Anthropometric Assessment of Nutritional Status of Children Aged 8-12 in Armenia

Report on a National Survey

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Abstract

In preparation for the ATG Board of Directors a countrywide study on children nutritional status with the use and interpretation of anthropometry was conducted from March 1 to August 25, 1997. ATG wishes to assess the degree of malnutrition among children who were born during a crucially dramatic period in

Armenia's history. The overall purpose of that study is to determine the national prevalence of malnutrition among children aged 8-12.

Methods and Materials: Data are presented from interviewers with 1641 school children (cross-sectional survey) aged 8-12. Sampling design was probability three stage cluster sampling with a systematic random sampling at the first and third stages. Anthropometric measurements (weight and height) and data concerning age, sex and nationality of children were collected.

Results: The analyses was conducted using three anthropometric parameters (height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ)). It has been noticed that the stunting is a marginal problem among 96 -107.99 month old children (9.2%). In other age categories it seems be an actual problem based on population cut-off points (10 % acceptable). As for marz level comparison, the highest prevalence of abnormal HAZ has been observed on mountainous Armenia. Weight-for-age is not considered to be a problem, because it tend to be less than acceptable standards (20 % acceptable). The abnormality for weight for stature demonstrate a tremendous problem of abnormal anthropometry in all marzes and in all age categories with high level of statistically significant differences between each other.

Conclusion: In summary, the adjusted and ANOVA analysis of that study shows that the 57.64 % (100% power) of all observed children has shown abnormality for index of current nutritional status. The acute malnutrition is an urgent problem for current point and may impair the immune system of the body and lead to the several diseases [1]. The findings of that study have practical implications for a large food distribution program to improve the nutritional status of vulnerable groups, to avoid the malnourished population grow-up.

1.0 Introduction

The immediate, physiologic cause of malnutrition is a food intake that is inadequate in quantity or quality to meet the requirements for normal growth and development [1]. There have been several approaches to defining malnutrition. The Jelliffe monograph, published in 1966 [2], identified four forms of malnutrition:

1. undernutrition resulting from lack of sufficient food over a period of time

2. overnutrition caused by an excess of food over time

3. specific deficiency states resulting from a lack of individual nutrients

4. imbalance caused by a disproportionate amount of required nutrients in a balanced diet.

During the 1990s, the Armenian Technology Group (ATG) began programs in the Republic of Armenia with the purpose of increasing food production and providing supplementary food to vulnerable groups within the population. In 1993 ATG began the program for wheat production; alfalfa production was subsequently added for improving quality of milk and milk products. In 1995-1996 ATG conducted a study on privately owned dairies with the purpose of developing a program of new dairy industry in Armenia. The overall aim of this proposed dairy program would be to increase production of dairy products and provide dairy supplements to vulnerable groups.

From 1987 to present, the socio economic status in Armenia has decreased because of war, earthquake, political restrictions, etc. This situation may continue for many years. Currently ATG wishes to assess the degree of malnutrition among children who were born during a crucially dramatic period in Armenia's history. ATG is interested in preventing malnutrition through the production and distribution of fresh milk and milk products among pregnant women, brestfeeding mothers and children in Armenia. Nutrition assessment is a base for intervention. Food assistance is a provision for distribution of critical foods. Feeding programs organized by agencies authorized by federal government is to provide nutritious food to eligible individuals, schools, and institutions [3].

There were no data available on nutritional status of children of that age group in Armenia. In March 1997 ATG started a survey to get a national overview of nutritional status of children aged 8-12. Only present survey, which was similar to that one, was conducted by Center's for Disease Control and Prevention (CDC) during May 1993[4] and August 1996 [5]. The CDC collected anthropometric data in 8 pediatric clinics of Yerevan on all children seen at the clinics from 0-59 months of age. Data was published in Armenian Monthly Public Health Report (AMPHR) [6]. Three parameters has been used to analyze the data: weight-for-height, weight-for-age and height-for-age. Data analyses was done on monthly basis and did not shown any acute malnutrition in the survey population. It shows that high prevalence of low height-for-age was due to chronic malnutrition and lack of vitamins in the older children. The survey was interrupted because of shortage of a funds.

Anthropometric measurements, that is, measurements of size, weight, and proportions of human body, are frequently the first step in assessing nutritional status. In children particularly, physical growth is one of the best indicators of nutritional status [7]. Weight-for-height is an anthropometric index that relates body mass to stature. Acute undernutrition, generally characterized by low weight-for-height, which is an indicator of present nutritional status of individual. The height-for-age index is a measure of linear growth and considered as an indicator of past nutritional adequacy [7].

The standard cut-off point is considered 5th percentile (±2SD), below which malnutrition could be assumed. As for population based standards the generally accepted classification of malnutrition uses the cut-off points of 90 % for the height-for-age standards [8], 80 % for weight-for-age standards [9], and for weight-for-height it assumed to be 90 %, because of absence of appropriate information from literature.

2.0 Methods and Materials

Population under study is 8 to 12 year old children from 11 regions, covering the Republic of Armenia. Probability three stage cluster sampling design with a systematic random sampling at the first and third stages was used. Both the list of the schools of Republic of Armenia and list of children in conveniently chosen classes were used as a sample frame. The schools and classes served as a sampling elements. All children, who were present in class during survey process, were measured and answered the questions. Data were obtained by trained surveyors. Data are presented from interviewers with 1887 school children born between 1984 and 1989. Anthropometric assessments were done simultaneously with interviews.

Study design was cross-sectional survey. Inability to contact sample children (who were in sample frame, but were absent during survey) was taken in to account for the contact rate calculation.

According to Carlson, et. al.[10] in populations with a high incidence of malnutrition suitable normal data are often unavailable, and comparison of growth in these children with that in well nourished children from other populations cannot be controlled for environmental or genetic differences. Nevertheless, this kind of population can supply valuable information on the effects of malnutrition on specific types of growth retardation.

2.1 Measurements:

Anthropometrics gets an increasing significance in nutritional assessment because of several advantages in measurement procedures. These are as follows: applicability to large sample sizes [11]; inexpensiveness and portability of equipment; feasibility of performance by relatively unskilled personnel; the possibility of identification of mild to moderate malnutrition, as well as severe states of malnutrition; the possibility of evaluation of changes in nutritional status over time. Despite above mentioned benefits, the anthropometrics has several inconveniences as well. These are as follows: low sensitivity; the reduction of sensitivity and specificity of measurements by non-nutritional factors, such as helminths, diseases and genetics [12]. Anthropometric measurements are of two types: growth and body comparison measurements. According to Simko et.al.[7] anthropometric measurements, that is, measurements of size, weight, and proportions of human body, are frequently the first step in assessing nutritional status. In children particularly, physical growth is one of the best indicators of nutritional status. Of the many measures of growth, those of total body height and weight are most frequently obtained and provide the most useful information. Anthropometric indicators have long been used to identify individuals, particularly children, who are either "normal" or "malnourished" and who need preventive and/or therapeutic services [7]. Weight-for-height is an anthropometric index that relates body mass to stature [7]. Acute malnutrition, generally characterized by low weight-for-height, which is an indicator of present nutritional status of individual. The height-for-age index is a measure of linear growth and considered as an indicator of past nutritional adequacy [7]. Several systems are available for estimating the prevalence of malnutrition in the study population or identifying individuals 'at risk' to malnutrition [12]. The World Health Organization

(WHO) [13] has recommended the use of the United States National Center for Health Statistics (NCHS) growth percentiles [14] as an international reference for comparisons of health and nutritional status among countries (Tables 17, 18, 19, 20 in appendix). Generally below 5th percentile (±2SD) is referred to as a 'cutoff point' for all three parameters used in this study and children with indices below this value are considered to be abnormal or malnourished. For this study responses to question on nationality, date of birth & anthropometric measurements *(weight and height)* were utilized. The mechanical digital Corpond Bath Scale was used for weighing and meter stick for measuring the children. Height was measured to the nearest 1 mm. Weight was measured to the nearest 100 g.

2.2 Survey:

The survey was conducted between March 1 and August 25, 1997. During that time the survey process was interrupted by one month period, due to fund shortage. The questionnaire was the same for all clusters

A group of surveyors working as a team survey each cluster. In each cluster approximately 20-25 children aged 8-12 were measured and surveyed, dependent on class size in a school. The schools which were impossible to contact because of whatever reason was considered as non contact. The two school which was populated exclusively with non Armenians was replaced by the closest school. The anthropometrics were done first and afterwards the questionnaires was completed.

