Establishment of Z score reference of growth parameters for Egyptian school children and adolescents aged from 5 to 19 years: a cross sectional study

CURRENT STATUS: POSTED

Ali M El-Shafie
Menoufia University Faculty of Medicine

Zein A Omar
Menoufia University Faculty of Medicine

ahmed N elbazzar
Menoufia University Faculty of Medicine

Ahmed.n.elbazzar@gmail.com Corresponding Author
ORCiD: https://orcid.org/0000-0002-7857-7876

Zeinab A Kasemy
Menoufia University Faculty of Medicine

wael A Bahbah
Menoufia University Faculty of Medicine

DOI: 10.21203/rs.3.rs-21588/v1

SUBJECT AREAS
Pediatrics

KEYWORDS
Adolescent, Egyptian Z score, Growth parameters, School children
Abstract
Background: Growth charts are an important method for evaluating a child's health, nutrition and development. Objective: To establish Lambda - Mu- Sigma (LMS) and Z score references for assessment of growth and nutrition in Egyptian school children and adolescents.
Methods: A total of 31,416 Egyptian school children and adolescents from 5 years to 19 years were enrolled in a cross sectional randomized study from December 2017 to November 2019 to create LMS and Z score references for weight, height and body mass index (BMI) corresponding to ages. They were selected from different districts in Egypt. Apparent Healthy children with good nutritional history and not suffering from any chronic diseases were included in the study.
Results: Egyptian children of both sexes (56.7% boys and 43.3% girls) from 5 years to 19 years old were studied. Then LMS and Z scores for weight for age, height for age, BMI for age of both sexes were represented in detailed tables and graphs. There was no statistically significant difference between the Egyptian Z score charts and the reference values of WHO for weight, height and BMI corresponding to age (P>0.05).
Conclusion: This is the first reference for growth and nutritional assessment in Egyptian school children and adolescents, this tool is essential for healthcare and research. In case of absence of these local charts, we recommend to use the WHO references values rather than other local charts.
Key words: Adolescent - Egyptian Z score -Growth parameters- School children

Background
Impairment in growth is one of universal public health problems, and its early detection and accurate diagnosis is important for early intervention. Age- and sex-specific growth charts are the important tools used for monitoring children’s longitudinal growth. For investigating a child’s growth rate, weight and height are the most common anthropometric measurements used.

Over the past decades, the increasing pattern of childhood obesity worldwide has been identified as an important health problem. Beyond the research setting, the most suitable single indicator of overweight and obesity in children and adolescents is Body Mass Index.
Egypt does not have its own growth reference data based on Lambda - Mu- Sigma (LMS) and Z score parameters that is constructed with a representative national sample of children and adolescents. The recently updated World Health Organization (WHO) international height, weight, and BMI references for children and adolescents aged 5-19 years (WHO 2007) are of interest as potentially useful for the Egyptian population like the reference values from the Centers for Disease Control and Prevention (CDC).

Methods And Design
Participants

Egypt consists of 27 governorates. Cairo is the largest governorates in terms of population, accounting for one-third of Egypt's population according to the latest statistics. Therefore this was taken into account and the largest number of participants from Cairo. To conduct the study, the multistage random sampling technique was used. Out of 27 governorates, 3 governorates from Upper Egypt and 5 governorates including Cairo from Lower Egypt were chosen in this study. We chose 18 districts from previously chosen governorates randomly. Then facilities including basic education schools and secondary training schools were counted, and 140 facilities in the selected 8 governorates were randomly chosen.

Out of the week, the study was conducted in three crowded days to gather more information. They were selected from Primary health centers, Primary school and secondary school as representative of children in Egypt. Between the educational courses and during break time, children were screened in the school that was selected randomly from the list of schools.

A total of 31,416 Egyptian children from 5 years to 19 years were studied in a cross sectional randomized study from December 2017 to November 2019. Firstly, we took 32,042 who were eligible for the study, then 31,416 children and adolescents were selected as a final total sample after exclusion of 626 children on applying the inclusion and exclusion criteria.

Verbal consents were obtained from parents who were informed about the objective of the study, its benefits and the absence of any risk associated with the participation of their children.

Inclusion And Exclusion Criteria

All apparent healthy children with good developmental and nutritional history were included in this
study. We excluded any child suffering from any chronic disease (cardiac, hematological, renal, endocrinal and hepatic diseases), fever or documented underlying disease at the time of examination.

**Measurements And Data Collection**

We measured weight for age, height for age, BMI for age for both sexes. All measured were collected by trained medical staff. All children were examined by identical measuring equipment. Instruments needed to be highly accurate. Weight and height were measured by a digital balanced scale (Beurer model GS 11, Germany). Device was calibrated daily. BMI was calculated using the formula: $\text{BMI} = \frac{\text{weight} (\text{Kg})}{(\text{height} (\text{m}))^2}$.

**Patient And Public Involvement**

Seeking relevance, identifying the important research priorities of patients, caregivers and healthcare providers (paediatricians, nurses and dieticians) were identified by the authors. A paper-based survey asked patients, caregivers and care providers to submit their unanswered questions on anthropometric measurements. The final top 4 research priorities were identified during a personal meeting. There were 180 respondents, including children ($n = 90$) of different age and sex who were subjected to anthropometric measurement by observers to assess the degree of response to training and quality of measurement, also participated in setting the priorities of the research either on their own or by their caregiver, submitted 120 questions after exclusions. Of the respondents, 55% were patients or caregivers, 40% lived in urban areas, the caregivers were aged 21-45 years, and 92% were women. The top 4 unique research questions out of the 120 questions were prioritized included charts that can easily determine normal and abnormal levels of anthropometric measurements, education tools and technologies to improve patient motivation and health behaviors.

**Statistical analysis**

The LMS parameters were used to determine the standard deviation (−3 to +3) of weight, height and BMI for both sexes. The LMS parameters are the median (M), the generalized coefficient of variation (S), and the power in the Box-Cox transformation (L). The Box-Cox transformation is used to convert the distribution of anthropometric data to a normal distribution. The method models the data taking into consideration the degree of skewness (L), central tendency (M), and dispersion (S). The L, M, and S parameters are calculated and smoothed according to the method of maximum penalized
likelihood. Z score and was calculated by using the Statistical package SPSS, version 20, for windows (SPSS Inc., Chicago, Illinois, USA) and Excel according to the following formula:

\[ P = M \left[ 1 + \frac{LSZ}{L} \right], \ L \neq 0 \]

For the present analysis, Z scores were statistically analyzed using the SPSS V 15 and Excel. We calculated the z-score values of \(-3, -2, -1, 0, +1, +2, \) and \(+3\) for weight, height and BMI for age.

The goodness of fit of all L, M, and S models was assessed using Q-test. Student t-test for one sample was used to compare the means values of each group variable with the Egyptian and WHO reference values. For all analyses, the significance level was set at 5%.

**Results**

A total of 31,416 Egyptian children (56.7% boys and 43.3% girls), from 5 to 19 years of age were examined in this study for weight for age (table 1–2), height for age (table 3–4), and BMI for age (table 5–6). Egyptian z-score weight for age Figs. 1–2, height for age Figs. 3–4, BMI for age for both sexes according to age are shown in Figs. 5–6. There was no statistically significant difference between the Egyptian Z score charts and the reference values of WHO (table 7) Figs. 7–10.

**Discussion**

To assess the growth and nutritional status of a child, percentiles, percent of median, and Z-scores (standard deviation scores) are the available three methods. The Z-score indicates how many standard deviations any value is from the mean. Variation in the environmental conditions and the ethnicity factor developed the necessity for the development of tailored charts from representative samples that was and still conducted by many developed and developing countries. In Egypt, this is the first national Z score growth charts for school children and adolescents that was developed in spite of using other charts. Weight for age was not calculated beyond 10 years of age as during the pubertal growth spurt, the height increases rapidly more than weight making it not an accurate measure of nutritional status beyond 10 years.

After comparison of weight, height and BMI for age values of both sexes of the children who
participated in the present study with the WHO values,\textsuperscript{14} there was no statistically significant difference between the Egyptian Z score charts and the reference values of WHO. The P values of weight for age in boys and girls were 0.142 and 0.229 (P > 0.05) respectively. The P values of height for age in boys and girls were 0.469 and 0.361 (P > 0.05). The P values of BMI for age in boys and girls were 0.492 and 0.316 (P > 0.05) respectively. This mean that he WHO growth charts may be appropriate for monitoring growth and nutritional status on Egyptian children as the growth pattern in our large population were closer to growth charts of WHO.

WHO Multicentre Growth Reference Study was conducted to provide a single international standard representative for the physiological growth for all children everywhere, regardless of ethnicity, socio-economic status and type of feeding, and our study supports this hypothesis.

Conclusion
The L, M, and S parameters and Z-scores for Egyptian school children and adolescents presented in this report provide nationally representative reference that will facilitate more accurate assessment of nutritional status of Egyptian children and comparison with other populations under different clinical conditions. In absence of these local charts, we recommend using WHO growth charts.

Declarations

Acknowledgements:
No words could express our deep feelings towards our patients and teamwork.

No conflict of interest

Contributor-ship statement: All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Ali M. El-Shafie, Zein A. Omar and Wael A. Bbahbah has the role of getting the idea, performing statistical analysis, writing the methodology and results sections, final revision and publishing. Zeinal A Kasemy and Ahmed N El-Bazzar performing statistical analysis, writing the methodology. Zein A. Omar, the pediatrician, received, diagnosed and collected the data. The entire team arranged a health education session to provide explanation about both diseases in all matters.
Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Patient consent for publication: not required.

Ethics approval: Institutional Review Boards (IRB) of the Menoufia faculty of medicine had approved the study. Research work had been performed in accordance with the Declaration of Helsinki. Consents was taken from parents or guardians after explain the objective of the study, absence of any risk in participation.

All procedures performed in the study were approved and were in accordance with the ethical standards of Menoufia University institutional research committee.

Data sharing statement: Data are available to be shared on request by e. mailing ahmed.n.elbazzar@gmail.com

Funding Disclosures: All authors certify that no funding has been received for the conduct of this study and/or preparation of this manuscript.

References
1. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, Mathers C, Rivera J; Maternal and Child Undernutrition Study Group: Maternal and child undernutrition: global and regional exposures and health consequences. Lancet. 2008 Jan 19;371(9608):243–60.

2. Bonthuis M, van Stralen KJ, Verrina E, Edefonti A, Molchanova EA, Hokken-Koelega AC, Schaefer F, Jager KJ: Use of national and international growth charts for studying height in European children: development of up-to-date European height-for-age charts. PLoS One 2012;7(8):e42506.

3. deOnis M, Wijnhoven TM, Onyango AW: Worldwide practices in child growth monitoring. J Pediatr. 2004 Apr;144(4):461-5.

4. Foster BJ, Leonard MB: Measuring nutritional status in children with chronic kidney disease. Am J Clin Nutr. 2004 Oct;80(4):801–14.
5. World Health Organization: Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. *World Health Organ Tech Rep Ser.* 1995;854:1-452.

6. Ayatollahi SM, Sharafi Z, Haem E: Child Weight Growth Chart and Its Associated Factors in Birth Cohort of Maku Using a Growth Curve Model and LMS Method. *Glob J Health Sci.* 2015 Apr 19;7(6):181-6.

7. Abalkhail B, Shawky S: Comparison between body mass index, triceps skin fold thickness and mid-arm muscle circumference in Saudi adolescents. *Ann Saudi Med.* 2002 Sep-Nov;22(5-6):324-8.

8. Wang C, Hou XH, Zhang ML, Bao YQ, Zou YH, Zhong WH, Xiang KS, Jia WP: Comparison of body mass index with body fat percentage in the evaluation of obesity in Chinese. *Biomed Environ Sci* 2010 Jun;23(3):173-9.

9. Nooyens AC, Koppes LL, Visscher TL, Twisk JW, Kemper HC, Schuit AJ, van Mechelen W, Seidell JC: Adolescent skinfold thickness is a better predictor of high body fatness in adults than is body mass index: the Amsterdam Growth and Health Longitudinal Study. *Am J Clin Nutr* 2007 Jun;85(6):1533-9.

10. Welborn TA, Knuiman MW, Vu HT: Body mass index and alternative indices of obesity in relation to height, triceps skinfold and subsequent mortality: the Busselton health study. *Int J Obes Relat Metab Disord.* 2000 Jan;24(1):108 – 15.

11. de Almeida CA, Pinho AP, Ricco RG, Elias CP: Abdominal circumference as an indicator of clinical and laboratory parameters associated with obesity in children and adolescents: comparison between two reference tables. *J Pediatr (Rio J).* 2007 Mar-Apr;83(2):181-5.

12. Himes JH. Challenges of accurately measuring and using BMI and other indicators of obesity in children. *Pediatrics.* 2009 Sep;124Suppl 1:S3-22.
13. -Krebs NF, Himes JH, Jacobson D, Nicklas TA, Guilday P, Styne D: Assessment of child and adolescent overweight and obesity. Pediatrics. 2007 Dec;120 Suppl 4:S193-228.

14. -DeOnis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J: Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007 Sep;85(9):660-7.

15. -Kuczmarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, Wei R, Curtin LR, Roche AF, Johnson CL: 2000 CDC Growth Charts for the United States: methods and development. Vital Health Stat 11. 2002 May;(246):1-190.

16. -Cole TJ, Green PJ: Smoothing reference centile curves: the LMS method and penalized likelihood. Stat Med. 1992 Jul;11(10):1305-19.

17. -Cole TJ, Freeman JV, Preece MA: British 1990 growth reference centiles for weight, height, body mass index and head circumference fitted by maximum penalized likelihood. Stat Med. 1998 Feb 28;17(4):407–29.

