.54	39.6	16.71	7
22	F	14	1.53	55.1	23.55	7
23	F	14	1.52	38.5	16.67	7
24	F	14	1.47	38.3	17.73	7
25	F	14	1.49	41.7	18.78	7
26	F	14	1.42	47.5	23.51	7
27	F	14	1.49	44.7	20.14	7
28	F	14	1.53	36.8	15.73	8
29	F	14	1.52	37.7	16.32	8
30	F	14	1.50	37.7	16.76	8
31	F	14	1.46	49.1	23.05	8
32	F	14	1.57	37.7	15.08	8
33	F	14	1.51	35	15.35	8
34	F	14	1.52	57.5	24.89	8
35	F	14	1.58	55.2	22.08	8
36	F	14	1.55	37.4	15.58	8
37	F	14	1.56	53	21.81	8
38	F	14	1.49	40.2	18.11	8
39	F	14	1.60	48.9	19.10	9
40	F	14	1.58	52	20.8	9

No	Sex	Age	Height	Weight	BMI	Grade
1	F	15	1.49	46.4	20.90	7
2	F	15	1.58	42.9	17.16	7
3	F	15	1.50	49.5	22	7
4	F	15	1.45	43.3	20.62	7
5	F	15	1.45	42.5	20.24	7
6	F	15	1.56	43.6	17.94	7
7	F	15	1.50	44.1	19.6	7
8	F	15	1.63	59.4	22.33	7
9	F	15	1.46	55	25.82	7
10	F	15	1.53	47.8	20.43	7
11	F	15	1.46	49.5	23.24	7
12	F	15	1.54	43.8	18.48	7
13	F	15	1.55	51.6	21.5	8
14	F	15	1.55	51.6	21.5	8
15	F	15	1.53	42.9	18.33	8
16	F	15	1.53	42.9	18.33	8
17	F	15	1.54	49.4	20.84	8
18	F	15	1.56	47.9	19.71	8
19	F	15	1.55	53.9	22.46	8
20	F	15	1.55	45.1	18.79	8
21	F	15	1.53	53.5	22.86	8
22	F	15	1.48	49.4	22.56	8
23	F	15	1.54	45	18.99	8
24	F	15	1.53	42.6	18.21	8
25	F	15	1.55	41.6	17.33	8
26	F	15	1.56	38.3	15.76	8
27	F	15	1.64	46.2	17.17	8
28	F	15	1.53	49.2	21.03	8
29	F	15	1.52	54.6	23.64	8
30	F	15	1.46	39.1	18.36	8
31	F	15	1.44	42.6	20.58	8
32	F	15	1.49	43.1	19.41	8
33	F	15	1.46	40.3	18.92	8
34	F	15	1.61	54.1	20.89	8
35	F	15	1.45	42.6	20.29	9
36	F	15	1.57	54.7	22.24	9
37	F	15	1.63	51	19.17	9
38	F	15	1.70	47	16.26	9
39	F	15	1.50	49.8	22.13	9
40	F	15	1.56	57.4	23.62	9

No	Sex	Age	Height	Weight	BMI	Grade
1	F	15	1.49	42.7	19.23	9
3	F	15	1.48	42.3	19.32	10
4	F	16	1.55	51.5	21.46	7
5	F	16	1.59	49.2	19.45	7
6	F	16	1.53	50.9	21.75	7
7	F	16	1.50	55.6	24.71	7
8	F	16	1.49	41.9	18.87	7
9	F	16	1.49	41.9	18.87	7
10	F	16	1.58	51.2	20.48	7
11	F	16	1.50	46.8	20.8	8
12	F	16	1.48	39.8	18.17	8
13	F	16	1.68	55.1	19.54	8
14	F	16	1.50	51.6	22.93	8
15	F	16	1.50	44.1	19.6	8
6	F	16	1.58	48	19.2	8
17	F	16	1.43	48.6	23.82	8
18	F	16	1.60	56.5	22.07	8
19	F	16	1.52	50.1	21.69	8
20	F	16	1.49	46.8	21.08	9
21	F	16	1.54	50.4	21.27	9
22	F	16	1.50	53.9	23.96	9
23	F	16	1.48	37	16.89	9
24	F	16	1.50	51.1	22.71	9
25	F	16	1.67	46.5	16.67	9
26	F	16	1.56	45.5	18.72	9
27	F	16	1.56	37.4	15.39	9
28	F	16	1.64	55.9	20.78	9
29	F	16	1.62	55.8	21.3	9
30	F	16	1.52	41.7	18.05	9
31	F	16	1.55	47.2	19.67	9
32	F	16	1.49	44.5	20.05	9
33	F	16	1.57	60.4	24.55	9
34	F	16	1.55	51	21.25	9
35	F	16	1.46	54.7	25.68	9
36	F	16	1.47	44.1	20.42	9
37	F	16	1.52	52.1	22.55	9
38	F	16	1.55	45.7	19.04	9
39	F	16	1.52	37.7	16.32	9
40	F	16	1.53	47.7	20.38	9