2.3 Questionnaire:

The questionnaire was prepared using the special format from EpiInfo (version 6) anthopometric package. Questionnaire, consisting of seven items (see in appendix , pg. 12), was translated from English into Armenian and pre-tested by interviewers.

2.4 Training of Surveyors and pre-testing

The survey was administered by four trained interviewers, who were students of Medical schools and colleges of Republic of Armenia. All surveyors were trained on use of the survey instruments in Yerevan schools. Total of 16 interviews was administered (four by each interviewer) during pretesting. Oral concent and written letter of permission from Ministry of Education and Enlightenment was presented to the school Director starting each cluster survey.

2.5 Sample size

Sample size was dictated by constraint conditions. It (n=2000) was offered by the ATG board members without any explanations or calculations for its bases.

Hypotheses: 1.1 Comparing normal population (expected) by HAZ parameter (one tail test).

H_0=Armenian children aged 8-12 has HAZ within normal expectations.

H_1 =Armenian children aged 8-12 has more abnormalities for HAZ than expected (>10%).

1.2 Comparing normal population (expected) by WAZ parameter (one tail test).

H_0=Armenian children aged 8-12 has WAZ within normal expectations.

H_1 =Armenian children aged 8-12 has more abnormalities for WAZ than expected (>20%)

1.3 Comparing normal population (expected) by WHZ parameter (one tail test).

H_0=Armenian children aged 8-12 has WHZ within normal expectations.

H_1 =Armenian children aged 8-12 has more abnormalities for WHZ than expected (>10%).

2.1 Age group comparison (age specific) for HAZ (two tail test).

H_0 =The percent of abnormality for HAZ is equal between age groups.

H_1 =The percent of abnormality for HAZ are different between age groups (>10%).

2.2 Age group comparison (age specific) for WAZ (two tail test).

H_0 = The percent of abnormality for WAZ is equal between age groups.

H_1 = The percent of abnormality for WAZ are different between age groups (>20%).

2.3 Age group comparison (age specific) for WHZ (two tail test).

H_0 = The percent of abnormality for WHZ is equal between age groups.

H_1 = The percent of abnormality for WHZ are different between age groups (>10%).

3.1 Marz comparison (marz specific) for HAZ (two tail test).

H_0 = The percent of abnormality for HAZ is equal between marzes.

H_1 = The percent of abnormality for HAZ are different between marzes (>10%).

3.2 Marz comparison (marz specific) for WAZ (two tail test).

H_0 = The percent of abnormality for WAZ is equal between marzes.

H_1 = The percent of abnormality for WAZ are different between marzes (>20%).

3.3 Marz comparison (marz specific) for WHZ (two tail test).

H_0 = The percent of abnormality for WHZ is equal between marzes.

H_1 = The percent of abnormality for WHZ are different between marzes (>10%).

Post estimation of sample size was done using following formula:

$$n = [Z_{(1-\alpha)} \sqrt{(1 + 1/r)\,(P + \blacklozenge / (r + 1))\,(1 - P - \blacklozenge / (r + 1))} + Z_{(1-\beta)} \sqrt{(1/r)\,P(1 - P) + (P + \blacklozenge)\,(1 - P - \blacklozenge)}]^2 / \blacklozenge^2$$

Assuming P = 0.05 (5 % baseline) Prevalence of malnutrition in study population

$\blacklozenge$ = Incremental prevalence of malnutrition in study population

α= 0.05 (95 CI)

Power = 80%

β = 0.2 (1-power)

r = 1

The results of expected number for every single group, marz specific and age specific calculations on sample size for each anthropometric parameter are shown in ***Chart 1.0***.

Chart 1.0 Chart of Sample Size Calculation for Used Anthropometric Parameters, by Age and Marz.

HAZ (10 %)			WAZ (20 %)			WHZ (10 %)		
Expected	Age Specific	Marz Specific	Expected	Age Specific	Marz Specific	Expected	Age Specific	Marz Specific
P = 0.05	P = 0.05	P = 0.05	P = 0.05	P = 0.05	P = 0.05	P = 0.05	P = 0.05	P = 0.05
♦ = 0.05	♦ = 0.05	♦ = 0.05	♦ = 0.15	♦ = 0.15	♦ = 0.15	♦ = 0.05	♦ = 0.05	♦ = 0.05
α= 0.05 (95 CI)	α= 0.05 (95 CI)	α= 0.05 (95 CI)	α= 0.05 (95 CI)	α= 0.05 (95 CI)	α= 0.05 (95 CI)	α= 0.05 (95 CI)	α= 0.05 (95 CI)	α= 0.05 (95 CI)
Power=80 %	Power=80%	Power=80%	Power=80%	Power=80%	Power=80%	Power=80 %	Power=80%	Power=80%
β = 0.2 (1-power)	β = 0.2 (1-power)	β = 0.2 (1-power)	β = 0.2 (1-power)	β = 0.2 (1-power)	β = 0.2 (1-power)	β = 0.2 (1-power)	β = 0.2 (1-power)	β = 0.2 (1-power)
n = 225	n = 1600	n = 3520	n = 46	n = 325	n = 715	n = 225	n = 1600	n = 3520

2.6 Sampling Methodology:

The school-based survey using multistage cluster sampling (with systematic random sampling at first and last stages) was begun in March 1997. Cluster sampling was chosen because of unavailability of any list of children of desired age group. The region-by-region list of all ten year schools in Armenia (excluding Yerevan region) and the district-by-district list of all ten year schools in Yerevan was used. There were neither geographical, nor alphabetical order of the schools within first list, but it was only list available from Ministry of Education and Enlightenment. The second list was ordered alphabetically by districts of Yerevan region. The Flow Chart of Sampling methodology (see appendix ***Fig. 4.0***) is explained below:

Stage I: It was assumed that sample for each cluster will consist approximately 20-30 children (depends on class size). Suggested sample size (n=2000) was divided by supposed number of children per cluster and was assessed approximate number of clusters (from 67 to 100 clusters for all regions of Armenia).

Stage II: There are total of 960 schools (10 year) located in territory of 10 marzes of Armenia (excluding Yerevan) and 188 schools (10 year) in territory of Yerevan. Sampling interval (14) for second stage of sampling was determined by dividing total number of 10 year schools in Armenia by assumed approximate number of clusters. There was a separate list of schools for each marz and each 14th school from particular marz had an equal chance to be chosen. Random start for each region (both Yerevan and outside of Yerevan) was chosen and each 14th school starting from chosen random start was considered as a cluster The exact # of clusters was 86.

Stage III: One class for each age group per school has been chosen conveniently. The technique for choosing children was following: The random start was # 3 and children were selected from class journal name lists. Each 5th child has been chosen and it was approximately 20-30 children per school.

2.7 Analysis:

Data was entered and analyzed using special anthropometric package in EpiInfo (version 6) program. Three parameters (height-for-age, weight-for-age and weight-for-height) were used to analyze data. For avoiding the bias of estimations, direct adjustment was used to adjust for difference between age groups and between marzes. For comparison between age groups and marzes analysis of variance (ANOVA) was used. 95 % Confidence Interval and p-value of ANOVA test results were considered for statistical significance.

3.0 Results:

3.1 Coverage and Response Rate

Of the 1814 records 173 were excluded from the analysis, because they felt outside the age parameters. The effective sample size was 1661 (see ***Table 1.0***). The overall contact rate was 94.7 % (1814). From all selected clusters four were not reached. The overall response rate was 90.7 % (n=1814). Children who were absent during survey for whatever reason, were considered non respondent.

3.2 Post Sampling Power Calculation

The post-sampling power of the sample size was calculated using formula below:

$$Z_{(1-\beta)} = \blacklozenge \sqrt{n} - Z_{(1-\alpha)} \sqrt{(1 + 1/r)(P + \blacklozenge / (r+1))(1 - P - \blacklozenge / (r+1))} \,/\, \sqrt{(1/r) P(1-P) + (P + \blacklozenge)(1 - P - \blacklozenge)}$$

Assuming that, P = 0.05 (5 % baseline) Prevalence of malnutrition in study population

$\blacklozenge$ = Incremental prevalence of malnutrition in study population

α= 0.05 (95 CI)

n = minimum sample size within group

The results for expected, age specific and marz specific power for each anthropometric parameter are shown in ***Chart 3.0***. It has been revealed an important points for hypothesis (stated in sample size part) testing.

Chart 3.0 Chart of Post-Sampling Calculation for Expected, Age Specific and Marz Specific Abnormalities.