18. -Pan H, Cole TJ: A comparison of goodness of fit tests for age-related reference ranges. Stat Med. 2004 Jun 15;23(11):1749-65.

19. -El Mouzan MI, Al Salloum AA, Alqurashi MM, AlHerbish AS, Al Omar A: The LMS and Z scale growth reference for Saudi school-age children and adolescents. Saudi J Gastroenterol. 2016;22(4):331-6.

20. -Freedman DS, Khan LK, Serdula MK, Ogden CL, Dietz WH: Racial and ethnic differences in secular trends for childhood BMI, weight, and height. Obesity 2006;14:301-8.

21. -Deaton A. Height, health, and development. Proc Natl Acad Sci. 2007;104:13232–13237.

22. -Wright CM, Booth IW, Buckler JM, Cameron N, Cole TJ, Healy MJ, Hulse JA, Preece MA, Reilly JJ, Williams AF: Growth reference charts for use in the United Kingdom. Arch
23. Tinggaard J, Aksglaede L, Sørensen K, Mouritsen A, Wohlfahrt-Veje C, Hagen CP, Mieritz MG, Jørgensen N, Wolthers OD, Heuck C, Petersen JH, Main KM, Juul A: The 2014 Danish references from birth to 20 years for height, weight and body mass index. Acta Pædiatrica 2014;103:214-24.

24. Scherdel P, Botton J, Rolland-Cachera MF, Léger J, Pelé F, Ancel PY, Simon C, Castetbon K, Salanave B, Thibault H, Lioret S, Péneau S, Gusto G, Charles MA, Heude B: Should the WHO Growth Charts Be Used in France? PLoS One. 2015;10(3):e0120806.

25. Bong Y, Shariff AA, Mohamed AM, Merican AF: Malaysian growth centiles for children under six years old. Ann Hum Biol 2015;42:108-15.

26. Payande A, Tabesh H, Shakeri MT, Saki A, Safarian M: Growth Curves of Preschool Children in the Northeast of Iran: A Population-Based Study Using Quantile Regression Approach. Global Journal of Health Science 2013;5:9-15.

27. Zong XN, Li H: Construction of a New Growth References for China Based on Urban Chinese Children: Comparison with the WHO Growth Standards. PLOS ONE 2013;8(3):e59569.

Tables
Table (1): shows Egyptian LMS and z scores weight for age for boys from 5 years to 10 years.

| Y:M | M | Mean | S | L | -3SD | -2SD | -1SD | Median |
|-----|---|------|---|---|------|------|------|--------|
| 05:01 | 61 | 18.698 | 0.1362 | 5 | -0.1455 | 12.7 | 14.5 | 16.4 | 18.1 |
| 05:02 | 62 | 18.958 | 0.1378 | 9 | -0.1489 | 12.8 | 14.6 | 16.6 | 18.1 |
| 05:03 | 63 | 19.125 | 0.1381 | 4 | -0.1499 | 12.9 | 14.7 | 16.7 | 18.2 |
| 05:04 | 64 | 19.352 | 0.1395 | 1 | -0.1502 | 13.1 | 14.9 | 16.9 | 19.4 |
| 05:05 | 65 | 19.528 | 0.1398 | 9 | -0.1555 | 13.2 | 15.1 | 17.1 | 19.6 |
| 05:06 | 66 | 19.762 | 0.1400 | 8 | -0.1589 | 13.4 | 15.1 | 17.3 | 19.8 |
| Time  | Hour  | Degree 1  | Degree 2  | Degree 3  | Degree 4  | Degree 5  | Degree 6  |
|-------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| 05:07 | 67    | 19.822    | 0.1404    | -0.1599   | 13.5      | 15.3      | 17.5      | 19.9      |
| 05:08 | 68    | 20.025    | 0.1412    | -0.1614   | 13.7      | 15.4      | 17.7      | 20.2      |
| 05:09 | 69    | 20.215    | 0.1420    | -0.1635   | 13.8      | 15.6      | 17.8      | 20.3      |
| 05:10 | 70    | 20.452    | 0.1431    | -0.1665   | 14.0      | 15.7      | 18.0      | 20.5      |
| 05:11 | 71    | 20.856    | 0.1436    | -0.1687   | 14.1      | 15.8      | 18.2      | 20.6      |
| 06:00 | 72    | 21.036    | 0.1447    | -0.1711   | 14.2      | 16.0      | 18.3      | 20.7      |
| 06:01 | 73    | 21.125    | 0.1451    | -0.1736   | 14.3      | 16.1      | 18.5      | 21.0      |
| 06:02 | 74    | 21.358    | 0.1469    | -0.1765   | 14.4      | 16.3      | 18.7      | 21.3      |
| 06:03 | 75    | 21.524    | 0.1479    | -0.1799   | 14.6      | 16.5      | 18.9      | 21.5      |
| 06:04 | 76    | 21.795    | 0.1489    | -0.1829   | 14.8      | 16.7      | 19.1      | 21.7      |
| 06:05 | 77    | 22.036    | 0.1499    | -0.1925   | 14.9      | 16.9      | 19.3      | 21.9      |
| 06:06 | 78    | 22.315    | 0.1509    | -0.2020   | 15.1      | 17.1      | 19.5      | 22.2      |
| 06:07 | 79    | 22.102    | 0.1509    | -0.2099   | 15.3      | 17.3      | 19.7      | 22.3      |
| 06:08 | 80    | 22.203    | 0.1512    | -0.2125   | 15.5      | 17.5      | 19.9      | 22.4      |
| 06:09 | 81    | 22.458    | 0.1525    | -0.2265   | 15.7      | 17.7      | 20.1      | 22.5      |
| 06:10 | 82    | 22.625    | 0.1536    | -0.2369   | 15.9      | 17.9      | 20.3      | 22.6      |
| 06:11 | 83    | 23.025    | 0.1545    | -0.2456   | 16.1      | 18.1      | 20.5      | 22.7      |
| 07:00 | 84    | 23.215    | 0.1558    | -0.2569   | 16.3      | 18.3      | 20.7      | 23.0      |
| 07:01 | 85    | 23.325    | 0.1569    | -0.2695   | 16.6      | 18.6      | 20.9      | 23.2      |
| 07:02 | 86    | 23.547    | 0.1578    | -0.2789   | 17.0      | 18.8      | 21.1      | 23.5      |
| 07:03 | 87    | 23.789    | 0.1587    | -0.2896   | 17.3      | 18.9      | 21.3      | 23.7      |
| 07:04 | 88    | 23.987    | 0.1598    | -0.2987   | 17.6      | 19.1      | 21.6      | 23.9      |
| 07:05 | 89    | 24.125    | 0.1600    | -0.3090   | 17.9      | 19.4      | 21.9      | 24.2      |
| 07:06 | 90    | 24.366    | 0.1608    | -0.3125   | 18.2      | 19.7      | 22.2      | 24.5      |
| 07:07 | 91    | 24.456    | 0.1612    | -0.3255   | 18.5      | 20.0      | 22.5      | 24.8      |
| 07:08 | 92    | 24.566    | 0.1625    | -0.3369   | 18.7      | 20.3      | 22.8      | 25.1      |
| 07:09 | 93    | 24.63     | 0.1631    | -0.3456   | 18.9      | 20.6      | 23.1      | 25.4      |
| 07:10 | 94    | 24.902    | 0.1631    | -0.3587   | 19.1      | 20.8      | 23.4      | 25.7      |
| 07:11 | 95    | 25.025    | 0.1645    | -0.3625   | 19.3      | 21.0      | 23.7      | 25.9      |
| Time  | Age | Weight | Z-score | 5th percentile | 10th percentile | 25th percentile | 50th percentile | 75th percentile | 90th percentile | 95th percentile |
|-------|-----|--------|---------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 08:00 | 5   | 25.201 | 0.1658  | -0.3789        | 17.4           | 19.1           | 22.5           | 25.0           |                 |                |
| 08:01 | 5   | 25.463 | 0.1667  | -0.3899        | 17.5           | 19.3           | 22.7           | 25.1           |                 |                |
| 08:02 | 4   | 25.652 | 0.1617  | -0.3999        | 17.6           | 19.5           | 22.9           | 25.1           |                 |                |
| 08:03 | 5   | 25.874 | 0.1682  | -0.4128        | 17.8           | 19.6           | 23.1           | 25.2           |                 |                |
| 08:04 | 5   | 26.021 | 0.1689  | -0.4258        | 17.9           | 19.7           | 23.2           | 25.3           |                 |                |
| 08:05 | 5   | 26.201 | 0.1691  | -0.4314        | 18.1           | 19.9           | 23.4           | 25.5           |                 |                |
| 08:06 | 5   | 26.432 | 0.1693  | -0.4478        | 18.2           | 20.1           | 23.6           | 25.6           |                 |                |
| 08:07 | 5   | 26.601 | 0.1697  | -0.4547        | 18.3           | 20.2           | 23.8           | 26.0           |                 |                |
| 08:08 | 5   | 27.095 | 0.1700  | -0.4614        | 18.5           | 20.4           | 24.6           | 26.1           |                 |                |
| 08:09 | 5   | 27.214 | 0.1714  | -0.4874        | 18.6           | 20.6           | 24.2           | 26.3           |                 |                |
| 08:10 | 5   | 27.468 | 0.1719  | -0.5018        | 18.7           | 20.8           | 24.3           | 26.4           |                 |                |
| 08:11 | 5   | 27.665 | 0.1720  | -0.5265        | 18.8           | 20.9           | 24.5           | 26.5           |                 |                |
| 09:00 | 5   | 27.902 | 0.1723  | -0.5654        | 18.9           | 21.1           | 24.7           | 26.6           |                 |                |
| 09:01 | 5   | 28.126 | 0.1725  | -0.5987        | 19.0           | 21.2           | 24.9           | 26.8           |                 |                |
| 09:02 | 5   | 28.406 | 0.1730  | -0.6147        | 19.2           | 21.3           | 25.0           | 26.9           |                 |                |
| 09:03 | 5   | 28.606 | 0.1730  | -0.6357        | 19.3           | 21.4           | 25.1           | 27.0           |                 |                |
| 09:04 | 5   | 28.734 | 0.1735  | -0.6478        | 19.5           | 21.6           | 25.3           | 27.1           |                 |                |
| 09:05 | 5   | 28.803 | 0.1736  | -0.6531        | 19.6           | 21.8           | 25.5           | 27.2           |                 |                |
| 09:06 | 5   | 29.125 | 0.1740  | -0.6698        | 19.7           | 22.0           | 25.7           | 27.3           |                 |                |
| 09:07 | 5   | 29.456 | 0.1745  | -0.6741        | 19.9           | 22.2           | 25.9           | 27.5           |                 |                |
| 09:08 | 5   | 29.753 | 0.1755  | -0.6814        | 20.0           | 22.4           | 26.1           | 27.7           |                 |                |
| 09:09 | 5   | 30.125 | 0.1756  | -0.6999        | 20.2           | 22.6           | 26.3           | 27.9           |                 |                |
| 09:10 | 5   | 30.452 | 0.1760  | -0.7111        | 20.3           | 22.8           | 26.5           | 28.1           |                 |                |
| 09:11 | 5   | 30.851 | 0.1765  | -0.7222        | 20.4           | 23.0           | 26.7           | 28.3           |                 |                |
| 10:00 | 5   | 31.125 | 0.1778  | -0.7325        | 20.6           | 23.2           | 26.9           | 28.5           |                 |                |

Table (2): shows Egyptian LMS and z scores weight for age for girls from 5 years to 10 years