No	Sex	Age	Height	Weight	BMI	Grade
1	F	16	1.52	39.6	17.14	9
2	F	16	1.57	41.3	16.79	9
3	F	16	1.54	44.8	18.90	9
4	F	16	1.46	40.2	18.87	9
5	F	16	1.59	51.2	20.24	9
6	F	16	1.56	45.5	18.72	9
7	F	16	1.48	43.5	19.86	9
8	F	16	1.53	46.1	19.70	10
9	F	16	1.57	38.8	15.77	10
10	F	16	1.60	47	18.36	10
11	F	16	1.62	50	19.08	10
12	F	16	1.54	41.8	17.64	10
13	F	16	1.64	47.2	17.55	10
14	F	16	1.54	41.7	17.59	10
15	F	17	1.54	58.6	24.73	7
16	F	17	1.60	60.2	23.52	7
17	F	17	1.45	57.9	27.57	7
18	F	17	1.55	49.2	20.5	7
19	F	17	1.53	57.7	24.66	7
20	F	17	1.57	51.5	20.93	8
21	F	17	1.53	52.7	22.52	8
22	F	17	1.50	41.7	18.53	8
23	F	17	1.60	46	17.97	8
24	F	17	1.49	44.8	20.18	9
25	F	17	1.67	51.5	18.46	9
26	F	17	1.54	49.4	20.84	9
27	F	17	1.49	47.1	21.22	9
28	F	17	1.54	48	20.25	9
29	F	17	1.55	53.6	22.33	9
30	F	17	1.47	38.5	17.82	9
31	F	17	1.60	50.9	19.88	9
32	F	17	1.46	54.1	25.4	9
33	F	17	1.55	52.3	21.79	9
34	F	17	1.57	50.7	20.61	10
35	F	17	1.54	39.7	16.75	10
36	F	17	1.55	56.4	23.5	10
37	F	17	1.58	42.2	16.88	10
38	F	17	1.57	39.7	16.14	10
39	F	17	1.60	52.6	20.55	10
40	F	17	1.67	54.7	19.61	10

No	Sex	Age	Height	Weight	BMI	Grade
1	F	17	1.61	47	18.15	10
2	F	17	1.61	40.4	15.60	10
3	F	17	1.62	49.8	19.01	10
4	F	17	1.60	41	16.02	10
5	F	17	1.59	56.9	22.49	10
6	F	17	1.62	62.3	23.78	10
7	F	17	1.65	59.8	21.99	10
8	F	17	1.58	47	18.8	10
9	F	17	1.54	47	19.83	10
10	F	17	1.58	47	18.8	10
11	F	17	1.57	37.7	15.33	10
12	F	17	1.55	67.7	28.21	10
13	F	17	1.60	56.3	21.99	10
14	F	17	1.48	42.8	19.54	10
15	F	17	1.70	60.2	20.83	10
16	F	17	1.67	50.9	18.24	10
17	F	17	1.63	54.2	20.38	10
18	F	17	1.53	39.4	16.84	10
19	F	17	1.56	44.5	18.31	10