HAZ (10 %)			**WAZ (20 %)**			**WHZ (10 %)**		
Total	Age Specific	Marz Specific	Total	Age Specific	Marz Specific	Total	Age Specific	Marz Specific
P = 0.05	P = 0.14	P = 0.12	P = 0.05	P = 0.02	P = 0.01	P = 0.05	P = 0.3	P = 0.48
♦ = 0.10	♦ = 0.09	♦ = 0.24	♦ = 0.036	♦ = 0.1	♦ = 0.15	♦ = 0.52	♦ = 0.69	♦ = 0.22
α= 0.05 (95 CI) n = 1641	α= 0.05 (95 CI) n = 180	α= 0.05 (95 CI) n = 70	α= 0.05 (95 CI) n = 1641	α= 0.05 (95 CI) n = 180	α= 0.05 (95 CI) n = 70	α= 0.05 (95 CI) n = 1641	α= 0.05 (95 CI) n = 180	α= 0.05 (95 CI) n = 70
Power=100 %	Power = 59%	Power = 92%	Power = 99%	Power = 96%	Power = 64%	Power= 100%	Power=100%	Power = 75%

The post sampling power calculations show that for accepting hypothesis 2.1 (59%. power), 3.2 (64% power) and 3.3 (75 % power) we may not be able to detect a true difference (type II error).

3.3 Descriptive Statistics

To characterize the sample, the ***Table 1.0*** contains the demographic characteristics in 11 marzes enrolled in survey. Of the study participants, 48.6 % (n=798) were male and 51.4 % (n=843) were female, 99.1 % (n=1627) were Armenians, 0.7 % (n=11) were Ezidies and 0.2% (n=3) were other minorities.

Table: 1.0 *Demographic Characteristics of Study Participants by Marz Category.*

Marze (Region) / Variable	Aragatsotn % (n)	Ararat % (n)	Armavir % (n)	Gegarkunik % (n)	Lori % (n)	Kotayk % (n)
Age category						
96 - 107.99 month	6.2 % (5)	9 % (12)	2 % (2)	19.1 % (31)	11.6 % (21)	5.5 % (8)
108 - 119.99 month	16 % (13)	26.9 % (36)	16.8 % (17)	21 % (34)	21.5 % (39)	23.3 % (34)
120 - 131.99 month	24.7 % (20)	26.1 % (35)	26.7 % (27)	18.5 % (30)	21.5 % (39)	26.7 % (39)

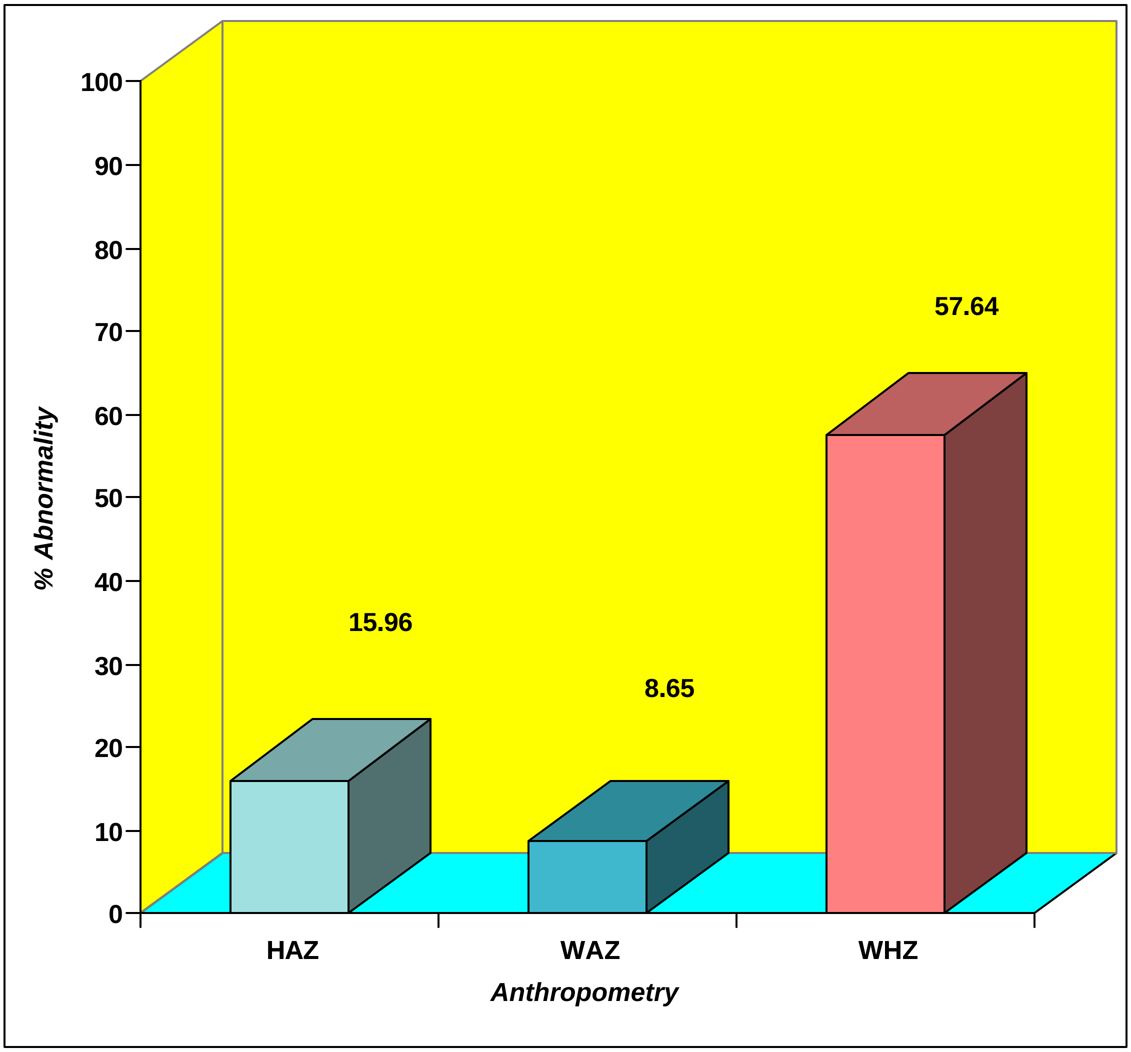
132 - 143.99 month	30.9 % (25)	20.9 % (28)	24.8 % (25)	24.7 % (40)	21 % (38)	21.9 % (32)
144 - 156 month	22.2 % (18)	17.2 % (23)	33.7 % (34)	16.7 % (27)	24.3 % (44)	22.6 % (33)
Gender						
Male	44.4 % (36)	56.7 % (76)	42.9 % (45)	50.6 % (82)	42 % (76)	54.1 % (79)
Female	55.6 % (45)	43.3 % (58)	57.1% (60)	49.4 % (80)	58 % (105)	45.9 % (67)
Nationality						
Armenian	100 % (81)	97.8 % (131)	96.2 % (101)	100 % (162)	100 % (181)	98.6 % (144)
Ezidy	0	2.2 % (3)	3.8 % (4)	0	0	1.4 % (2)
Others	0	0	0	0	0	0
Total # of Observed Children	**81**	**134**	**105**	**162**	**181**	**146**

Table break

Marz (Region) **Variable**	**Shirak** **% (n)**	**Syunik** **% (n)**	**Vayots Dzor** **% (n)**	**Taush** **% (n)**	**Yerevan** **% (n)**	**Total** **% (n)**
Age category						
96 - 107.99 month	15.6 % (36)	16.1 % (18)	15.7 % (11)	15.9% (14)	% 6.6 (22)	***11 % (180)***
108 - 119.99 month	17.3 % (40)	21.4 % (24)	24.3 % (17)	23.9 % (21)	21.5 % (71)	***21.1 % (346)***
120 - 131.99 month	23.4 % (54)	23.2 % (26)	24.3 % (17)	25 % (22)	22.4 % (74)	***23.3 % (383)***
132 - 143.99 month	20.3 % (47)	18.8 % (21)	18.6 % (13)	21.6 % (19)	26 % (86)	***22.8 % (374)***
144 - 156 month	23.4 % (54)	20.5 % (23)	17.1 % (12)	13.6 % (12)	23.6 % (78)	***21.8 % (358)***
Gender						
Male	55.8 % (129)	38.4 % (43)	58.6 % (41)	53.4 % (47)	43.5 % (144)	***48.6 % (798)***
Female	44.2 % (102)	61.6 % (69)	41.4 % (29)	46.6 % (41)	56.5 % (187)	***51.4 % (843)***
Nationality						
Armenian	100 % (231)	100 % (112)	100 % (70)	100 % (88)	98.5 % (326)	***99.1 % (1627)***
Ezidy	0	0	0	0	0.6 % (2)	***0.7 % (11)***
Others	0	0	0	0	0.9 % (3)	***0.2 % (3)***
Total # of Observed Children	**231**	**112**	**70**	**88**	**331**	**1641**

Throughout the analysis that follows it was revealed the following: of the study participants 15.96% were classified as abnormal for HAZ, 8.64% for WAZ, 57.64% for WHZ (Fig. 1.1).