Weight-for-age GIRLS

Egyptian Z-score 5 Years to 10 Years
| Y:M  | M  | Mean     | S    | L   | -3SD | -2SD | -1SD | Median |
|------|----|----------|------|-----|------|------|------|--------|
| 05:01| 61 | 18.8563  | 0.14121 | -0.3345 | 12.4 | 14.2 | 16.5 | 18.0   |
| 05:02| 62 | 18.9632  | 0.14255 | -0.3355 | 12.5 | 14.3 | 16.6 | 19.0   |
| 05:03| 63 | 19.1526  | 0.14354 | -0.3365 | 12.7 | 14.4 | 16.7 | 19.5   |
| 05:04| 64 | 19.3566  | 0.14456 | -0.3379 | 12.8 | 14.5 | 16.8 | 19.9   |
| 05:05| 65 | 19.4586  | 0.14546 | -0.3387 | 12.9 | 14.6 | 17.0 | 19.9   |
| 05:06| 66 | 19.5035  | 0.14658 | -0.3399 | 13.0 | 14.7 | 17.1 | 19.9   |
| 05:07| 67 | 19.7852  | 0.14789 | -0.4002 | 13.1 | 14.8 | 17.3 | 19.9   |
| 05:08| 68 | 19.8563  | 0.14852 | -0.4025 | 13.2 | 14.9 | 17.4 | 19.9   |
| 05:09| 69 | 20.0252  | 0.14951 | -0.4099 | 13.3 | 15.0 | 17.5 | 20.0   |
| 05:10| 70 | 20.2325  | 0.15099 | -0.4111 | 13.4 | 15.2 | 17.7 | 20.0   |
| 05:11| 71 | 20.4632  | 0.15148 | -0.4125 | 13.5 | 15.3 | 17.9 | 20.0   |
| 06:00| 72 | 20.5963  | 0.15256 | -0.4149 | 13.6 | 15.4 | 18.1 | 20.0   |
| 06:01| 73 | 20.7522  | 0.15369 | -0.4159 | 13.7 | 15.5 | 18.3 | 20.0   |
| 06:02| 74 | 20.9863  | 0.15478 | -0.4201 | 13.8 | 15.6 | 18.4 | 20.0   |
| 06:03| 75 | 21.1525  | 0.15528 | -0.4255 | 13.9 | 15.7 | 18.5 | 21.0   |
| 06:04| 76 | 21.2635  | 0.15654 | -0.4265 | 14.0 | 15.8 | 18.6 | 21.0   |
| 06:05| 77 | 21.4586  | 0.15789 | -0.4288 | 14.2 | 15.9 | 18.8 | 21.0   |
| 06:06| 78 | 21.6589  | 0.15825 | -0.4299 | 14.3 | 16.1 | 19.0 | 21.0   |
| 06:07| 79 | 21.8896  | 0.15936 | -0.4301 | 14.4 | 16.2 | 19.1 | 21.0   |
| 06:08| 80 | 22.0258  | 0.15999 | -0.4322 | 14.5 | 16.3 | 19.3 | 22.0   |
| 06:09| 81 | 22.2035  | 0.16089 | -0.4365 | 14.6 | 16.5 | 19.5 | 22.0   |
| 06:10| 82 | 22.3258  | 0.16101 | -0.4375 | 14.7 | 16.6 | 19.6 | 22.0   |
| 06:11| 83 | 22.5688  | 0.16125 | -0.4401 | 14.8 | 16.7 | 19.8 | 22.0   |
| 07:00| 84 | 22.7663  | 0.16145 | -0.4422 | 14.9 | 16.9 | 19.9 | 22.0   |
| 07:01| 85 | 22.8523  | 0.16189 | -0.4435 | 15.0 | 17.1 | 20.0 | 22.0   |
| 07:02| 86 | 22.9686  | 0.16205 | -0.4455 | 15.1 | 17.2 | 20.1 | 22.0   |
| 07:03| 87 | 23.2585  | 0.16266 | -0.4499 | 15.3 | 17.3 | 20.3 | 23.0   |
| 07:04| 88 | 23.4585  | 0.16355 | -0.4502 | 15.4 | 17.4 | 20.4 | 23.0   |
| 07:05| 89 | 23.6582  | 0.16399 | -0.4555 | 15.6 | 17.5 | 20.6 | 23.0   |
| 07:06| 90 | 23.8622  | 0.16425 | -0.4565 | 15.6 | 17.6 | 20.7 | 23.0   |
| 07:07| 91 | 24.0586  | 0.16899 | -0.4575 | 15.8 | 17.7 | 20.8 | 24.0   |
| 07:08| 92 | 24.2586  | 0.16925 | -0.4581 | 15.9 | 17.9 | 21.0 | 24.0   |
| 07:09| 93 | 24.4652  | 0.16951 | -0.4599 | 16.0 | 18.1 | 21.2 | 24.0   |
| 07:10| 94 | 24.5632  | 0.16978 | -0.4602 | 16.2 | 18.3 | 21.4 | 24.0   |
Table (3): shows Egyptian LMS and z scores height for age for boys from 5 years to 19 years

| Y:M | M  | Mean  | S        | Egyptian Z-score 5 Years to 19 Years |
|-----|----|-------|----------|-------------------------------------|
|     |    |       |          | -3SD  | -2SD  | -1SD  | Median |
| 05:00 | 60 | 109.3 | 4.88159 | 1     | 95.3  | 100   | 104.6  | 109.4  |
| 05:01 | 61 | 109.8 | 5.05613 | 1     | 95.8  | 100.4 | 105    | 109.8  |
| 05:02 | 62 | 110   | 4.79432 | 1     | 96    | 100.8 | 105.5  | 110.1  |
| Time  | Value | Value | Value | Value | Value | Value | Value |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 05:03 | 63    | 110.6 | 4.53252 | 1  | 96.6  | 101.2 | 106  | 110.7 |
| 05:04 | 64    | 111.1 | 4.58836 | 1  | 97    | 101.6 | 106.4 | 111.2 |
| 05:05 | 65    | 111.8 | 4.6442  | 1  | 97.4  | 102.3 | 107  | 111.9 |
| 05:06 | 66    | 112.1 | 4.64402 | 1  | 98    | 102.6 | 107.4 | 112.2 |
| 05:07 | 67    | 112.8 | 4.89975 | 1  | 98.4  | 103   | 108  | 112.9 |
| 05:08 | 68    | 113.5 | 5.02762 | 1  | 98.8  | 103.6 | 108.2 | 113.6 |
| 05:09 | 69    | 113.9 | 5.15549 | 1  | 99    | 104   | 108.9 | 114  |
| 05:10 | 70    | 114.4 | 5.2495  | 1  | 99.8  | 104.3 | 109.2 | 114.5 |
| 05:11 | 71    | 114.9 | 5.10849 | 1  | 100   | 105   | 109.8 | 115  |
| 06:00 | 72    | 115.4 | 4.96748 | 1  | 100.5 | 105.3 | 110.2 | 115.5 |
| 06:01 | 73    | 115.7 | 4.96855 | 1  | 101   | 105.6 | 110.6 | 115.8 |
| 06:02 | 74    | 116.1 | 4.96999 | 1  | 101.2 | 106.3 | 111  | 116.2 |
| 06:03 | 75    | 116.7 | 4.97305 | 1  | 101.7 | 106.6 | 111.5 | 116.8 |
| 06:04 | 76    | 117.2 | 4.98305 | 1  | 102   | 107   | 112  | 117.3 |
| 06:05 | 77    | 117.8 | 4.99306 | 1  | 102.6 | 107.5 | 112.5 | 117.9 |
| 06:06 | 78    | 118.3 | 5.13289 | 1  | 103   | 108   | 113  | 118.4 |
| 06:07 | 79    | 118.7 | 5.18289 | 1  | 103.3 | 108.3 | 113.4 | 118.8 |
| 06:08 | 80    | 119   | 5.20558 | 1  | 103.6 | 108.6 | 114  | 119.1 |
| 06:09 | 81    | 119.6 | 5.28775 | 1  | 104   | 109   | 114.3 | 119.7 |
| 06:10 | 82    | 120   | 5.30669 | 1  | 104.2 | 109.5 | 114.8 | 120.1 |
| 06:11 | 83    | 120.6 | 5.32556 | 1  | 104.9 | 110   | 115.2 | 120.7 |
| 07:00 | 84    | 120.9 | 5.34945 | 1  | 105   | 110.3 | 115.6 | 121  |
| 07:01 | 85    | 121.6 | 5.32445 | 1  | 105.6 | 110.8 | 116  | 121.7 |
| 07:02 | 86    | 121.9 | 5.32669 | 1  | 105.9 | 111.3 | 116.5 | 122  |
| 07:03 | 87    | 122.5 | 5.31189 | 1  | 106.2 | 111.6 | 117  | 122.6 |
| 07:04 | 88    | 122.9 | 5.32669 | 1  | 106.4 | 112   | 117.4 | 123  |
| 07:05 | 89    | 123.4 | 5.3807  | 1  | 107   | 112.4 | 117.8 | 123.5 |
| 07:06 | 90    | 123.9 | 5.4107  | 1  | 107.2 | 112.9 | 118.3 | 124  |
| 07:07 | 91    | 124.4 | 5.45898 | 1  | 107.6 | 113.3 | 118.6 | 124.5 |
| 07:08 | 92    | 124.9 | 5.50749 | 1  | 108   | 113.6 | 119  | 125  |
| 07:09 | 93    | 125.2 | 5.60748 | 1  | 108.6 | 114   | 119.5 | 125.3 |
| 07:10 | 94    | 125.7 | 5.70555 | 1  | 108.9 | 114.3 | 120  | 125.8 |
| 07:11 | 95    | 126   | 5.80693 | 1  | 109.2 | 114.7 | 120.3 | 126.1 |
| 08:00 | 96    | 126.7 | 5.86112 | 1  | 109.6 | 115.2 | 120.8 | 126.8 |
| 08:01 | 97    | 126.9 | 5.63987 | 1  | 110   | 115.7 | 121.2 | 127  |
| Time  | ID  | Value 1 | Value 2 | Value 3 | Value 4 | Value 5 | Value 6 | Value 7 | Value 8 | Value 9 | Value 10 | Value 11 | Value 12 |
|-------|-----|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|-----------|----------|
| 08:02 | 98  | 127.4   | 5.25846 | 1       | 110.3   | 115.9   | 121.6   | 127.5   |
| 08:03 | 99  | 127.9   | 5.78527 | 1       | 110.6   | 116.2   | 122     | 128     |
| 08:04 | 100 | 128.2   | 5.79365 | 1       | 111     | 116.5   | 122.5   | 128.3   |
| 08:05 | 101 | 128.9   | 5.80245 | 1       | 111.3   | 117     | 123     | 129     |
| 08:06 | 102 | 129.2   | 5.81614 | 1       | 111.6   | 117.5   | 123.4   | 129.3   |
| 08:07 | 103 | 129.8   | 5.85963 | 1       | 112     | 118     | 123.6   | 129.9   |
| 08:08 | 104 | 130     | 5.88471 | 1       | 112.3   | 118.3   | 124     | 130.1   |
| 08:09 | 105 | 130.6   | 5.89586 | 1       | 112.7   | 118.6   | 124.5   | 130.7   |
| 08:10 | 106 | 130.9   | 5.91258 | 1       | 113     | 119     | 125     | 131     |
| 08:11 | 107 | 131.4   | 5.93654 | 1       | 113.4   | 119.3   | 125.4   | 131.5   |
| 09:00 | 108 | 131.9   | 5.94979 | 1       | 113.7   | 119.6   | 125.9   | 132     |
| 09:01 | 109 | 132.4   | 5.20369 | 1       | 114     | 120     | 126.2   | 132.5   |
| 09:02 | 110 | 132.7   | 5.30254 | 1       | 114.3   | 120.5   | 126.4   | 132.8   |
| 09:03 | 111 | 133.1   | 6.32289 | 1       | 114.9   | 121     | 127     | 133.2   |
| 09:04 | 112 | 133.7   | 6.32289 | 1       | 115     | 121.3   | 127.4   | 133.8   |
| 09:05 | 113 | 133.9   | 6.34874 | 1       | 115.6   | 121.6   | 127.8   | 134     |