No	Sex	Age	Height	Weight	BMI	Grade
1	M	13	1.45	29.6	14.10	7
2	M	13	1.47	38	17.59	7
3	M	13	1.43	49	24.02	7
4	M	13	1.45	40.1	19.10	7
5	M	13	1.42	32.6	16.14	7
6	M	13	1.50	39.7	17.64	7
7	M	13	1.32	38.7	22.24	7
8	M	13	1.58	42.5	17	7
9	M	13	1.50	33.3	14.8	7
10	M	13	1.42	31	15.35	7
11	M	13	1.50	44.2	19.64	7
12	M	13	1.39	32.6	16.89	7
13	M	13	1.54	38.7	16.33	7
13	M	13	1.53	38.8	16.58	7
15	M	13	1.53	41.1	17.56	7
16	M	13	1.40	33.5	17.09	7
17	M	13	1.44	37	17.87	7
18	M	13	1.52	38.5	16.67	7
19	M	13	1.46	34	15.96	7
20	M	13	1.48	42.8	19.54	7
21	M	14	1.46	37	17.37	7
22	M	14	1.56	42.1	17.33	7
23	M	14	1.45	32.4	15.43	7
24	M	14	1.56	41.9	17.24	7
25	M	14	1.56	38.1	15.68	7
26	M	14	1.63	60.4	22.71	7
27	M	14	1.48	33.8	15.43	7
28	M	14	1.58	45.6	18.24	7
29	M	14	1.47	40.2	18.61	7
30	M	14	1.50	55.6	24.71	7
31	M	14	1.37	32.7	17.39	7
32	M	14	1.55	47.1	19.63	7
33	M	14	1.55	45.5	18.96	7
34	M	14	1.58	44.8	17.92	7
35	M	14	1.53	42.3	18.08	7
36	M	14	1.50	36.2	16.09	7
37	M	14	1.52	60.2	26.06	7
38	M	14	1.58	42.6	17.04	7
39	M	14	1.59	44.7	17.67	7
40	M	14	1.40	28.2	14.39	8

No	Sex	Age	Height	Weight	BMI	Grade
1	M	14	1.53	55.9	23.89	8
2	M	14	1.59	45.5	17.98	8
3	M	14	1.55	35.5	14.80	8
4	M	14	1.50	36.8	16.36	8
5	M	14	1.50	40.4	17.96	8
6	M	14	1.44	39	18.84	8
7	M	14	1.52	38.5	16.67	8
8	M	14	1.60	46.3	18.09	8
9	M	14	1.59	44.7	17.67	8
10	M	14	1.58	44.7	17.88	8
11	M	14	1.58	45.8	18.32	8
12	M	14	1.64	41.5	15.43	8
13	M	14	1.46	45.3	21.27	8
14	M	15	1.68	47	16.67	7
15	M	15	1.57	48.8	19.84	7
16	M	15	1.56	43.3	17.82	7
17	M	15	1.50	39.2	17.42	7
18	M	15	1.65	44.3	16.29	8
19	M	15	1.56	47.6	19.59	8
20	M	15	1.70	53	18.34	8
21	M	15	1.60	45	17.58	8
22	M	15	1.67	49.4	17.71	8
23	M	15	1.60	56.4	22.03	8
24	M	15	1.67	56.4	20.22	8
25	M	15	1.44	42.9	20.72	8
26	M	15	1.55	45.2	18.83	8
27	M	15	1.64	51.4	19.11	8
28	M	15	1.60	47.4	18.52	8
29	M	15	1.66	52.4	18.99	8
30	M	15	1.53	40.7	17.39	8
31	M	15	1.64	45.3	16.84	8
32	M	15	1.60	41.7	16.29	8
33	M	15	1.65	54.6	20.07	9
34	M	15	1.70	54.5	18.86	9
35	M	15	1.58	46.1	18.44	9
36	M	15	1.62	40.8	15.57	9
37	M	15	1.64	48.4	17.99	9
38	M	15	1.50	45.8	20.36	9
39	M	15	1.57	45.1	18.33	9
40	M	15	1.73	65.6	21.94	9