Fig. 1.1: Age Adjusted % of Abnormal Anthropometry in Armenia



3.4 Between Age Group Comparison

Between age group comparison analysis were conducted using direct method of adjustment by marz category and ANOVA. The results are presented in ***Table 2.0,*** which shows the difference of abnormal anthropometry between age groups. Table demonstrates both crude and adjusted data by age category. The analyses has conducted using three anthropometric parameters (height-for-age, weight-for-age and weight-for-height). Test for significance has based on ANOVA.

Table 2.0: Marz Adjusted (%) Abnormal Anthropometry by Age Groups.

AGE	HAZ *		WAZ **		WHZ **	
(by month)	*Crude (%)*	*Adjusted (%)*	*Crude (%)*	*Adjusted (%)*	*Crude (%)*	*Adjusted (%)*

96 - 107.99	14.4	9.2	2.2	2	30	23.4
108 - 119.99	14	14	8.1	8.4	24.9	22.5
120 - 131.99	14.9	12.3	7.6	3.6	44.9	58
132 - 143.99	23.3	21.5	10.2	11.6	71.9	70
144 - 156.00	22.9	21.5	12.5	12.6	99.7	99.5

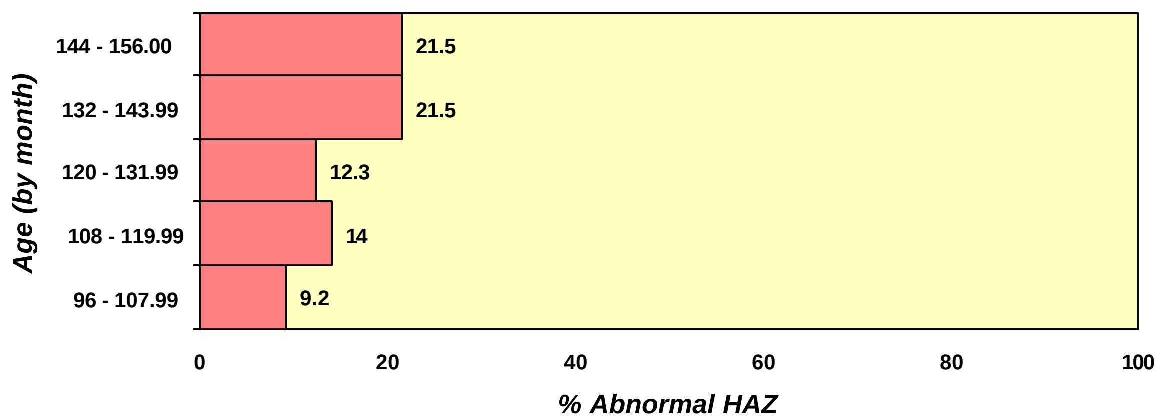
* p > .05 (ANOVA)

** p < .05 (ANOVA)

3.4.1 Height-for-Age

The results of marz adjusted abnormal height-for-age Z-score (HAZ) analysis is presented in ***Figure 2.1.*** The highest prevalence of abnormal HAZ has been observed at 144-156.00 and 132-143.99 months old (21.5 %) children, while the lowest one was reported at the 96-107.99 month old (9.2 %). The comparison of abnormal HAZ % showed marginal statistical significance difference between age categories (p = .066). It has been noticed that stunting is a marginal problem among 96-107.99 month old children (9.2 %). In other age categories is seems to be an actual problem in Armenia as compare to population based acceptable standards (10% acceptable).

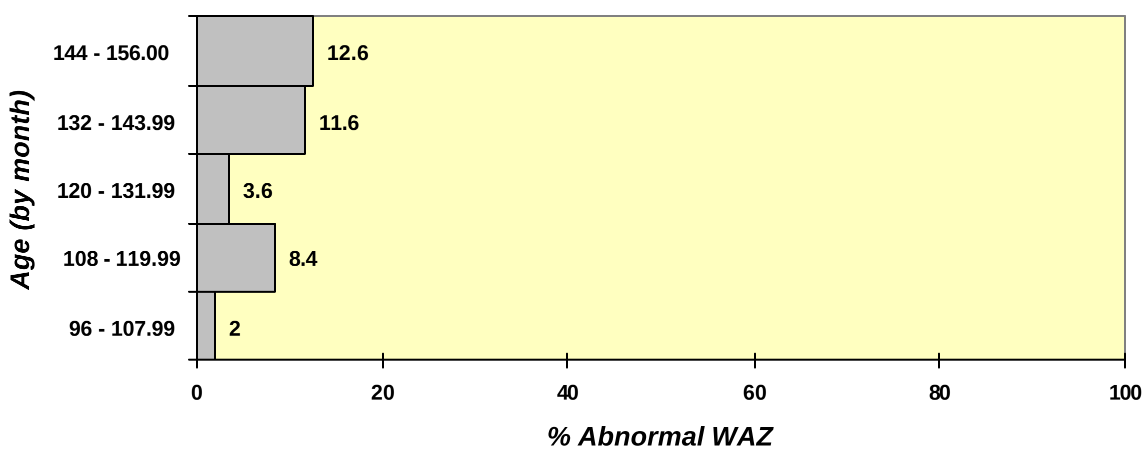
Fig. 2.1: Marz Adjusted Abnormal HAZ (%) by Age Groups.



3.4.2 Weight-for-Age

Figure 2.2 presents the results of marz adjusted abnormal weight-for-age Z-score (WAZ), which presents the WAZ as a smaller problem as compared to HAZ and WHZ. The comparison of abnormal WAZ % between age groups has shown highly significant differences ($p < .001$). The highest prevalence of abnormal WAZ has been detected at 144-156.00 age groups (12.6 %). The range of detected abnormal WAZ was 2% to 12.6%. The results reveal that the percent of abnormal WAZ increase with the age increasing. The Acceptable standard for population is 20 % and WA might not considered as a problem.

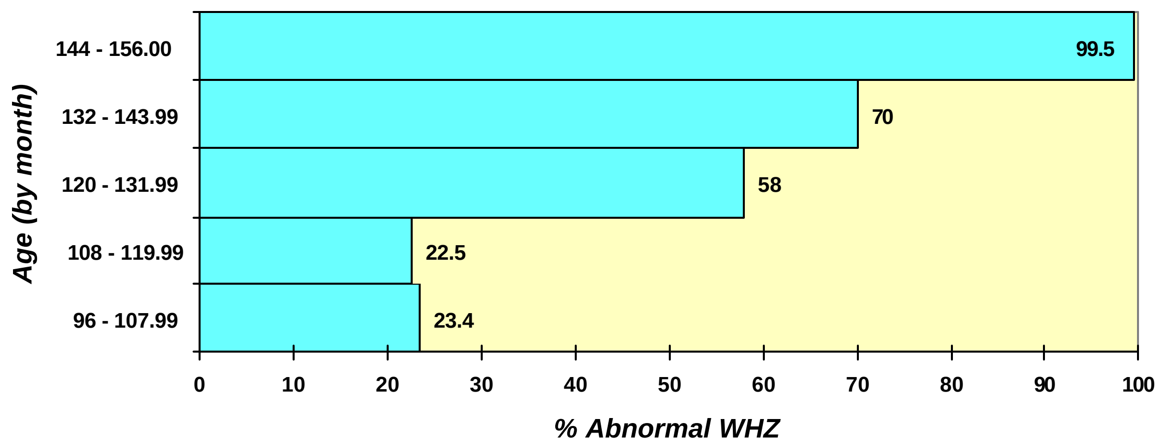
Fig. 2.2: Marz Adjusted Abnormal WAZ (%) by Age Groups.