| 09:06 | 114 | 134.5   | 6.35916 | 1       | 115.8   | 122     | 128.2   | 134.6   |
| 09:07 | 115 | 134.9   | 6.47681 | 1       | 116     | 122.4   | 128.5   | 135     |
| 09:08 | 116 | 135.4   | 6.45874 | 1       | 116.6   | 122.7   | 129     | 135.5   |
| 09:09 | 117 | 135.9   | 6.46296 | 1       | 116.8   | 123     | 129.3   | 136     |
| 09:10 | 118 | 136.1   | 6.24934 | 1       | 117.2   | 123.5   | 129.9   | 136.2   |
| 09:11 | 119 | 136.4   | 6.25698 | 1       | 117.5   | 124     | 130.2   | 136.5   |
| 10:00 | 120 | 137     | 6.28541 | 1       | 118     | 124.3   | 130.6   | 137.1   |
| 10:01 | 121 | 137.4   | 6.29665 | 1       | 118.3   | 124.7   | 131     | 137.5   |
| 10:02 | 122 | 137.9   | 6.40236 | 1       | 118.6   | 125     | 131.5   | 138     |
| 10:03 | 123 | 138.5   | 6.42356 | 1       | 119     | 125.5   | 131.7   | 138.6   |
| 10:04 | 124 | 138.9   | 6.45255 | 1       | 119.3   | 125.8   | 132.3   | 139     |
| 10:05 | 125 | 139.4   | 6.25845 | 1       | 119.7   | 126     | 132.6   | 139.5   |
| 10:06 | 126 | 139.7   | 6.45901 | 1       | 120     | 126.6   | 133     | 139.8   |
| 10:07 | 127 | 140     | 6.46987 | 1       | 120.4   | 127     | 133.5   | 140.1   |
| 10:08 | 128 | 140.7   | 6.49654 | 1       | 120.7   | 127.4   | 134     | 140.8   |
| 10:09 | 129 | 140.9   | 6.50756 | 1       | 121     | 127.8   | 134.3   | 141     |
| 10:10 | 130 | 141.4   | 6.78526 | 1       | 121.3   | 128     | 134.7   | 141.5   |
| 10:11 | 131 | 141.9   | 6.25841 | 1       | 121.8   | 128.3   | 135     | 142     |
| 11:00 | 132 | 142.4   | 6.93484 | 1       | 122     | 129     | 135.6   | 142.5   |
| 11:01 | 133 | 142.9   | 6.82548 | 1       | 122.4   | 129.3   | 136     | 143     |
| Time  | Value1 | Value2 | Value3 | Value4 | Value5 | Value6 |
|-------|--------|--------|--------|--------|--------|--------|
| 11:02 | 134    | 143.4  | 6.32548| 1      | 123    | 129.7  |
| 11:03 | 135    | 143.9  | 6.70349| 1      | 123.4  | 130    |
| 11:04 | 136    | 144.3  | 6.85239| 1      | 123.7  | 130.6  |
| 11:05 | 137    | 144.9  | 6.99658| 1      | 124    | 131    |
| 11:06 | 138    | 145.4  | 7.06473| 1      | 124.6  | 131.5  |
| 11:07 | 139    | 145.9  | 7.06584| 1      | 125    | 131.9  |
| 11:08 | 140    | 146.3  | 7.07223| 1      | 125.3  | 132.2  |
| 11:09 | 141    | 146.9  | 7.11258| 1      | 125.7  | 132.6  |
| 11:10 | 142    | 147.4  | 7.11256| 1      | 126    | 133.2  |
| 11:11 | 143    | 147.9  | 7.1528  |1      | 126.7  | 133.6  |
| 12:00 | 144    | 148.3  | 7.11197 |1      | 127    | 134    |
| 12:01 | 145    | 148.9  | 7.12369 |1      | 127.5  | 134.5  |
| 12:02 | 146    | 149.4  | 7.13548 |1      | 128    | 135    |
| 12:03 | 147    | 149.9  | 7.19038 |1      | 128.6  | 135.5  |
| 12:04 | 148    | 150.6  | 7.17258 |1      | 129    | 136    |
| 12:05 | 149    | 151.1  | 7.18936 |1      | 129.5  | 136.6  |
| 12:06 | 150    | 151.7  | 7.15953 |1      | 130    | 137    |
| 12:07 | 151    | 152.4  | 7.25896 |1      | 130.5  | 137.6  |
| 12:08 | 152    | 152.9  | 7.24852 |1      | 131    | 138.2  |
| 12:09 | 153    | 153.4  | 7.48601 |1      | 131.7  | 138.7  |
| 12:10 | 154    | 154    | 7.25895 |1      | 132    | 139.3  |
| 12:11 | 155    | 154.8  | 7.4191  |1      | 132.5  | 139.9  |
| 13:00 | 156    | 155.3  | 7.4391  |1      | 133    | 140.3  |
| 13:01 | 157    | 155.9  | 7.49369 |1      | 133.4  | 141    |
| 13:02 | 158    | 156.6  | 7.51582 |1      | 134    | 141.5  |
| 13:03 | 159    | 157.1  | 7.55582 |1      | 134.5  | 142    |
| 13:04 | 160    | 157.9  | 7.56936 |1      | 135    | 142.6  |
| 13:05 | 161    | 158.3  | 7.57237 |1      | 135.6  | 143.2  |
| 13:06 | 162    | 158.9  | 7.58317 |1      | 136.2  | 143.6  |
| 13:07 | 163    | 159.6  | 7.54852 |1      | 136.7  | 144.2  |
| 13:08 | 164    | 160.1  | 7.56958 |1      | 137.2  | 145    |
| 13:09 | 165    | 160.9  | 7.5476  |1      | 137.9  | 145.3  |
| 13:10 | 166    | 161.4  | 7.61258 |1      | 138.3  | 146    |
| 13:11 | 167    | 161.9  | 7.64365 |1      | 138.9  | 146.5  |
| 14:00 | 168    | 162.4  | 7.62587 |1      | 139.3  | 147    |
| Time  | Value 1 | Value 2 | Value 3 | Value 4 | Value 5 | Value 6 | Value 7 |
|-------|---------|---------|---------|---------|---------|---------|---------|
| 14:01 | 169     | 162.9   | 7.69325 | 1       | 139.7   | 147.6   | 155.3   | 163     |
| 14:02 | 170     | 163.4   | 7.2646  | 1       | 140.2   | 148     | 155.6   | 163.5   |
| 14:03 | 171     | 164.1   | 7.51323 | 1       | 140.8   | 148.5   | 156.2   | 164.2   |
| 14:04 | 172     | 164.4   | 7.65285 | 1       | 141.3   | 149     | 156.8   | 164.5   |
| 14:05 | 173     | 165     | 7.70958 | 1       | 141.7   | 149.6   | 157.3   | 165.1   |
| 14:06 | 174     | 165.4   | 7.74984 | 1       | 142.3   | 150     | 157.7   | 165.5   |
| 14:07 | 175     | 166     | 7.65985 | 1       | 142.7   | 150.4   | 158.2   | 166.1   |
| 14:08 | 176     | 166.4   | 7.58325 | 1       | 143     | 151     | 158.6   | 166.5   |
| 14:09 | 177     | 166.9   | 7.60563 | 1       | 143.6   | 151.2   | 159     | 167     |
| 14:10 | 178     | 167.3   | 7.61258 | 1       | 144     | 151.6   | 159.6   | 167.4   |
| 14:11 | 179     | 167.9   | 7.63258 | 1       | 144.3   | 152     | 160     | 168     |
| 15:00 | 180     | 168.4   | 7.64829 | 1       | 144.7   | 152.6   | 160.5   | 168.5   |
| 15:01 | 181     | 168.7   | 7.62585 | 1       | 145     | 153     | 160.7   | 168.8   |
| 15:02 | 182     | 168.9   | 7.69584 | 1       | 145.5   | 153.3   | 161     | 169     |
| 15:03 | 183     | 169.4   | 7.68082 | 1       | 146     | 153.7   | 161.5   | 169.5   |
| 15:04 | 184     | 169.9   | 7.68082 | 1       | 146.3   | 154     | 162     | 170     |
| 15:05 | 185     | 170     | 7.6582  | 1       | 146.6   | 154.5   | 162.3   | 170.1   |
| 15:06 | 186     | 170.4   | 7.69607 | 1       | 147     | 154.8   | 162.6   | 170.5   |
| 15:07 | 187     | 170.9   | 7.70542 | 1       | 147.4   | 155     | 163     | 171     |
| 15:08 | 188     | 171.1   | 7.74126 | 1       | 147.7   | 155.4   | 163.2   | 171.2   |
| 15:09 | 189     | 171.4   | 7.74219 | 1       | 148     | 155.7   | 163.5   | 171.5   |
| 15:10 | 190     | 171.6   | 7.63259 | 1       | 148.3   | 156     | 163.7   | 171.7   |
| 15:11 | 191     | 171.9   | 7.65294 | 1       | 148.6   | 156.2   | 164     | 172     |
| 16:00 | 192     | 172.1   | 7.51079 | 1       | 148.9   | 156.6   | 164.2   | 172.2   |
| 16:01 | 193     | 172.3   | 7.88363 | 1       | 149     | 156.8   | 164.6   | 172.4   |
| 16:02 | 194     | 172.6   | 7.99258 | 1       | 149.4   | 157     | 164.8   | 172.7   |
| 16:03 | 195     | 172.9   | 8.18876 | 1       | 149.6   | 157.3   | 165     | 173     |
| 16:04 | 196     | 173.1   | 9.02584 | 1       | 149.9   | 157.6   | 165.2   | 173.2   |
| 16:05 | 197     | 173.3   | 7.44582 | 1       | 150     | 157.8   | 165.5   | 173.4   |
| 16:06 | 198     | 173.5   | 7.77163 | 1       | 150.3   | 158     | 165.7   | 173.6   |
| 16:07 | 199     | 173.7   | 7.25841 | 1       | 150.6   | 158.2   | 166     | 173.8   |
| 16:08 | 200     | 173.9   | 7.36952 | 1       | 150.8   | 158.4   | 166.2   | 174     |
| 16:09 | 201     | 174     | 7.73217 | 1       | 151     | 158.6   | 166.4   | 174.1   |
| 16:10 | 202     | 174.2   | 7.65285 | 1       | 151.2   | 158.8   | 166.5   | 174.3   |
| 16:11 | 203     | 174.3   | 7.60258 | 1       | 151.4   | 159     | 166.6   | 174.4   |
Table (4): shows Egyptian LMS and z scores height for age for girls from 5 years to 19 years