No	Sex	Age	Height	Weight	BMI	Grade
1	M	15	1.57	45.4	18.46	9
2	M	15	1.60	48.8	19.06	9
3	M	16	1.60	53.5	20.90	7
4	M	16	1.63	53.2	20	7
5	M	16	1.65	59.1	21.73	7
6	M	16	1.69	52.4	18.32	7
7	M	16	1.60	48.8	19.06	8
8	M	16	1.68	48	17.02	8
9	M	16	1.64	45.4	16.88	8
10	M	16	1.64	58.7	21.82	8
11	M	16	1.74	56	18.48	8
12	M	16	1.60	47.7	18.63	8
13	M	16	1.67	51.1	18.32	8
14	M	16	1.79	52.9	16.53	8
15	M	16	1.65	50.4	18.53	8
16	M	16	1.67	49.4	17.71	8
17	M	16	1.74	51.4	16.96	8
18	M	16	1.75	50.1	16.37	8
19	M	16	1.65	50	18.38	8
20	M	16	1.67	56.4	20.22	8
21	M	16	1.62	51.5	19.66	8
22	M	16	1.54	47.9	20.21	8
23	M	16	1.59	48.5	19.17	8
24	M	16	1.72	52.3	17.67	8
25	M	16	1.70	59.9	20.73	8
26	M	16	1.70	56	19.38	9
27	M	16	1.61	53.1	20.50	9
28	M	16	1.74	59.9	19.77	9
29	M	16	1.66	52.6	19.06	9
30	M	16	1.61	41.8	16.14	9
31	M	16	1.65	49	18.01	9
32	M	16	1.71	50.2	17.19	9
33	M	16	1.60	47	18.36	9
34	M	16	1.64	48	17.84	9
35	M	16	1.58	49.1	19.64	9
36	M	16	1.58	38	15.2	9
37	M	16	1.63	42.2	15.86	9
38	M	16	1.55	45.3	18.86	9
39	M	16	1.50	42.2	18.76	9
40	M	16	1.65	59.1	21.73	9

No	Sex	Age	Height	Weight	BMI	9Grade
1	M	16	1.58	46	18.4	9
2	M	16	1.58	40	16	9
3	M	16	1.50	40.9	18.18	9
4	M	16	1.70	62.5	21.63	9
5	M	16	1.63	41.8	15.71	9
6	M	16	1.67	45.7	16.38	10
7	M	16	1.73	49	16.39	10
8	M	16	1.64	55	20.45	10
9	M	16	1.65	49	18.01	10
10	M	16	1.65	48.5	17.83	10
11	M	16	1.64	44	16.36	10
12	M	16	1.70	47	16.26	10
13	M	16	1.74	57.3	18.91	10
14	M	16	1.63	55.6	20.90	10
15	M	16	1.63	40.8	15.34	10
16	M	16	1.67	45.3	16.24	10
17	M	16	1.55	41.8	17.42	10
18	M	16	1.67	47.6	17.06	10
19	M	16	1.59	40	15.81	10
20	M	16	1.65	54	19.85	10
21	M	17	1.64	49.9	18.55	7
22	M	17	1.65	47	17.28	7
23	M	17	1.67	46.7	16.74	8
24	M	17	1.61	49	18.92	9
25	M	17	1.64	48	17.84	9
26	M	17	1.60	48.8	19.06	9
27	M	17	1.73	50.3	16.82	9
28	M	17	1.66	59.1	21.41	9
29	M	17	1.63	48.1	18.08	9
30	M	17	1.71	61	20.89	9
31	M	17	1.70	56.2	19.45	9
32	M	17	1.66	51.5	18.66	9
33	M	17	1.73	59.7	19.97	9
34	M	17	1.64	60.4	22.45	9
35	M	17	1.64	50.6	18.81	9
36	M	17	1.66	55.1	19.96	9
37	M	17	1.61	47.7	18.42	10
38	M	17	1.69	63	22.03	10
39	M	17	1.67	47	16.85	10
40	M	17	1.66	44	15.94	10

No	Sex	Age	Height	Weight	BMI	Grade
1	M	17	1.69	57.3	20.03	10
2	M	17	1.68	61.6	21.84	10
3	M	17	1.65	48.9	17.98	10
4	M	17	1.67	52.9	18.96	10
5	M	17	1.71	63	21.58	10
6	M	17	1.72	54.4	18.38	10
7	M	17	1.52	44.7	19.35	10
8	M	17	1.61	47.7	18.42	10
9	M	17	1.58	43.2	17.28	10
10	M	17	1.64	52.3	19.44	10
11	M	17	1.73	47	15.72	10
12	M	17	1.68	52.3	18.55	10
13	M	17	1.79	58	18.13	10
14	M	17	1.71	63.6	21.78	10
15	M	17	1.63	44.3	16.65	10
16	M	17	1.60	44.9	17.54	10
17	M	17	1.62	48.9	18.66	10
18	M	17	1.72	49.3	16.66	10