<u>3.4.3 Weight-for-Height</u>

Figure 2.3 has revealed the enormous problem of abnormal anthropometry in observed age categories. The WHZ is approximately four times higher than detected HAZ and approximately eighth times as higher than reported WAZ. The range of abnormal anthropometry was 22.5 % to 99.5 % between age groups. The highest level of abnormal WHZ has been detected at 144-156.00 age groups (99.5 %). It is necessary to mention that the differences between age groups was highly significant ($p < .001$).

Fig. 2.3: Marz Adjusted Abnormal WAZ (%) by Age Groups.



3.5 Between Marz Comparison

Table 3.0: Crude and Age Adjusted Data on Abnormal Anthropometry (%) by Marz Category.

Region (Marz)	Crude abnormal anthropometry (%)			Adjusted abnormal anthropometry (%)			# of Observed Children	Population (000)
	*HAZ**	*WAZ**	*WHZ**	*HAZ*	*WAZ*	*WHZ*		
Aragatsotn	20	10	60	20	10	60	81	162.5
Ararat	17	14	52	15	14	51	134	305.0
Armavir	13	14	67	11	12	48	105	315.5
Gegharkunik	23	5	70	23	5	70	162	272.4
Lori	12	10	60	12	9	57	181	392.4
Kotayk	16	16	62	13	13	57	146	325.9
Shirak	22	7	61	21	7	58	231	358.3
Syunik	21	1	64	21	1	64	112	161.9
Vayots Dzor	36	0	64	35	0	65	70	68.3
Taush	15	0	48	13	0	49	88	154.8
Yerevan	17	11	57	15	9	51	331	1249.4
Total	18.2	8.8	60	15.96	8.64	57.64	1641	3766.4

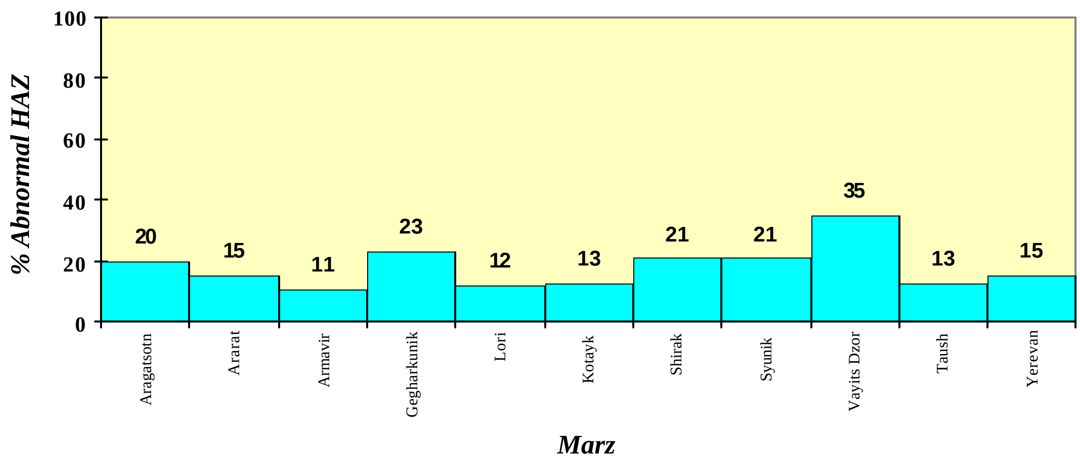
* p < .05

** p > .05

3.5.1 Height-for-Age

Figure 3.1 compares abnormal height-for-age Z-score (HAZ) between 11 marzes, which has shown statistically significant difference ($p = .038$). The highest prevalence of abnormal HAZ has been observed in Vayots Dzor (35 %) and the lowest one has been reported in Armavir (11 %). What is notable are the stature for age problem exists in all marzes mainly with statistically significant differences between each other (Population base cut-off point is 90 %).

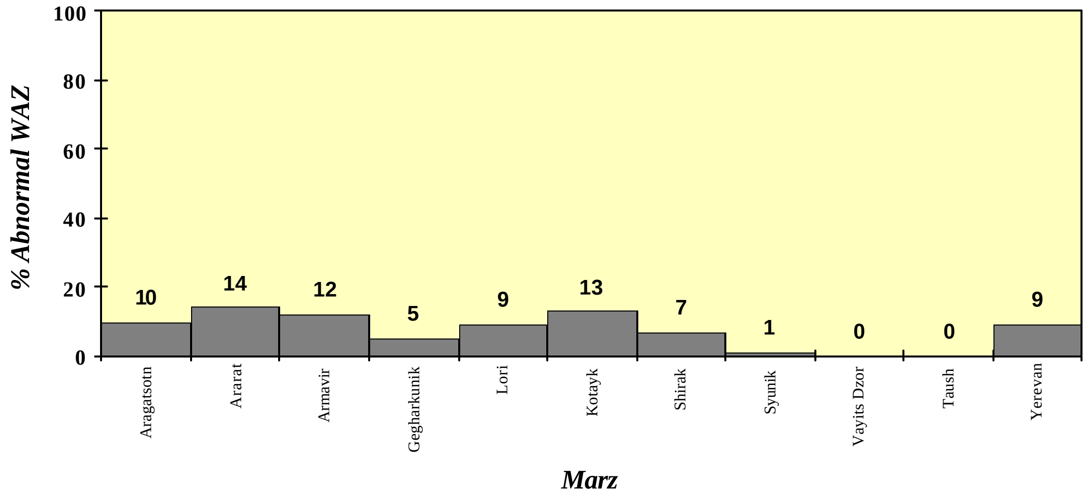
Fig. 3.1: Age Adjusted Abnormal HAZ (%).



3.4.2 Weight-for-Age

The ***Figure 3.2*** gives the overview of age adjusted abnormal weight-for-age Z-scores (WAZ). The comparison of abnormal WAZ % in marz level has indicated consequential differences ($p = .024$). The highest prevalence of abnormal WAZ has been found in Ararat (14 %). In two of the marzes (Vayots Dzor and Taush) there were not recorded abnormal anthropometry. Taking into consideration the generally accepted classification of malnutrition for weight-for-age (20 % acceptable), there were no abnormality detected in observed children.

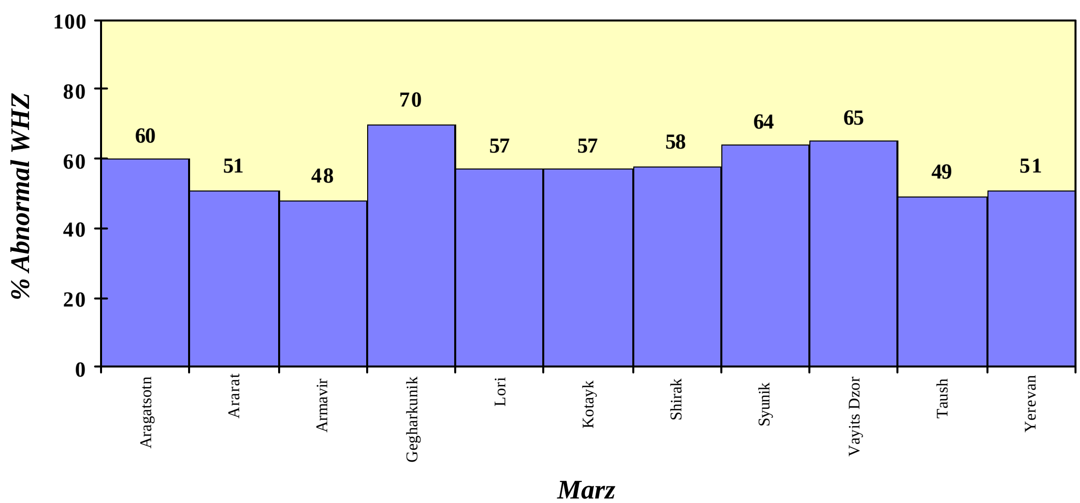
Fig. 3.2 Age Adjusted Abnormal WAZ (%)



3.5.3 Weight-for-Height

The differences in weight for stature between marzes is demonstrated in ***Figure 3.3***. It inform the tremendous problem of abnormal anthropometry in all marzes with very high level of statistically significant differences between each other ($p < .001$). The abnormal WHZ is ranged from 48 % to 70 %.

Fig. 3.3 Age Adjusted Abnormal WHZ (%)



4.0 Discussion:

Based on Jellife DB [2] measurement of the variations of the physical dimensions and the gross comparison of the human body at different age levels and degrees of nutrition defined as nutritional anthropometry. According to Gipson RS [15] the cut-off points are based on the relationship between nutritional assessment indices and functional impairment and / or clinical signs of deficiency. They are used to establish the prevalence of malnutrition within a population or to identify and classify malnourished individuals. The standard cut-off point is considered 5th percentile (±2SD), below which malnutrition could be assumed. As for population based standards the generally accepted classification of malnutrition uses the cut-off points of 90 % for the height-for-age standards [8], 80 % for weight-for-age standards [9], and for weight-for-height it assumed to be 90 %, because of absence of appropriate information from literature.