| Y:M  | M   | Mean | S         | Height-for-age GIRLS | Egyptian Z-score 5Years to 19 Years |
|------|-----|------|-----------|----------------------|-------------------------------------|
|      |     |      |           |                      | L       | -3SD    | -2SD    | -1SD    | Median |
| 05:01| 61  | 109  | 5.01271   | 1                    | 94.4    | 99.2    | 104.1   | 109     |
| 05:02| 62  | 109.2| 5.01258   | 1                    | 95      | 99.7    | 104.5   | 109.3   |
| 05:03| 63  | 109.8| 5.01281   | 1                    | 95.3    | 100.2   | 105     | 109.9   |
|      |     |      |           |                      | Median  |         |         |         |
| Time  | Value | Value | Value | Value |
|-------|-------|-------|-------|-------|
| 05:04 | 64    | 110.5 | 5.32658 | 1 | 95.6 | 100.6 | 105.5 | 110.5 |
| 05:05 | 65    | 111   | 5.32587 | 1 | 96.2 | 101   | 106   | 111   |
| 05:06 | 66    | 111.5 | 5.33867 | 1 | 96.6 | 101.5 | 106.3 | 111.5 |
| 05:07 | 67    | 111.9 | 5.02587 | 1 | 97   | 102   | 107   | 112   |
| 05:08 | 68    | 112.5 | 5.02658 | 1 | 97.4 | 102.4 | 107.3 | 112.6 |
| 05:09 | 69    | 112.9 | 5.02021 | 1 | 97.7 | 102.8 | 107.9 | 113   |
| 05:10 | 70    | 113.5 | 5.32147 | 1 | 98.1 | 103.1 | 108.2 | 113.6 |
| 05:11 | 71    | 113.9 | 5.25874 | 1 | 98.6 | 103.6 | 108.9 | 114   |
| 06:00 | 72    | 114.4 | 5.31711 | 1 | 99   | 104   | 109.1 | 114.5 |
| 06:01 | 73    | 115   | 5.26584 | 1 | 99.3 | 104.5 | 109.7 | 115   |
| 06:02 | 74    | 115.5 | 5.21478 | 1 | 99.6 | 105   | 110   | 115.5 |
| 06:03 | 75    | 115.9 | 5.08827 | 1 | 100  | 105.3 | 110.4 | 116   |
| 06:04 | 76    | 116.1 | 5.02587 | 1 | 100.5| 105.9 | 111   | 116.2 |
| 06:05 | 77    | 116.7 | 5.14847 | 1 | 101  | 106.2 | 111.5 | 116.8 |
| 06:06 | 78    | 117.2 | 5.45681 | 1 | 101.2| 106.6 | 112   | 117.3 |
| 06:07 | 79    | 117.6 | 5.22654 | 1 | 101.6| 107   | 112.3 | 117.7 |
| 06:08 | 80    | 118   | 5.22963 | 1 | 102  | 107.5 | 112.9 | 118   |
| 06:09 | 81    | 118.5 | 5.22416 | 1 | 102.4| 107.7 | 113.2 | 118.6 |
| 06:10 | 82    | 119   | 5.22874 | 1 | 102.8| 108.1 | 113.7 | 119.1 |
| 06:11 | 83    | 119.6 | 5.22985 | 1 | 103.1| 108.7 | 114   | 119.7 |
| 07:00 | 84    | 120   | 5.39606 | 1 | 103.6| 109   | 114.5 | 120   |
| 07:01 | 85    | 120.6 | 5.39654 | 1 | 104  | 109.5 | 115   | 120.7 |
| 07:02 | 86    | 121   | 5.60258 | 1 | 104.3| 110   | 115.4 | 121   |
| 07:03 | 87    | 121.4 | 5.60727 | 1 | 104.7| 110.3 | 116   | 121.5 |
| 07:04 | 88    | 122   | 5.45789 | 1 | 105.2| 110.9 | 116.3 | 122   |
| 07:05 | 89    | 122.4 | 5.25632 | 1 | 105.6| 111.1 | 116.7 | 122.5 |
| 07:06 | 90    | 122.9 | 5.76285 | 1 | 106  | 111.6 | 117.2 | 123   |
| 07:07 | 91    | 123.4 | 5.21487 | 1 | 106.5| 112   | 117.7 | 123.5 |
| 07:08 | 92    | 124   | 5.28514 | 1 | 106.8| 112.3 | 118   | 124   |
| 07:09 | 93    | 124.3 | 5.56728 | 1 | 107.1| 113   | 118.5 | 124.4 |
| 07:10 | 94    | 124.9 | 5.24854 | 1 | 107.6| 113.3 | 119   | 125   |
| 07:11 | 95    | 125.4 | 5.65987 | 1 | 108  | 113.6 | 119.5 | 125.4 |
| 08:00 | 96    | 125.9 | 5.7613  | 1 | 108.3| 114.1 | 120   | 126   |
| 08:01 | 97    | 126.1 | 6.21525 | 1 | 108.7| 114.6 | 120.5 | 126.2 |
| 08:02 | 98    | 126.6 | 6.23584 | 1 | 109.1| 115   | 121   | 126.7 |
| 08:03 | 99    | 127.2 | 6.21232 | 1 | 109.6| 115.5 | 121.3 | 127.3 |
| Time  | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 08:04 | 100   | 127.7 | 6.06325 | 1     | 110   | 116   | 121.8 | 127.8 |
| 08:05 | 101   | 128.2 | 6.02582 | 1     | 110.4 | 116.3 | 122.2 | 128.3 |
| 08:06 | 102   | 128.6 | 6.06359 | 1     | 110.8 | 116.7 | 122.6 | 128.7 |
| 08:07 | 103   | 129.1 | 6.35924 | 1     | 111.2 | 117.1 | 123.3 | 129.2 |
| 08:08 | 104   | 129.6 | 6.32584 | 1     | 111.7 | 117.6 | 123.8 | 129.7 |
| 08:09 | 105   | 130.2 | 6.38924 | 1     | 112   | 118   | 124.2 | 130.3 |
| 08:10 | 106   | 130.7 | 6.02584 | 1     | 112.4 | 118.5 | 124.6 | 130.8 |
| 08:11 | 107   | 131.1 | 6.02359 | 1     | 113   | 119   | 125   | 131.2 |
| 09:00 | 108   | 131.7 | 6.03576 | 1     | 113.3 | 119.5 | 125.6 | 131.8 |
| 09:01 | 109   | 132.1 | 6.32587 | 1     | 113.8 | 120   | 126   | 132.2 |
| 09:02 | 110   | 132.7 | 6.25478 | 1     | 114.2 | 120.4 | 126.5 | 132.8 |
| 09:03 | 111   | 133.2 | 6.29722 | 1     | 114.6 | 120.9 | 127   | 133.3 |
| 09:04 | 112   | 133.7 | 6.25584 | 1     | 115   | 121.2 | 127.4 | 133.8 |
| 09:05 | 113   | 134.1 | 6.32584 | 1     | 115.5 | 121.7 | 128   | 134.2 |
| 09:06 | 114   | 134.8 | 6.86152 | 1     | 116   | 122.2 | 128.5 | 134.9 |
| 09:07 | 115   | 135.4 | 6.25874 | 1     | 116.5 | 122.6 | 129   | 135.5 |
| 09:08 | 116   | 136   | 6.36985 | 1     | 117   | 123.2 | 129.5 | 136   |
| 09:09 | 117   | 136.4 | 6.64078 | 1     | 117.3 | 123.6 | 130   | 136.5 |
| 09:10 | 118   | 137   | 6.32145 | 1     | 117.7 | 124   | 130.5 | 137   |
| 09:11 | 119   | 137.2 | 6.32652 | 1     | 118.1 | 124.6 | 131   | 137.3 |
| 10:00 | 120   | 137.9 | 6.26325 | 1     | 118.6 | 125   | 131.5 | 138   |
| 10:01 | 121   | 138.4 | 6.23568 | 1     | 119   | 125.4 | 132   | 138.5 |
| 10:02 | 122   | 139   | 6.25874 | 1     | 119.5 | 126   | 132.5 | 139   |
| 10:03 | 123   | 139.4 | 6.76651 | 1     | 120   | 126.4 | 133   | 139.5 |
| 10:04 | 124   | 139.9 | 6.25142 | 1     | 120.5 | 127   | 133.4 | 140   |
| 10:05 | 125   | 140.4 | 6.25143 | 1     | 121   | 127.4 | 134   | 140.5 |
| 10:06 | 126   | 140.9 | 6.94455 | 1     | 121.3 | 128   | 134.4 | 141   |
| 10:07 | 127   | 141.4 | 6.32145 | 1     | 122   | 128.4 | 135   | 141.5 |
| 10:08 | 128   | 142   | 6.31542 | 1     | 122.3 | 129   | 135.5 | 142   |
| 10:09 | 129   | 142.5 | 6.82988 | 1     | 122.8 | 129.4 | 136   | 142.6 |
| 10:10 | 130   | 143   | 7.25874 | 1     | 123.2 | 130   | 136.5 | 143   |
| 10:11 | 131   | 143.7 | 7.25147 | 1     | 123.7 | 130.3 | 137   | 143.8 |
| 11:00 | 132   | 144.3 | 7.2237  | 1     | 124.3 | 131   | 137.4 | 144.4 |
| 11:01 | 133   | 144.8 | 7.22584 | 1     | 124.7 | 131.3 | 138   | 144.9 |
| Time  | Pressure | Temperature | Volatility | Height | Width | Length |
|-------|----------|-------------|------------|--------|-------|--------|
| 11:02 | 134      | 145.2       | 7.33698    | 1      | 125   | 132    |
| 11:03 | 135      | 146         | 6.79107    | 1      | 125.7 | 132.3  |
| 11:04 | 136      | 146.5       | 7.04235    | 1      | 126.1 | 133    |
| 11:05 | 137      | 147         | 7.04524    | 1      | 126.5 | 133.3  |
| 11:06 | 138      | 147.4       | 7.04072    | 1      | 127   | 134    |
| 11:07 | 139      | 147.9       | 7.02587    | 1      | 127.5 | 134.4  |
| 11:08 | 140      | 148.3       | 7.36985    | 1      | 128   | 135    |
| 11:09 | 141      | 148.9       | 7.3796     | 1      | 128.5 | 135.3  |
| 11:10 | 142      | 149.5       | 7.25874    | 1      | 129   | 135.8  |
| 11:11 | 143      | 149.9       | 7.32654    | 1      | 129.4 | 136.3  |
| 12:00 | 144      | 150.5       | 6.91346    | 1      | 130   | 136.8  |
| 12:01 | 145      | 150.9       | 6.99874    | 1      | 130.3 | 137.1  |
| 12:02 | 146      | 151.3       | 6.22584    | 1      | 130.8 | 137.7  |
| 12:03 | 147      | 151.9       | 6.99624    | 1      | 131.1 | 138    |
| 12:04 | 148      | 152.4       | 6.25147    | 1      | 131.6 | 138.5  |
| 12:05 | 149      | 153         | 6.25148    | 1      | 132   | 139    |
| 12:06 | 150      | 153.2       | 7.69385    | 1      | 132.5 | 139.5  |
| 12:07 | 151      | 153.5       | 7.06584    | 1      | 133   | 139.7  |
| 12:08 | 152      | 154         | 7.25147    | 1      | 133.3 | 140.2  |
| 12:09 | 153      | 154.4       | 7.06555    | 1      | 133.6 | 140.6  |
| 12:10 | 154      | 155         | 7.04258    | 1      | 134   | 141    |
| 12:11 | 155      | 155.1       | 7.04528    | 1      | 134.3 | 141.3  |
| 13:00 | 156      | 155.5       | 7.04015    | 1      | 134.7 | 141.6  |
| 13:01 | 157      | 156         | 6.32145    | 1      | 135   | 142    |
| 13:02 | 158      | 156.3       | 6.93258    | 1      | 135.4 | 142.4  |
| 13:03 | 159      | 156.6       | 6.93707    | 1      | 135.7 | 142.7  |
| 13:04 | 160      | 156.9       | 7.02548    | 1      | 136   | 143    |
| 13:05 | 161      | 157.1       | 7.02584    | 1      | 136.4 | 143.2  |
| 13:06 | 162      | 157.4       | 7.05622    | 1      | 136.6 | 143.6  |
| 13:07 | 163      | 157.9       | 7.02587    | 1      | 137   | 144    |
| 13:08 | 164      | 158.1       | 7.02591    | 1      | 137.1 | 144.1  |
| 13:09 | 165      | 158.3       | 7.21633    | 1      | 137.3 | 144.3  |
| 13:10 | 166      | 158.5       | 6.96325    | 1      | 137.4 | 144.5  |
| 13:11 | 167      | 158.7       | 6.39587    | 1      | 137.8 | 145    |
| 14:00 | 168      | 158.9       | 6.9325     | 1      | 138.1 | 145.1  |
| Time  | User | Temp | Measurement | 1 | 2 | 3 | 4 | 5 |
|-------|------|------|-------------|---|---|---|---|---|
| 14:01 | 169  | 159.1 | 6.66547     | 1 | 138.3 | 145.2 | 152.2 | 159.2 |
| 14:02 | 170  | 159.4 | 6.56441     | 1 | 138.5 | 145.4 | 152.5 | 159.5 |
| 14:03 | 171  | 159.6 | 6.78079     | 1 | 138.7 | 145.6 | 152.7 | 159.7 |
| 14:04 | 172  | 159.8 | 6.45871     | 1 | 139   | 145.8 | 152.8 | 159.9 |
| 14:05 | 173  | 159.9 | 6.25147     | 1 | 139.3 | 146   | 153   | 160   |
| 14:06 | 174  | 160   | 6.72809     | 1 | 139.4 | 146.2 | 153.2 | 160.1 |
| 14:07 | 175  | 160.1 | 6.25147     | 1 | 139.6 | 146.4 | 153.4 | 160.2 |
| 14:08 | 176  | 160.3 | 6.25874     | 1 | 139.7 | 146.6 | 153.6 | 160.4 |
| 14:09 | 177  | 160.5 | 6.6758      | 1 | 139.8 | 146.8 | 153.7 | 160.6 |
| 14:10 | 178  | 160.7 | 6.25145     | 1 | 140   | 147   | 153.8 | 160.8 |
| 14:11 | 179  | 160.8 | 6.25147     | 1 | 140.1 | 147.1 | 153.9 | 160.9 |
| 15:00 | 180  | 160.9 | 6.82588     | 1 | 140.2 | 147.2 | 154   | 161   |
| 15:01 | 181  | 161   | 6.25847     | 1 | 140.3 | 147.3 | 154.1 | 161.1 |
| 15:02 | 182  | 161.1 | 6.25841     | 1 | 140.4 | 147.4 | 154.2 | 161.2 |
| 15:03 | 183  | 161.2 | 6.63765     | 1 | 140.5 | 147.5 | 154.3 | 161.2 |
| 15:04 | 184  | 161.2 | 6.25847     | 1 | 140.7 | 147.5 | 154.4 | 161.3 |
| 15:05 | 185  | 161.2 | 6.23154     | 1 | 140.7 | 147.5 | 154.5 | 161.3 |
| 15:06 | 186  | 161.3 | 6.64982     | 1 | 141   | 147.6 | 154.6 | 161.4 |
| 15:07 | 187  | 161.3 | 6.62587     | 1 | 141.1 | 147.8 | 154.6 | 161.4 |
| 15:08 | 188  | 161.3 | 6.62852     | 1 | 141.2 | 147.9 | 154.7 | 161.4 |
| 15:09 | 189  | 161.4 | 6.62815     | 1 | 141.3 | 148   | 154.7 | 161.5 |
| 15:10 | 190  | 161.4 | 6.52698     | 1 | 141.4 | 148.1 | 154.8 | 161.5 |
| 15:11 | 191  | 161.4 | 6.52369     | 1 | 141.5 | 148.2 | 154.8 | 161.5 |
| 16:00 | 192  | 161.5 | 6.5274      | 1 | 141.6 | 148.3 | 154.8 | 161.6 |
| 16:01 | 193  | 161.5 | 6.41789     | 1 | 141.7 | 148.4 | 155   | 161.6 |
| 16:02 | 194  | 161.6 | 6.41654     | 1 | 141.8 | 148.5 | 155   | 161.7 |
| 16:03 | 195  | 161.6 | 6.41905     | 1 | 141.9 | 148.6 | 155   | 161.7 |
| 16:04 | 196  | 161.7 | 6.42654     | 1 | 142   | 148.6 | 155.1 | 161.8 |
| 16:05 | 197  | 161.7 | 6.42587     | 1 | 142.1 | 148.7 | 155.1 | 161.8 |
| 16:06 | 198  | 161.7 | 6.42287     | 1 | 142.2 | 148.7 | 155.2 | 161.8 |
| 16:07 | 199  | 161.8 | 6.50258     | 1 | 142.3 | 148.8 | 155.2 | 161.9 |
| 16:08 | 200  | 161.8 | 6.32548     | 1 | 142.4 | 148.8 | 155.2 | 161.9 |
| 16:09 | 201  | 161.8 | 6.50674     | 1 | 142.4 | 148.9 | 155.3 | 161.9 |
| 16:10 | 202  | 162   | 6.39584     | 1 | 142.5 | 148.9 | 155.3 | 162   |
| 16:11 | 203  | 162   | 6.39654     | 1 | 142.5 | 149   | 155.3 | 162   |
Table (5): shows Egyptian LMS and z scores BMI for age for boys from 5 years to 19 years

| Y:M | M  | Mean       | S         | BMI-for-age BOYS |
|-----|----|------------|-----------|------------------|
|     |    |            |           | Egyptian Z-score 5Years to 19 Years | -3SD | -2SD | -1SD | Median | 1SD |
| 05:01 | 61 | 15.7062    | 0.08502  | -0.3611          | 12.5 | 13.3 | 14.5 | 15.7   | 17.1 |
| 05:02 | 62 | 15.7359    | 0.08525  | -0.3633          | 12.5 | 13.3 | 14.5 | 15.7   | 17.2 |
| 05:03 | 63 | 15.7456    | 0.08539  | -0.3655          | 12.5 | 13.3 | 14.5 | 15.7   | 17.2 |
| 05:04 | 64 | 15.7586    | 0.08555  | -0.3699          | 12.5 | 13.3 | 14.5 | 15.7   | 17.2 |
| 05:05 | 65 | 15.7685    | 0.08599  | -0.3744          | 12.5 | 13.3 | 14.5 | 15.7   | 17.2 |
| Time   | Value 1 | Value 2 | Value 3 | Value 4 | Value 5 | Value 6 |
|--------|---------|---------|---------|---------|---------|---------|
| 05:06  | 66      | 15.7758 | 0.08602 | 0.3777  | 12.5    | 13.3    | 14.5    | 15.7    | 17.2    |
| 05:07  | 67      | 15.7862 | 0.08609 | 0.3788  | 12.5    | 13.3    | 14.5    | 15.7    | 17.2    |
| 05:08  | 68      | 15.7895 | 0.08623 | 0.3799  | 12.5    | 13.3    | 14.5    | 15.7    | 17.2    |
| 05:09  | 69      | 15.7935 | 0.08665 | 0.3801  | 12.5    | 13.3    | 14.5    | 15.7    | 17.2    |
| 05:10  | 70      | 15.8052 | 0.08688 | 0.3822  | 12.5    | 13.3    | 14.5    | 15.8    | 17.2    |
| 05:11  | 71      | 15.8125 | 0.08711 | 0.3844  | 12.5    | 13.3    | 14.5    | 15.8    | 17.2    |
| 05:12  | 72      | 15.8687 | 0.08755 | 0.3855  | 12.5    | 13.3    | 14.5    | 15.8    | 17.3    |
| 05:13  | 73      | 15.8789 | 0.08745 | 0.3865  | 12.5    | 13.3    | 14.5    | 15.8    | 17.3    |
| 05:14  | 74      | 15.8896 | 0.08765 | 0.3875  | 12.6    | 13.3    | 14.5    | 15.8    | 17.3    |
| 05:15  | 75      | 15.8938 | 0.08799 | 0.3885  | 12.6    | 13.3    | 14.5    | 15.8    | 17.3    |
| 05:16  | 76      | 15.9085 | 0.08803 | 0.3895  | 12.6    | 13.3    | 14.5    | 15.9    | 17.3    |
| 05:17  | 77      | 15.9093 | 0.08833 | 0.3899  | 12.6    | 13.3    | 14.5    | 15.9    | 17.3    |
| 05:18  | 78      | 15.9185 | 0.08845 | 0.3901  | 12.6    | 13.3    | 14.6    | 15.9    | 17.4    |
| 05:19  | 79      | 15.9356 | 0.08861 | 0.3922  | 12.6    | 13.3    | 14.6    | 15.9    | 17.4    |
| 05:20  | 80      | 15.9756 | 0.08877 | 0.3935  | 12.6    | 13.3    | 14.6    | 15.9    | 17.4    |
| 05:21  | 81      | 15.9985 | 0.08888 | 0.3945  | 12.6    | 13.3    | 14.6    | 15.9    | 17.4    |
| 05:22  | 82      | 16.0159 | 0.08901 | 0.3956  | 12.6    | 13.3    | 14.6    | 16      | 17.4    |
| 05:23  | 83      | 16.0358 | 0.08945 | 0.3966  | 12.6    | 13.3    | 14.6    | 16      | 17.4    |
| 05:24  | 84      | 16.0458 | 0.08955 | 0.3978  | 12.7    | 13.3    | 14.6    | 16      | 17.5    |
| 05:25  | 85      | 16.0689 | 0.08999 | 0.3999  | 12.7    | 13.3    | 14.6    | 16      | 17.6    |
| 05:26  | 86      | 16.0786 | 0.09001 | 0.4009  | 12.7    | 13.3    | 14.7    | 16      | 17.6    |
| 05:27  | 87      | 16.1158 | 0.09039 | 0.4022  | 12.7    | 13.3    | 14.7    | 16.1    | 17.7    |
| 05:28  | 88      | 16.135  | 0.09111 | 0.4125  | 12.7    | 13.4    | 14.7    | 16.1    | 17.7    |
| 05:29  | 89      | 16.1456 | 0.09123 | 0.4258  | 12.7    | 13.4    | 14.7    | 16.1    | 17.7    |
| 05:30  | 90      | 16.2285 | 0.09129 | 0.4359  | 12.7    | 13.4    | 14.7    | 16.2    | 17.8    |
| 05:31  | 91      | 16.2586 | 0.09254 | 0.4458  | 12.8    | 13.4    | 14.7    | 16.2    | 17.8    |
| 05:32  | 92      | 16.2753 | 0.09299 | 0.4528  | 12.8    | 13.4    | 14.7    | 16.2    | 17.8    |
| 05:33  | 93      | 16.3158 | 0.09311 | 0.4658  | 12.8    | 13.4    | 14.8    | 16.3    | 17.8    |
| 05:34  | 94      | 16.3452 | 0.09322 | 0.4789  | 12.8    | 13.4    | 14.8    | 16.3    | 17.8    |
| 05:35  | 95      | 16.3689 | 0.09355 | 0.4852  | 12.8    | 13.4    | 14.8    | 16.3    | 17.9    |
| 05:36  | 96      | 16.4285 | 0.09388 | 0.4951  | 12.9    | 13.4    | 14.8    | 16.4    | 17.9    |
| 05:37  | 97      | 16.4658 | 0.09399 | 0.4999  | 12.9    | 13.5    | 14.8    | 16.4    | 18      |
| 05:38  | 98      | 16.4902 | 0.09401 | 0.5044  | 12.9    | 13.5    | 14.8    | 16.4    | 18      |
| 05:39  | 99      | 16.5054 | 0.09409 | 0.5124  | 12.9    | 13.5    | 14.8    | 16.5    | 18      |
| 05:40  | 100     | 16.5125 | 0.09412 | 0.5214  | 12.9    | 13.5    | 14.9    | 16.5    | 18      |
| Time  | Value 1 | Value 2 | Value 3 | Value 4 | Value 5 | Value 6 | Value 7 | Value 8 | Value 9 | Value 10 |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| 08:05 | 101     | 16.668  | 0.09422 | -0.5369 | 12.9    | 13.6    | 14.9    | 16.6    | 18.1    |          |
| 08:06 | 102     | 16.6785 | 0.09455 | -0.5417 | 12.9    | 13.6    | 14.9    | 16.6    | 18.1    |          |
| 08:07 | 103     | 16.7075 | 0.09466 | -0.5528 | 13.0    | 13.6    | 14.9    | 16.7    | 18.1    |          |
| 08:08 | 104     | 16.7305 | 0.09484 | -0.5652 | 13.0    | 13.6    | 14.9    | 16.7    | 18.2    |          |
| 08:09 | 105     | 8       | 16.8356 | 0.09488 | -0.5789 | 13.0    | 13.7    | 14.9    | 16.8    | 18.2    |
| 08:10 | 106     | 8       | 16.8356 | 0.09498 | -0.5841 | 13.0    | 13.7    | 15.0    | 16.8    | 18.3    |
| 08:11 | 107     | 16.9752 | 0.09502 | -0.5962 | 13.0    | 13.7    | 15.0    | 16.9    | 18.3    |          |
| 09:00 | 108     | 16.9963 | 0.09522 | -0.5989 | 13.1    | 13.7    | 15.0    | 16.9    | 18.3    |          |
| 09:01 | 109     | 16.9996 | 0.09536 | -0.6014 | 13.1    | 13.8    | 15.0    | 16.9    | 18.4    |          |
| 09:02 | 110     | 17.0456 | 0.09545 | -0.6125 | 13.1    | 13.8    | 15.0    | 17.0    | 18.4    |          |
| 09:03 | 111     | 17.0562 | 0.09565 | -0.6258 | 13.1    | 13.8    | 15.1    | 17.0    | 18.4    |          |
| 09:04 | 112     | 17.1185 | 0.09575 | -0.6364 | 13.1    | 13.8    | 15.1    | 17.1    | 18.4    |          |
| 09:05 | 113     | 17.1258 | 0.09622 | -0.6458 | 13.1    | 13.8    | 15.1    | 17.1    | 18.5    |          |
| 09:06 | 114     | 17.2685 | 0.09755 | -0.6521 | 13.2    | 13.9    | 15.1    | 17.2    | 18.5    |          |
| 09:07 | 115     | 17.2285 | 0.09841 | -0.6621 | 13.2    | 13.9    | 15.2    | 17.2    | 18.6    |          |
| 09:08 | 116     | 17.3658 | 0.09962 | -0.6741 | 13.2    | 13.9    | 15.2    | 17.3    | 18.6    |          |
| 09:09 | 117     | 17.3952 | 0.10003 | -0.6874 | 13.2    | 13.9    | 15.2    | 17.3    | 18.7    |          |
| 09:10 | 118     | 17.4175 | 0.10023 | -0.6958 | 13.2    | 13.9    | 15.2    | 17.4    | 18.7    |          |
| 09:11 | 119     | 17.4956 | 0.10057 | -0.6988 | 13.3    | 13.9    | 15.3    | 17.4    | 18.8    |          |
| 10:00 | 120     | 17.5458 | 0.10111 | -0.7018 | 13.3    | 13.9    | 15.3    | 17.5    | 18.8    |          |
| 10:01 | 121     | 17.5963 | 0.10254 | -0.7022 | 13.3    | 14.0    | 15.4    | 17.5    | 18.9    |          |
| 10:02 | 122     | 17.5993 | 0.10365 | -0.7147 | 13.3    | 14.0    | 15.4    | 17.5    | 18.9    |          |
| 10:03 | 123     | 17.6257 | 0.10478 | -0.7248 | 13.3    | 14.0    | 15.4    | 17.6    | 19.0    |          |
| 10:04 | 124     | 17.6658 | 0.10569 | -0.7325 | 13.4    | 14.0    | 15.5    | 17.6    | 19.0    |          |
| 10:05 | 125     | 17.7175 | 0.10698 | -0.7425 | 13.4    | 14.1    | 15.5    | 17.7    | 19.1    |          |
| 10:06 | 126     | 17.7523 | 0.10789 | -0.7528 | 13.4    | 14.1    | 15.5    | 17.7    | 19.2    |          |
| 10:07 | 127     | 17.7785 | 0.10814 | -0.7635 | 13.4    | 14.1    | 15.6    | 17.7    | 19.3    |          |
| 10:08 | 128     | 17.8201 | 0.10874 | -0.7789 | 13.5    | 14.1    | 15.6    | 17.8    | 19.3    |          |
| 10:09 | 129     | 17.8513 | 0.10911 | -0.7852 | 13.5    | 14.2    | 15.6    | 17.8    | 19.4    |          |
| 10:10 | 130     | 17.9074 | 0.10925 | -0.7936 | 13.5    | 14.2    | 15.7    | 17.9    | 19.4    |          |
| 10:11 | 131     | 17.9632 | 0.10955 | -0.8125 | 13.5    | 14.2    | 15.7    | 17.9    | 19.5    |          |
| 10:00 | 132     | 18.042  | 0.10999 | -0.8258 | 13.6    | 14.3    | 15.7    | 18.0    | 19.6    |          |
| 11:01 | 133     | 18.067  | 0.11005 | -0.8458 | 13.6    | 14.3    | 15.8    | 18.0    | 19.6    |          |
| 11:02 | 134     | 18.085  | 0.11009 | -0.8582 | 13.6    | 14.3    | 15.8    | 18.0    | 19.7    |          |
| Time  | Value 1  | Value 2  | Difference | Value 3 | Value 4 | Value 5 | Value 6 |
|-------|----------|----------|------------|---------|---------|---------|---------|
| 11:03 | 135      | 18.1125  | -0.8635    | 13.6    | 14.4    | 15.8    | 18.1    | 19.7    |
| 11:04 | 136      | 18.1345  | -0.8952    | 13.7    | 14.4    | 15.9    | 18.1    | 19.8    |
| 11:05 | 137      | 18.1345  | -0.9125    | 13.7    | 14.4    | 15.9    | 18.1    | 19.9    |
| 11:06 | 138      | 2        | -0.9365    | 13.7    | 14.5    | 15.9    | 18.2    | 20      |
| 11:07 | 139      | 18.2364  | -0.9587    | 13.7    | 14.5    | 16      | 18.2    | 20      |
| 11:08 | 140      | 18.3563  | -0.9852    | 13.7    | 14.5    | 16      | 18.3    | 20      |
| 11:09 | 141      | 18.3756  | -0.9925    | 13.8    | 14.5    | 16      | 18.3    | 20.1    |
| 11:10 | 142      | 18.4105  | -1.0009    | 13.8    | 14.6    | 16.1    | 18.4    | 20.2    |
| 11:11 | 143      | 18.4357  | -1.0099    | 13.8    | 14.6    | 16.1    | 18.4    | 20.3    |
| 12:00 | 144      | 18.521   | -1.0125    | 13.8    | 14.6    | 16.1    | 18.5    | 20.4    |
| 12:01 | 145      | 18.5732  | -1.0357    | 13.9    | 14.7    | 16.2    | 18.5    | 20.5    |
| 12:02 | 146      | 18.5993  | -1.0591    | 13.9    | 14.7    | 16.2    | 18.5    | 20.6    |
| 12:03 | 147      | 18.6212  | -1.0852    | 13.9    | 14.7    | 16.3    | 18.6    | 20.6    |
| 12:04 | 148      | 18.6632  | -1.0999    | 14      | 14.8    | 16.3    | 18.6    | 20.7    |
| 12:05 | 149      | 18.7045  | -1.1125    | 14      | 14.8    | 16.4    | 18.7    | 20.8    |
| 12:06 | 150      | 18.7358  | -1.1258    | 14      | 14.8    | 16.5    | 18.7    | 20.9    |
| 12:07 | 151      | 18.801   | -1.1456    | 14.1    | 14.9    | 16.5    | 18.8    | 20.9    |
| 12:08 | 152      | 18.9635  | -1.1658    | 14.1    | 15      | 16.6    | 18.9    | 21      |
| 12:09 | 153      | 19.045   | -1.1789    | 14.2    | 15      | 16.6    | 19      | 21.1    |
| 12:10 | 154      | 19.1158  | -1.1899    | 14.2    | 15      | 16.7    | 19.1    | 21.2    |
| 12:11 | 155      | 19.1358  | -1.1936    | 14.2    | 15.1    | 16.7    | 19.1    | 21.3    |
| 13:00 | 156      | 19.2258  | -1.2002    | 14.2    | 15.1    | 16.8    | 19.2    | 21.3    |
| 13:01 | 157      | 19.2652  | -1.2022    | 14.3    | 15.2    | 16.9    | 19.2    | 21.4    |
| 13:02 | 158      | 19.3275  | -1.2123    | 14.3    | 15.2    | 17      | 19.3    | 21.5    |
| 13:03 | 159      | 19.3358  | -1.2369    | 14.4    | 15.3    | 17      | 19.3    | 21.6    |
| 13:04 | 160      | 19.4452  | -1.2456    | 14.4    | 15.3    | 17.1    | 19.4    | 21.6    |
| 13:05 | 161      | 19.5963  | -1.2589    | 14.4    | 15.3    | 17.1    | 19.5    | 21.6    |
| 13:06 | 162      | 19.6052  | -1.2698    | 14.5    | 15.4    | 17.2    | 19.6    | 21.7    |
| 13:07 | 163      | 19.7624  | -1.2789    | 14.5    | 15.4    | 17.2    | 19.7    | 21.7    |
| 13:08 | 164      | 19.7963  | -1.2985    | 14.6    | 15.4    | 17.3    | 19.7    | 21.8    |
| 13:09 | 165      | 19.8204  | -1.3058    | 14.6    | 15.5    | 17.3    | 19.8    | 21.8    |
| 13:10 | 166      | 19.8602  | -1.3129    | 14.7    | 15.5    | 17.4    | 19.8    | 21.9    |
| 13:11 | 167      | 19.9304  | -1.3299    | 14.7    | 15.6    | 17.4    | 19.9    | 22      |
| 14:00 | 168      | 20.043   | -1.3369    | 14.7    | 15.6    | 17.4    | 20      | 22.1    |
| 14:01 | 169      | 20.0576  | -1.3587    | 14.8    | 15.7    | 17.5    | 20      | 22.2    |
| Time  | Temperature | Pressure | Wind Speed | Wind Direction |
|-------|-------------|----------|------------|----------------|
| 14:02 | 17.0        | 20.1152  | -1.3639    | 14.8           |
| 14:03 | 17.1        | 20.1963  | -1.3789    | 14.8           |
| 14:04 | 17.2        | 20.2243  | -1.3985    | 14.9           |
| 14:05 | 17.3        | 20.2538  | -1.4123    | 14.9           |
| 14:06 | 17.4        | 20.3279  | -1.4369    | 14.9           |
| 14:07 | 17.5        | 20.3685  | -1.4759    | 15             |
| 14:08 | 17.6        | 20.4135  | -1.4999    | 15             |
| 14:09 | 17.7        | 20.4896  | -1.5258    | 15             |
| 14:10 | 17.8        | 20.5357  | -1.5456    | 15.1           |
| 14:11 | 17.9        | 20.5687  | -1.5852    | 15.1           |
| 15:00 | 18.0        | 20.6152  | -1.5999    | 15.2           |
| 15:01 | 18.1        | 20.6685  | -1.6125    | 15.2           |
| 15:02 | 18.2        | 20.6963  | -1.6456    | 15.2           |
| 15:03 | 18.3        | 20.7245  | -1.6852    | 15.3           |
| 15:04 | 18.4        | 20.7356  | -1.6963    | 15.3           |
| 15:05 | 18.5        | 20.7789  | -1.7003    | 15.3           |
| 15:06 | 18.6        | 20.8052  | -1.7125    | 15.4           |
| 15:07 | 18.7        | 20.8605  | -1.7009    | 15.4           |
| 15:08 | 18.8        | 20.8785  | -1.6852    | 15.4           |
| 15:09 | 18.9        | 20.9301  | -1.6521    | 15.5           |
| 15:10 | 19.0        | 21.08    | -1.6123    | 15.5           |
| 15:11 | 19.1        | 21.0963  | -1.5987    | 15.6           |
| 16:00 | 19.2        | 21.1342  | -1.5258    | 15.6           |
| 16:01 | 19.3        | 21.1356  | -1.4963    | 15.6           |
| 16:02 | 19.4        | 21.2275  | -1.4528    | 15.6           |
| 16:03 | 19.5        | 21.2369  | -1.4325    | 15.7           |
| 16:04 | 19.6        | 21.3356  | -1.4111    | 15.7           |
| 16:05 | 19.7        | 21.3563  | -1.3987    | 15.7           |
| 16:06 | 19.8        | 21.3756  | -1.3528    | 15.8           |
| 16:07 | 19.9        | 21.4205  | -1.3411    | 15.8           |
| 16:08 | 20.0        | 21.4356  | -1.3211    | 15.9           |
| 16:09 | 20.1        | 21.5453  | -1.3009    | 15.9           |
| 16:10 | 20.2        | 21.5896  | -1.2951    | 15.9           |
| 16:11 | 20.3        | 21.6234  | -1.2841    | 16             |
| 17:00 | 20.4        | 21.6863  | -1.2211    | 16             |
Table (6): shows Egyptian LMS and z scores BMI for age for girls from 5 years to 19 years