The analysis revealed that the population under study were mainly Armenian and not ethnic minorities. It has been noticed that the ***stunting*** is a marginal problem among 96-107.99 month old children (9.2 %). In other age categories it seems to be an actual problem based on population cut-off points (10% acceptable). The power of rejecting H_0 (hypothesis 2.1) and accepting alternative hypothesis for age specific data is 59 %, which was small enough to state that the difference between age groups are marginal (p = .066). Either sample size was too small or there were not real difference between age groups. The highest prevalence of abnormal HAZ (p = .038) has been observed in mountainous Armenia, such as in Vayots Dzor (35 %), Gegarkunik (23 %), Syunik (21 %), etc. The high prevalence of low HAZ may be due to chronic malnutrition and lack of vitamins in the older children as well as in mountainous marzes. As for mountainous marzes it might be explained by short growing season because of altitude, which bring to the limitation of green vegetables in a diet.

Weight-for-age is an acute index of malnutrition and generally used to assess protein-energy malnutrition [16]. In that study the range of detected abnormal WAZ by age category (2% to 12.6%) is included in acceptable standard for population (20 %) and can not be considered as a problem, inspite of highly significant differences (p < .001) between age groups, given by ANOVA.

The proportion of abnormality among observed children in marz level was below threshold, although the comparison of abnormal WAZ % has indicated consequential differences ($p = .024$). Weight-for-age is not considered to be a problem, because it tend to be less than acceptable standards.

According to Waterlow JC, et.al. [16] ***weight-for-height*** is a sensitive index of current nutritional status and is relatively independent of age as well as ethnic group. The analysis reveals, that the weight-for-height abnormality is a broad and urgent problem for today's growing generation. The WHZ is approximately four times higher than detected HAZ, which seems to be a problem as well. The abnormality ranges from 22.5 % to 99.5 % between age groups. The highest level of abnormal WHZ has been detected at the oldest age group (144-156.00) among observed categories. The differences in weight for stature between marzes demonstrate a tremendous problem of abnormal anthropometry in all marzes with very high level of statistically significant differences between each other ($p < .001$). The growth of abnormality with the growth of age is obvious, which might be explained in two ways:

1. The situation with food intake getting worst every year. Food expenses tend to the increasing and minimum official salary tend to be not changed.
2 The result of lack of sufficient food over period of time, imbalance diet and lack of individual nutrients.

Sample size was dictated by constraint conditions, but further power calculations has shown, that as distinct from assumed 80 % power in sample size calculation the obtained power is much more higher for all cases, except marz specific WAZ, but it is not a problem for Armenia, taking into consideration the 20 % acceptable standard for population.

Evaluating by use of validity threats we can state the potential limitations of this study, which are as follows:

1. *Instrument error.* The same scale and meter stick were used and the measurements has been conducted by the same group of surveyors during all survey period. Height was measured to the nearest 1 mm and weight was measured to the nearest 100 g. Both measurements were done only once, which

might bring to the instrument error. All surveyors were trained on use of the survey instruments, which lead to decrease the instrument error.

2. *Selection bias*. Only 10 year schools was taken as a sample frame. It leads to the possibility of losing children with the lowest socio-economic status in country, such as children from overnight schools, orphanages and 3, 4 and 8 year schools. Non standard (convenient) methodology for choosing classes might lead to the selection bias as well.

3. *The poor research design*. The decision of ATG to conduct the cross-sectional survey on school basis was for having budgetary and timely savings. The sampling design was urged to be cluster (because of unavailability / absence of list of school children by age and location). Every school had an equal chance to be chosen, but every kid did not have equal chance to be chosen because of absence of list of kids, which bring to the overrepresentation of kids in small schools and underrepresentation of kids in big schools. These leads to the low reliability and absence of internal validity in research design.

5.0 Conclusion:

In summary, the adjusted and ANOVA analysis of that study shows that the 57.64 % (100% power) of all observed children has shown abnormality for index of current nutritional status.

The acute malnutrition is an urgent problem for current point and may impair the immune system of the body and lead to the diseases [1] such as

- marasmus or kwashiorkor (protein deficiency),
- tuberculosis,
- pneumonia,
- measles,
- malaria,
- diarrheal diseases,
- parasitic infections.

Also may cause

- rickets,
- osteoporosis,
- anemia and
- growth retardation [17]

Taking into consideration the findings of that study, which have practical implications for a large food distribution program to improve the nutritional status of vulnerable groups, we are suggesting the nutrition intervention strategy.

- Child Nutrition Program designed to protect the health of children through partial food subsidies, such as school lunch, school breakfast, child care food program, summer food service and special milk provision [3].
- To develop a surveillance system by continuous collection of data, analysis, interpretation and utilization of information to determine effects of intervention strategy [3].

It is obviously preferable to start providing supplementary foods including dairy products to the school children of observed and lower age groups, for avoiding malnourished generation grow up.

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ARAGATSOTN *(crude data)*

Table: 4.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	5	1	20	-0.894 (1.028)	-2.540; -0.070
108 - 119.99 month	13	2	15	-0.541 (1.234)	-2.280; 1.760
120 - 131.99 month	20	2	10	-0.867 (1.110)	-2.350; 0.970
132 - 143.99 month	25	7	28	-1.306 (0.953)	-3.310; 0.740
144 - 156 month	18	5	27.8	-1.627 (0.915)	-4.140; -0.070

Table: 4.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	5	0	0	0.552 (0.539)	0.120; 1.460
108 - 119.99 month	13	0	0	-0.039 (0.790)	-1.220; 1.520
120 - 131.99 month	20	1	5	-0.283 (0.787)	-2.120; 1.010
132 - 143.99 month	25	2	8	-0.862 (0.686)	-2.670; 0.650
144 - 156 month	18	7	38.9	-1.304 (1.023)	-2.560; 0.390

Table: 4.3 Weight-for-Height (WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	5	2	40	2.284 (2.049)	0.530; 4.760
108 - 119.99 month	13	5	38.5	0.774 (1.942)	-2.360; 3.330
120 - 131.99 month	20	16	80	7.221 (4.427)	-1.560; 9.990
132 - 143.99 month	25	11	44	4.084 (4.985)	-1.940; 9.990
144 - 156 month	18	18	100	9.990 (0.000)	9.990; 9.990

ARARAT *(crude data)*

Table: 5.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	12	1	8.3	-0.695 (1.183)	-2.100; 1.630
108 - 119.99 month	36	1	30.6	-0.981 (1.112)	-2.700; 1.980
120 - 131.99 month	35	8	22.9	-1.321 (1.239)	-5.370; 1.190
132 - 143.99 month	28	3	20.7	-1.127 (0.751)	-2.610; 0.480
144 - 156 month	23	0	0	-0.753 (0.705)	-1.820; 0.590

Table: 5.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	12	2	16.7	-0 .513 (1.502)	-2.640; 1.850
108 - 119.99 month	36	9	25	-0.931 (1.097)	-2.740; 0.990
120 - 131.99 month	35	4	11.4	-1.034 (0.902)	-2.640; 0.620
132 - 143.99 month	28	2	7.1	-0.870 (0.901)	-2.140; 0.570

144 - 156 month	23	2	8.7	-0.705 (0.891)	-2.470; 1.710

Table: 5.3 Weight-for-Height (WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	12	2	16.7	-0.080 (1.468)	-2.280; 2.260
108 - 119.99 month	36	11	30.6	0.341 (2.838)	-2.480; 9.990
120 - 131.99 month	35	21	60	5.520 (4.975)	-1.770; 9.990
132 - 143.99 month	28	13	46.4	4.423 (4.967)	-2.010; 9.990
144 - 156 month	23	23	100	9.990 (0.000)	9.990; 9.990

ARMAVIR *(crude data)*

Table: 6.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	2	0	100	-0.375 (0.771)	-0.920; 0.170
108 - 119.99 month	17	1	5.9	-0.975 (0.994)	-3.230; 1.180
120 - 131.99 month	27	5	18.5	-1.275 (2.015)	-9.980l; 2.390
132 - 143.99 month	25	4	16	-0.859 (1.177)	-3.280; 1.120
144 - 156 month	34	4	11.8	-0.932 (0.918)	-2.860; 1.090