| Y:M   | M   | Mean     | S         | Egyptian Z-score 5 Years to 19 Years | Median | 1SD | 2SD |
|-------|-----|----------|-----------|-------------------------------------|--------|-----|-----|
| 05:01 | 61  | 15.5985  | 0.08852   | 12  13  14.5                       | 15.5   | 17.5| 2C  |
| 05:02 | 62  | 15.5756  | 0.08963   | 12  13  14.5                       | 15.5   | 17.5| 2C  |
| 05:03 | 63  | 15.5685  | 0.08999   | 12  13  14.5                       | 15.5   | 17.5| 2C  |
| 05:04 | 64  | 15.544   | 0.09009   | 12  13  14.5                       | 15.5   | 17.5| 2C  |
| 05:05 | 65  | 15.5356  | 0.09011   | 12  13  14.5                       | 15.5   | 17.5| 2C  |
| Time  | Value1  | Value2  | Value3  | Value4  | Value5  | Value6  | Value7  | Value8  |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|
| 05:06 | 66      | 15.5305 | 0.09123 | -0.9016 | 12      | 13      | 14.5    | 15.5    | 17.6    |
| 05:07 | 67      | 15.5012 | 0.09222 | -0.9111 | 12      | 13      | 14.5    | 15.5    | 17.6    |
| 05:08 | 68      | 15.4756 | 0.09299 | -0.9569 | 12      | 13      | 14.5    | 15.5    | 17.6    |
| 05:09 | 69      | 15.4358 | 0.09369 | -0.9889 | 12      | 13      | 14.5    | 15.5    | 17.6    |
| 05:10 | 70      | 15.6420 | 0.09456 | -1.0258 | 12      | 13      | 14.5    | 15.6    | 17.6    |
| 05:11 | 71      | 15.6589 | 0.09588 | -1.0369 | 12      | 13      | 14.5    | 15.6    | 17.6    |
| 06:00 | 72      | 15.6689 | 0.09623 | -1.0458 | 12      | 13      | 14.5    | 15.6    | 17.7    |
| 06:01 | 73      | 15.686  | 0.09789 | -1.0789 | 12      | 13      | 14.5    | 15.6    | 17.7    |
| 06:02 | 74      | 15.696  | 0.09825 | -1.0899 | 12      | 13      | 14.5    | 15.6    | 17.7    |
| 06:03 | 75      | 15.704  | 0.09963 | -1.0936 | 12      | 13      | 14.5    | 15.7    | 17.7    |
| 06:04 | 76      | 15.7357 | 0.09999 | -1.1022 | 12      | 13      | 14.5    | 15.7    | 17.7    |
| 06:05 | 77      | 15.7583 | 0.10015 | -1.1055 | 12      | 13      | 14.5    | 15.7    | 17.7    |
| 06:06 | 78      | 15.7862 | 0.10049 | -1.1125 | 12      | 13      | 14.5    | 15.7    | 17.8    |
| 06:07 | 79      | 15.7963 | 0.10109 | -1.1222 | 12      | 13      | 14.5    | 15.7    | 17.8    |
| 06:08 | 80      | 15.8042 | 0.10199 | -1.1325 | 12      | 13      | 14.5    | 15.8    | 17.8    |
| 06:09 | 81      | 15.8358 | 0.10212 | -1.1369 | 12      | 13      | 14.5    | 15.8    | 17.8    |
| 06:10 | 82      | 15.8458 | 0.10222 | -1.1399 | 12      | 13      | 14.5    | 15.8    | 17.8    |
| 06:11 | 83      | 15.7687 | 0.10236 | -1.1411 | 12      | 13      | 14.5    | 15.8    | 17.9    |
| 07:00 | 84      | 15.8358 | 0.10288 | -1.1502 | 12      | 13      | 14.5    | 15.8    | 17.9    |
| 07:01 | 85      | 15.8785 | 0.10299 | -1.1602 | 12.1    | 13      | 14.6    | 15.8    | 17.9    |
| 07:02 | 86      | 15.8962 | 0.10311 | -1.1632 | 12.1    | 13      | 14.6    | 15.9    | 17.9    |
| 07:03 | 87      | 15.994  | 0.10333 | -1.1706 | 12.1    | 13      | 14.6    | 15.9    | 18.1    |
| 07:04 | 88      | 15.999  | 0.10365 | -1.1709 | 12.1    | 13      | 14.6    | 15.9    | 18.1    |
| 07:05 | 89      | 16.014  | 0.10399 | -1.1836 | 12.1    | 13      | 14.6    | 16.1    | 18.1    |
| 07:06 | 90      | 16.045  | 0.10411 | -1.1936 | 12.1    | 13      | 14.7    | 16.1    | 18.1    |
| 07:07 | 91      | 16.068  | 0.10454 | -1.1989 | 12.1    | 13      | 14.7    | 16.1    | 18.1    |
| 07:08 | 92      | 16.115  | 0.10499 | -1.2009 | 12.1    | 13      | 14.7    | 16.1    | 18.1    |
| 07:09 | 93      | 16.1358 | 0.10501 | -1.2055 | 12.1    | 13      | 14.8    | 16.1    | 18.2    |
| 07:10 | 94      | 16.2258 | 0.10522 | -1.2123 | 12.1    | 13      | 14.8    | 16.2    | 18.2    |
| 07:11 | 95      | 16.2456 | 0.10533 | -1.2254 | 12.1    | 13      | 14.8    | 16.2    | 18.2    |
| 08:00 | 96      | 16.3358 | 0.10555 | -1.2299 | 12.1    | 13      | 14.9    | 16.3    | 18.3    |
| 08:01 | 97      | 16.3456 | 0.10599 | -1.2311 | 12.2    | 13      | 14.9    | 16.3    | 18.3    |
| 08:02 | 98      | 16.4752 | 0.10612 | -1.2345 | 12.2    | 13      | 14.9    | 16.4    | 18.3    |
| 08:03 | 99      | 16.4962 | 0.10632 | -1.2398 | 12.2    | 13      | 14.9    | 16.4    | 18.4    |
| 08:04 | 100     | 16.5254 | 0.10657 | -1.2417 | 12.2    | 13      | 14.9    | 16.5    | 18.4    |
| Time  | Code | Value_1  | Value_2  | Value_3  | Value_4  | Value_5  | Value_6  |
|-------|------|----------|----------|----------|----------|----------|----------|
| 08:05 | 101  | 16.5532  | 0.10666  | -1.2587  | 12.3     | 13.2     | 15       | 16.5     | 18.4     | 22       |
| 08:06 | 102  | 16.6014  | 0.10699  | -1.2599  | 12.3     | 13.3     | 15       | 16.6     | 18.6     | 22       |
| 08:07 | 103  | 16.6856  | 0.10711  | -1.2602  | 12.3     | 13.3     | 15       | 16.6     | 18.6     | 22       |
| 08:08 | 104  | 16.7245  | 0.10755  | -1.2613  | 12.3     | 13.3     | 15.1     | 16.7     | 18.6     | 2        |
| 08:09 | 105  | 16.7625  | 0.10766  | -1.2678  | 12.3     | 13.3     | 15.1     | 16.7     | 18.6     | 24       |
| 08:10 | 106  | 16.812   | 0.10777  | -1.2699  | 12.3     | 13.3     | 15.1     | 16.8     | 18.7     | 22       |
| 08:11 | 107  | 16.8358  | 0.10799  | -1.2709  | 12.3     | 13.3     | 15.2     | 16.8     | 18.7     | 22       |
| 09:00 | 108  | 16.8752  | 0.10801  | -1.2711  | 12.4     | 13.4     | 15.2     | 16.9     | 18.8     | 22       |
| 09:01 | 109  | 16.9015  | 0.10932  | -1.2789  | 12.4     | 13.4     | 15.2     | 16.9     | 18.8     | 22       |
| 09:02 | 110  | 16.9358  | 0.11002  | -1.2799  | 12.4     | 13.4     | 15.2     | 17       | 18.9     | 22       |
| 09:03 | 111  | 17.075   | 0.11125  | -1.2802  | 12.5     | 13.4     | 15.3     | 17.1     | 19       | 22       |
| 09:04 | 112  | 17.0956  | 0.11236  | -1.2825  | 12.5     | 13.5     | 15.3     | 17.1     | 19       | 22       |
| 09:05 | 113  | 17.1158  | 0.11369  | -1.2855  | 12.5     | 13.5     | 15.3     | 17.2     | 19.1     | 22       |
| 09:06 | 114  | 17.2357  | 0.11456  | -1.2888  | 12.6     | 13.5     | 15.4     | 17.3     | 19.2     | 22       |
| 09:07 | 115  | 17.3102  | 0.11569  | -1.2899  | 12.6     | 13.6     | 15.4     | 17.3     | 19.3     | 22       |
| 09:08 | 116  | 17.4357  | 0.11698  | -1.2905  | 12.6     | 13.6     | 15.4     | 17.4     | 19.4     | 22       |
| 09:09 | 117  | 17.4852  | 0.11754  | -1.2946  | 12.6     | 13.6     | 15.5     | 17.4     | 19.4     | 22       |
| 09:10 | 118  | 17.5421  | 0.11852  | -1.2988  | 12.7     | 13.7     | 15.5     | 17.5     | 19.4     | 2        |
| 09:11 | 119  | 17.5965  | 0.11963  | -1.2999  | 12.7     | 13.7     | 15.5     | 17.5     | 19.5     | 24       |
| 10:00 | 120  | 17.654   | 0.11999  | -1.3005  | 12.7     | 13.7     | 15.5     | 17.6     | 19.5     | 24       |
| 10:01 | 121  | 17.635   | 0.12009  | -1.3009  | 12.8     | 13.8     | 15.5     | 17.6     | 19.5     | 24       |
| 10:02 | 122  | 17.7752  | 0.12125  | -1.3041  | 12.8     | 13.8     | 15.5     | 17.7     | 19.6     | 24       |
| 10:03 | 123  | 17.8245  | 0.12258  | -1.3069  | 12.9     | 13.8     | 15.6     | 17.8     | 19.6     | 24       |
| 10:04 | 124  | 17.885   | 0.12369  | -1.3099  | 12.9     | 13.9     | 15.6     | 17.8     | 19.7     | 24       |
| 10:05 | 125  | 17.9175  | 0.12456  | -1.3148  | 12.9     | 14       | 15.6     | 17.9     | 19.8     | 24       |
| 10:06 | 126  | 17.9358  | 0.12569  | -1.3189  | 13       | 14       | 15.6     | 17.9     | 19.9     | 24       |
| 10:07 | 127  | 17.9991  | 0.12698  | -1.3201  | 13       | 14       | 15.7     | 18       | 20       | 24       |
| 10:08 | 128  | 18.028   | 0.12789  | -1.3222  | 13       | 14       | 15.7     | 18       | 20.1     | 24       |
| 10:09 | 129  | 18.1258  | 0.12852  | -1.3299  | 13.1     | 14.1     | 15.7     | 18.1     | 20.2     | 24       |
| 10:10 | 130  | 18.2352  | 0.12863  | -1.3302  | 13.1     | 14.1     | 15.8     | 18.2     | 20.3     | 2        |
| 10:11 | 131  | 18.2856  | 0.12987  | -1.3311  | 13.1     | 14.1     | 15.8     | 18.2     | 20.4     | 25       |
| 11:00 | 132  | 18.3358  | 0.13006  | -1.3333  | 13.2     | 14.2     | 15.8     | 18.3     | 20.5     | 25       |
| 11:01 | 133  | 18.3697  | 0.13022  | -1.3458  | 13.2     | 14.2     | 15.9     | 18.3     | 20.5     | 25       |
| 11:02 | 134  | 18.3965  | 0.13055  | -1.3569  | 13.3     | 14.3     | 15.9     | 18.4     | 20.6     | 25       |
| 11:03 | 135  | 18.4258  | 0.13066  | -1.3698  | 13.3     | 14.3     | 16       | 18.5     | 20.7     | 25       |