Table: 6.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	2	0	100	-0.510 (1.047)	-1.250; 0.230
108 - 119.99 month	17	3	17.6	-1.293 (0.715)	-2.030; 0.370
120 - 131.99 month	27	5	18.5	-1.312 (1.128)	-3.610; 2.960
132 - 143.99 month	25	2	8	-1.051 (0.728)	-2.310; 0.220
144 - 156 month	34	5	14.7	-0.760 (0.936)	-2.400; 1.130

Table: 6.3 Weight-for-Height (WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	2	0	100	-0.320 (0.764)	-0.860; 0.220
108 - 119.99 month	17	2	11.8	-0.223 (2.809)	-2.120; 9.990
120 - 131.99 month	27	19	70.4	6.247 (5.414)	-2.310; 9.990
132 - 143.99 month	25	15	60	5.319 (5.406)	-2.490; 9.990
144 - 156 month	34	34	100	9.990 (0.000)	-9.990; 9.990

GEGARKUNIK *(crude data)*

Table: 7.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99	31	6	19.4	-0.969	-2.650; 0.900

month				(0.943)	
108 - 119.99 month	34	3	8.8	-0.882 (1.027)	-2.950; 1.800
120 - 131.99 month	30	5	16.7	-1.217 (0.755)	-2.610; -0.100
132 - 143.99 month	40	9	22.5	-1.088 (1.366)	-6.280; 1.040
144 - 156 month	27	13	50	-2.046 (0.944)	-4.910; -0.810

Table: 7.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	31	1	3.2	0.658 (0.833)	-1.100; 2.060
108 - 119.99 month	34	1	2.9	0.431 (1.788)	-1.460; 9.980
120 - 131.99 month	30	1	3.3	-0.392 (0.686)	-2.440; 0.530
132 - 143.99 month	40	1	2.5	-0.363 (0.824)	-2.160; 0.800
144 - 156 month	27	4	14.8	-1.197 (0.746)	-2.720; 0.210

Table: 7.3 Weight-for-Height (WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	31	17	54.8	2.360 (1.546)	-0.300; 5.100
108 - 119.99 month	34	11	32.4	2.250 (2.691)	-0.340; 9.990
120 - 131.99 month	30	21	70	6.742 (4.723)	-1.240; 9.990
132 - 143.99 month	40	38	95	9.168 (2.934)	-2.240; 9.990
144 - 156 month	27	27	100	9.990 (0.000)	9.990; 9.990

LORI *(crude data)*

Table: 8.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	21	3	14.3	-0.454 (0.950)	-0.500; 0.950
108 - 119.99 month	39	3	7.7	-0.549 (0.875)	-2.320; 1.340
120 - 131.99 month	39	0	0	-0.571 (0.843)	-1.840; 1.340
132 - 143.99 month	38	5	13.2	-0.713 (1.033)	-3.380; 1.220
144 - 156 month	44	10	22.7	-1.214 (1.017)	-3.690; 0.970

Table: 8.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	21	1	4.8	0.223 (0.993)	-1.350; 2.290
108 - 119.99 month	39	2	5.1	-0.341 (0.817)	-2.270; 1.350
120 - 131.99 month	39	2	5.1	-0.716 (0.946)	-2.320; 2.560
132 - 143.99 month	38	5	13.2	-0.333 (1.913)	-2.230; 9.980
144 - 156 month	44	8	18.2	-1.043 (0.883)	-2.590; 0.600

Table: 8.3 Weight-for-Height (WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range

96 - 107.99 month	21	1	28.6	0.917 (1.434)	-2.020; 3.390
108 - 119.99 month	39	2	7.7	0.515 (2.419)	-1.680; 9.990
120 - 131.99 month	39	2	59	5.201 (5.055)	-2.310; 9.990
132 - 143.99 month	38	5	86	8.233 (3.518)	0.130; 9.990
144 - 156 month	44	8	100	9.990 (0.000)	9.990; 9.990

KOTAYK *(crude data)*

Table: 9.1 Height-for-Age (HAZ)

Age Group	# of observed children	#of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	8	0	0	-0.729 (0.578)	-1.750; 0.130
108 - 119.99 month	34	5	14.7	-0.611 (1.298)	-3.160; 2.770
120 - 131.99 month	39	6	15.4	-1.061 (0.916)	-2.810; 1.100
132 - 143.99 month	32	7	21.9	-1.017 (1.170)	-2.900; 1.910
144 - 156 month	33	5	15.2	-1.245 (0.884)	-2.800; 0.690

Table: 9.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	8	0	0	-0.018 (1.004	-1.240; 1.450
108 - 119.99 month	34	7	20.6	-0.886 (1.073)	-2.560; 1.700
120 - 131.99 month	39	6	15.4	-0.801 (1.112)	-2.870; 1.850
132 - 143.99 month	32	6	18.8	-0.978 (0.903)	-2.670; 0.660
144 - 156 month	33	4	12.1	-0.975 (0.715)	-2.390; 0.190

Table: 9.3 Weight-for-Height (WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	8	2	25	0.938 (1.595)	-0.990; 3.320
108 - 119.99 month	34	14	41.2	0.082 (3.036)	-2.890; 9.990
120 - 131.99 month	39	22	56.4	4.568 (5.229)	-2.760; 9.990
132 - 143.99 month	32	20	62.5	5.630 (5.132)	-3.340; 9.990
144 - 156 month	33	33	100	9.990 (0.000)	9.990; 9.990

SHIRAK *(crude data)*

Table: 10.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	36	7	19.4	-0.830 (1.077)	-2.980; 1.090
108 - 119.99 month	40	3	7.5	-0.797 (1.112)	-3.800; 1.770
120 - 131.99 month	54	10	18.5	-0.848 (1.097)	-2.790; 2.260
132 - 143.99 month	47	17	36.2	-1.478 (1.196)	-3.840; 0.930
144 - 156 month	54	13	24.1	-1.413 (0.977)	-4.430; 0.440

Table: 10.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	36	0	0	0.226 (0.769)	-1.890; 1.610
108 - 119.99 month	40	1	2.5	-0.226 (0.809)	-2.100; 1.280
120 - 131.99 month	54	3	5.7	-0.542 (1.046)	-2.370; 3.100
132 - 143.99 month	47	5	10.6	-0.790 (0.940)	-2.850; 1.070
144 - 156 month	54	7	13	-1.041 (0.855)	-2.590; 1.210

Table: 10.3 Weight-for-Height (WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	36	13	36.1	1.450 (1.423)	-2.890; 4.330
108 - 119.99 month	40	12	30	1.467 (2.774)	-2.290; 9.990
120 - 131.99 month	54	28	51.9	4.417 (4.949)	-2.060; 9.990
132 - 143.99 month	47	33	70.2	6.236 (4.906)	-2.180; 9.990
144 - 156 month	54	54	100	9.990 (0.000)	-9.990; 9.990

SYUNIK *(crude data)*

Table: 11.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	18	4	22.2	-1.087 (0.937)	-2.760; 0.600
108 - 119.99 month	24	0	0	-0.560 (0.750)	-1.950; 0.920
120 - 131.99 month	26	2	7.7	-1.122 (0.714)	-2.490; 0.600
132 - 143.99 month	21	7	33.3	-1.150 (0.931)	-2.640; 0.560
144 - 156 month	23	10	43.5	-1.783 (1.090)	-4.220; 0.120

Table: 11.2 Weight-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	18	0	0	0.218 (0.578)	-0.760; 1.480
108 - 119.99 month	24	0	0	0.046 (0.618)	-1.200; 1.740
120 - 131.99 month	26	1	3.8	-0.369 (0.613)	-2.080; 0.940
132 - 143.99 month	21	0	0	-0.460 (0.586)	-1.460; 0.870
144 - 156 month	23	0	0	-0.990 (0.482)	-1.810; 0.050

Table: 11.3 Weight-for-Height(WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	18	6	33.3	1.677 (0.787)	0.470; 3.170
108 - 119.99 month	24	5	20.8	2.375 (3.551)	-0.790; 9.990
120 - 131.99 month	26	17	65.4	6.790 (4.498)	-0.220; 9.990
132 - 143.99 month	21	21	100	9.990 (0.000)	9.990; 9.990
144 - 156 month	23	23	100	9.990 (0.000)	9.990; 9.990