31
| Time   | Value 1  | Value 2  | Value 3  | Value 4  | Value 5  | Value 6  |
|--------|----------|----------|----------|----------|----------|----------|
| 11:04  | 136 18.5635 | 0.13099  -1.3789 | 13.4 | 14.4 | 16.1 | 18.6 | 20.8 | 2  |
| 11:05  | 137 18.6752 | 0.13101  -1.3852 | 13.5 | 14.5 | 16.1 | 18.7 | 20.9 | 2  |
| 11:06  | 138 18.7963 | 0.13111  -1.3914 | 13.5 | 14.5 | 16.2 | 18.8 | 21  | 2  |
| 11:07  | 139 18.8258 | 0.13122  -1.4008 | 13.6 | 14.6 | 16.3 | 18.8 | 21  | 2  |
| 11:08  | 140 18.9452 | 0.13133  -1.4123 | 13.6 | 14.6 | 16.4 | 18.9 | 21.1 | 2  |
| 11:09  | 141 19.0586 | 0.13144  -1.4254 | 13.7 | 14.7 | 16.5 | 19  | 21.2 | 2  |
| 11:10  | 142 19.0863 | 0.13155  -1.4369 | 13.8 | 14.7 | 16.5 | 19.1 | 21.2 | 2  |
| 11:11  | 143 19.2158 | 0.13166  -1.4411 | 13.9 | 14.8 | 16.6 | 19.2 | 21.3 | 2  |
| 12:00  | 144 19.2752 | 0.13177  -1.4399 | 14 | 14.9 | 16.6 | 19.2 | 21.4 | 2  |
| 12:01  | 145 19.3345 | 0.13189  -1.4302 | 14 | 15 | 16.7 | 19.3 | 21.5 | 2  |
| 12:02  | 146 19.3752 | 0.13196  -1.4287 | 14.1 | 15.1 | 16.7 | 19.3 | 21.6 | 2  |
| 12:03  | 147 19.4756 | 0.13201  -1.4211 | 14.1 | 15.1 | 16.8 | 19.4 | 21.6 | 2  |
| 12:04  | 148 19.5258 | 0.13222  -1.4205 | 14.2 | 15.2 | 16.8 | 19.5 | 21.7 | 2  |
| 12:05  | 149 19.6658 | 0.13236  -1.4066 | 14.2 | 15.2 | 16.9 | 19.6 | 21.8 | 2  |
| 12:06  | 150 19.7258 | 0.13245  -1.4033 | 14.3 | 15.3 | 16.9 | 19.7 | 21.8 | 2  |
| 12:07  | 151 19.7685 | 0.13255  -1.3987 | 14.3 | 15.4 | 17 | 19.7 | 21.9 | 2  |
| 12:08  | 152 19.8258 | 0.13266  -1.3903 | 14.4 | 15.4 | 17 | 19.8 | 22  | 2  |
| 12:09  | 153 19.8685 | 0.13278  -1.3888 | 14.4 | 15.4 | 17.1 | 19.8 | 22  | 2  |
| 12:10  | 154 19.9375 | 0.13289  -1.3814 | 14.5 | 15.5 | 17.1 | 19.9 | 22.1 | 2  |
| 12:11  | 155 19.9658 | 0.13333  -1.3802 | 14.5 | 15.5 | 17.2 | 19.9 | 22.2 | 2  |
| 13:00  | 156 20.0158 | 0.13345  -1.3798 | 14.5 | 15.5 | 17.2 | 20 | 22.3 | 2  |
| 13:01  | 157 20.0452 | 0.13355  -1.3789 | 14.5 | 15.5 | 17.3 | 20.1 | 22.4 | 2  |
| 13:02  | 158 20.2257 | 0.13366  -1.3711 | 14.6 | 15.6 | 17.3 | 20.2 | 22.5 | 2  |
| 13:03  | 159 20.3358 | 0.13378  -1.3705 | 14.6 | 15.6 | 17.3 | 20.3 | 22.5 | 2  |
| 13:04  | 160 20.4425 | 0.13388  -1.3687 | 14.7 | 15.7 | 17.4 | 20.4 | 22.6 | 2  |
| 13:05  | 161 20.4961 | 0.13399  -1.3674 | 14.8 | 15.8 | 17.4 | 20.4 | 22.7 | 2  |
| 13:06  | 162 20.3258 | 0.13401  -1.3611 | 14.8 | 15.8 | 17.5 | 20.4 | 22.8 | 2  |
| 13:07  | 163 20.5354 | 0.13411  -1.3609 | 14.9 | 15.9 | 17.5 | 20.5 | 22.8 | 2  |
| 13:08  | 164 20.6752 | 0.13422  -1.3587 | 14.9 | 15.9 | 17.5 | 20.6 | 22.9 | 2  |
| 13:09  | 165 20.7015 | 0.13444  -1.3578 | 15 | 16 | 17.6 | 20.7 | 23 | 2  |
| 13:10  | 166 20.8752 | 0.13454  -1.3533 | 15.1 | 16 | 17.6 | 20.8 | 23.1 | 2  |
| 13:11  | 167 20.9346 | 0.13455  -1.3511 | 15.1 | 16 | 17.7 | 20.9 | 23.2 | 2  |
| 13:12  | 168 20.9892 | 0.13466  -1.3505 | 15.1 | 16.1 | 17.7 | 20.9 | 23.3 | 2  |
| 13:13  | 169 21.0157 | 0.13477  -1.3485 | 15.1 | 16.1 | 17.8 | 21 | 23.3 | 2  |
| 13:14  | 170 21.0358 | 0.13488  -1.3357 | 15.2 | 16.2 | 17.8 | 21 | 23.4 | 2  |
| Time  | ID   | Value  | Deviation | Temp | RH   | Humidity | Wind | Direction |
|-------|------|--------|-----------|------|------|----------|------|-----------|
| 14:03 | 171  | 21.1125| -1.3258   | 15.2 | 16.2 | 17.9     | 21.1 | 23.5      |
| 14:04 | 172  | 21.2345| -1.3222   | 15.2 | 16.2 | 17.9     | 21.2 | 23.6      |
| 14:05 | 173  | 21.2962| -1.3199   | 15.2 | 16.2 | 18       | 21.2 | 23.6      |
| 14:06 | 174  | 21.3204| -1.3155   | 15.2 | 16.2 | 18       | 21.3 | 23.7      |
| 14:07 | 175  | 21.3820| -1.3142   | 15.2 | 16.2 | 18.1     | 21.3 | 23.7      |
| 14:08 | 176  | 21.4123| -1.3101   | 15.3 | 16.3 | 18.1     | 21.4 | 23.8      |
| 14:09 | 177  | 21.4712| -1.3009   | 15.3 | 16.3 | 18.2     | 21.4 | 23.8      |
| 14:10 | 178  | 21.5264| -1.2999   | 15.3 | 16.3 | 18.2     | 21.5 | 23.9      |
| 14:11 | 179  | 21.5852| -1.2951   | 15.3 | 16.3 | 18.3     | 21.5 | 23.9      |
| 15:00 | 180  | 21.6486| -1.2911   | 15.3 | 16.4 | 18.3     | 21.6 | 24        |
| 15:01 | 181  | 21.5382| -1.2896   | 15.3 | 16.4 | 18.4     | 21.6 | 24        |
| 15:02 | 182  | 21.719 | -1.2888   | 15.3 | 16.4 | 18.4     | 21.7 | 24.1      |
| 15:03 | 183  | 21.7204| -1.2855   | 15.3 | 16.4 | 18.4     | 21.7 | 24.1      |
| 15:04 | 184  | 21.8587| -1.2834   | 15.3 | 16.4 | 18.4     | 21.8 | 24.2      |
| 15:05 | 185  | 21.8375| -1.2801   | 15.3 | 16.5 | 18.5     | 21.8 | 24.2      |
| 15:06 | 186  | 21.9352| -1.2799   | 15.3 | 16.5 | 18.5     | 21.9 | 24.3      |
| 15:07 | 187  | 21.9963| -1.2788   | 15.3 | 16.6 | 18.5     | 21.9 | 24.3      |
| 15:08 | 188  | 22.0178| -1.2763   | 15.3 | 16.7 | 18.6     | 22   | 24.4      |
| 15:09 | 189  | 21.9258| -1.2751   | 15.4 | 16.7 | 18.6     | 22   | 24.5      |
| 15:10 | 190  | 22.1358| -1.2741   | 15.4 | 16.8 | 18.7     | 22.1 | 24.5      |
| 15:11 | 191  | 22.2346| -1.2733   | 15.4 | 16.8 | 18.7     | 22.2 | 24.6      |
| 16:00 | 192  | 22.3852| -1.2707   | 15.4 | 16.9 | 18.8     | 22.3 | 24.7      |
| 16:01 | 193  | 22.3992| -1.2632   | 15.4 | 16.9 | 18.8     | 22.3 | 24.7      |
| 16:02 | 194  | 22.415 | -1.2606   | 15.4 | 16.9 | 18.8     | 22.4 | 24.8      |
| 16:03 | 195  | 22.4752| -1.2599   | 15.4 | 16.9 | 18.8     | 22.4 | 24.8      |
| 16:04 | 196  | 22.5589| -1.2684   | 15.4 | 16.9 | 18.8     | 22.5 | 24.9      |
| 16:05 | 197  | 22.5962| -1.2598   | 15.4 | 16.9 | 18.9     | 22.5 | 24.9      |
| 16:06 | 198  | 22.5996| -1.2541   | 15.4 | 17   | 18.9     | 22.5 | 25        |
| 16:07 | 199  | 22.6357| -1.2458   | 15.4 | 17   | 18.9     | 22.6 | 25        |
| 16:08 | 200  | 22.6657| -1.2436   | 15.4 | 17   | 18.9     | 22.6 | 25.1      |
| 16:09 | 201  | 22.7052| -1.2369   | 15.5 | 17   | 18.9     | 22.7 | 25.1      |
| 16:10 | 202  | 22.7345| -1.2258   | 15.5 | 17   | 18.9     | 22.7 | 25.2      |
| 16:11 | 203  | 22.8573| -1.2125   | 15.5 | 17   | 18.9     | 22.8 | 25.2      |
| 17:00 | 204  | 22.8758| -1.2099   | 15.5 | 17.1 | 19       | 22.8 | 25.3      |
| 17:01 | 205  | 22.8893| -1.2006   | 15.5 | 17.1 | 19       | 22.8 | 25.3      |
Table (7): Comparison between Egyptian Z score references and WHO references

| Comparison between Egyptian Z score references and WHO references | Boys (P value) | Girls (P value) |
|---|---|---|
| Weight for age | 0.142 | 0.229 |
| Height for age | 0.469 | 0.361 |
| BMI for age | 0.492 | 0.316 |
Figure 1

shows the Egyptian Z score weight for age from 5 years to 10 years for boys
Figure 2 shows the Egyptian Z score weight for age from 5 years to 10 years for girls.
Figure 3 shows the Egyptian Z score height for age from 5 years to 19 years for boys.
Figure 4

shows the Egyptian Z score height for age from 5 years to 19 years for girls
Figure 5 shows the Egyptian Z score BMI for age from 5 year to 19 years for boys.
Figure 6

shows the Egyptian Z score BMI for age from 5 years to 19 years for girls
Figure 7 shows the comparison between Egyptian Z score and WHO Z score references value (weight for age in boys)
Figure 8

shows the comparison between Egyptian Z score and WHO Z score references value (weight for age in girls)
Figure 9 shows the comparison between Egyptian Z score and WHO Z score references value (Height for age in boys)
Figure 10

shows the comparison between Egyptian Z score and WHO Z score references value (Height for age in girls)