VAYOTS DZOR *(crude data)*

Table: 12.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	11	3	27.3	-0.824 (1.390)	-3.150; 1.640
108 - 119.99 month	17	7	41.2	-1.702 (1.004)	-3.730; -0.090
120 - 131.99 month	17	6	35.3	-1.374 (0.773)	-2.520; -0.280
132 - 143.99 month	13	5	38.5	-1.451 (1.024)	-2.700; 0.770
144 - 156 month	12	4	33.3	-1.657 (1.153)	-3.890; 0.300

Table: 12.2 Weight-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	11	0	0	0.268 (0.722)	-1.230; 1.170
108 - 119.99 month	17	0	0	-0.014 (0.607)	-0.890; 1.300
120 - 131.99 month	17	0	0	-0.272 (0.479)	-1.080; 0.620
132 - 143.99 month	13	0	0	-0.417 (0.741)	-1.280; 0.970
144 - 156 month	12	0	0	-0.694 (0.919)	-1.810; 1.430

Table: 12.3 Weight-for-Height(WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	11	2	18.2	2.375 (2.742)	0.730; 9.990
108 - 119.99 month	17	9	52.9	2.232 (1.226)	0.120; 4.330
120 - 131.99 month	17	9	52.9	3.969 (4.092)	0.090; 9.990
132 - 143.99 month	13	13	100	8.828 (2.838)	2.120; 9.990
144 - 156 month	12	12	100	9.990 (0.000)	9.990; 9.990

TAUSH *(crude data)*

Table: 13.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	14	0	0	-0.505 (0.871)	-1.410; 1.060
108 - 119.99 month	21	2	9.5	-0.962 (0.770)	-2.670; 0.540
120 - 131.99 month	22	5	22.7	-1.069 (0.946)	-2.480; 0.930
132 - 143.99 month	19	5	26.3	-1.097 (1.160)	-2.810; 1.800
144 - 156 month	12	1	16.7	-1.216 (0.688)	-2.650; -0.180

Table: 13.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	14	0	0	0.126 (0.602)	-0.570; 1.700
108 - 119.99 month	21	2	0	-0.179 (0.550)	-1.400; 0.570
120 - 131.99 month	22	5	0	-0.235 (0.706)	-1.740; 1.380

132 - 143.99 month	19	5	0	-0.373 (0.793)	-1.890; 0.980
144 - 156 month	12	1	0	-0.394 (0.562)	-1.120; 0.850

Table: 13.3 Weight-for-Height(WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	14	0	0	0.833	-0.460; 1.820

				(0.769)	
108 - 119.99 month	21	2	9.5	0.926 (0.864)	-1.070; 2.670
120 - 131.99 month	22	15	68.2	6.365 (4.492)	0.080; 9.990
132 - 143.99 month	19	13	68.4	6.369 (4.384)	0.240; 9.990
144 - 156 month	12	12	100	9.990 (0.000)	9.990; 9.990

YEREVAN *(crude data)*

Table: 14.1 Height-for-Age (HAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	22	1	4.8	0.017 (0.938)	-1.960; 2.200
108 - 119.99 month	71	11	15.5	-0.580 (1.312)	-4.180; 2.830
120 - 131.99 month	74	8	10.8	-0.614 (1.117)	-4.580; 2.880
132 - 143.99 month	86	18	20.9	-0.980 (1.167)	-4.040; 2.530
144 - 156 month	78	17	21.8	-0.912 (1.288)	-4.190; 1.560

Table: 14.2 Weight-for-Age (WAZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	22	0	0	-0.355 (0.841)	-1.600; 0.870
108 - 119.99 month	71	5	7	-0.798 (0.783)	-2.690; 1.400
120 - 131.99 month	74	6	51.4	-0.912	-2.920; 1.160

				(0.835)	
132 - 143.99 month	86	15	17.4	-1.127 (1.020)	-3.870; 1.850
144 - 156 month	78	9	11.5	-0.994 (0.910)	-2.610; 1.390

Table: 14.3 Weight-for-Height (WHZ)

Age Group	# of observed children	# of abnormal anthropometry	% Abnormal Anthropometry	Mean Z-score (SD)	Range
96 - 107.99 month	22	4	18.2	-0.013 (2.540)	-3.050; 9.990
108 - 119.99 month	71	18	25.4	0.961 (3.681)	-2.580; 9.990
120 - 131.99 month	74	37	28	4.629 (5.323)	-2.490; 9.990
132 - 143.99 month	86	59	68.6	6.055 (5.070)	-2.580; 9.990
144 - 156 month	78	78	100	9.990 (0.000)	9.990; 9.990

Table 15.0: ***List of Population and Number of Clusters By Region***

Region (Marz)	Population (000) [1]	Cumulative Population (000)	#of schools (*10 year)*	# of clusters
Aragatsotn	162.5	162.5	88	6
Ararat	305.0	467.5	102	8
Armavir	315.5	783.0	108	8
Kotayk	325.9	1108.9	100	7

[1] ***Source of data****: State Department of Statistics, Government of Republic of Armenia*

Shirak	358.3	1467.2	146	11
Lori	392.4	1859.6	123	9
Gegharkunik	272.4	2132.0	111	8
Vayits Dzor	68.3	2200.3	40	3
Taush	154.8	2355.1	66	5
Syunik	161.9	2517.0	76	5
Yerevan	1249.4	3766.4	188	16

Table 16: Location and Names of Observed Clusters

Cl #	Cluster's name	Region	Marz
1	named by Proshian	Ashtarak	Aragatsotn
2	Ohanavan	Ashtarak	Aragatsotn
300	Tsilkar	Aragats	Aragatsotn
4	Aparan #2	Aparan	Aragatsotn
5	Vardenut	Aparan	Aragatsotn
6	Nerkin Bazmaberd	Talin	Aragatsotn
7	Ararat # 2	Ararat	Ararat
8	Pokr Vedy	Ararat	Ararat
9	Surenavan	Ararat	Ararat
10	Aigestan	Artashat	Ararat
11	Degtsut	Artashat	Ararat
12	Aartashat #1	Artashat	Ararat
13	Nor Kharberd #1	Masis	Ararat
14	Hovtashat	Masis	Ararat
15	#15 Armavir night	Armavir	Armavir
16	Metsamor #1	Armavir	Armavir
17	Hoktember	Armavir	Armavir
18	Armavir #3	Armavir	Armavir
19	Aygek	Echmiadzin	Armavir
20	Norakert	Echmiadzin	Armavir
21	Echmiadzin #1	Echmiadzin	Armavir
22	Dalarik # 2	Bagramian	Armavir
23	Gegarkunik	Gavar	Gegarkunik
24	Lchap	Gavar	Gegarkunik
25	Dprabak	Krasnoselsk	Gegarkunik
26	Lichk	Martuni	Gegarkunik
27	Artsvanist	Martuni	Gegarkunik
28	Tsagkunk	Sevan	Gegarkunik
29	Ayrk	Vardenis	Gegarkunik
30	Kutakan	Vardenis	Gegarkunik
31	Vahagn	Gugark	Lori
32	Hagpat	Tumanian	Lori
33	Spitak # 7	Spitak	Lori
34	Gurali	Spitak	Lori
35	named by Tumanian	Stepanavan	Lori
36	Tashir # 2	Tashir	Lori
37	Vanadzor # 1	c. Vanadzor	Lori
38	N. By Abovian # 9	c. Vanadzor	Lori
39	Vanadzor # 17	c. Vanadzor	Lori
40	Abovian # 1	Kotaik	Kotaik
141	Abovian # 7	Kotaik	Kotaik
42	Ptgni	Kotaik	Kotaik
43	Hrazdan # 8	Hrazdan	Kotaik
44	Solak	Hrazdan	Kotaik
45	Nor-Geg	Nairi	Kotaik
46	Kanakeravan	Nairi	Kotaik
47	Baiandur	Akhurian	Shirak
48	Erazgavors	Akhurian	Shirak
49	Bandivan	Amasia	Shirak
50	Bagravan	Ani	Shirak
51	Tsogamarg	Ashotsk	Shirak
52	Artik # 3	Artik	Shirak
53	Harich	Artik	Shirak
54	Ngjdeh # 17	c. Gumry	Shirak
55	Gogol # 21	c. Gumry	Shirak
56	Shtchedrin # 30	c. Gumry	Shirak
57	Mazmanian # 35	c. Gumry	Shirak
58	Kornidzor	Goris	Sunik
59	Bartsravan	Goris	Sunik
60	Artsvanik	Kapan	Sunik
61	Khorani	Kapan	Sunik
62	Sarnakunk	Sisian	Sunik
63	Vernashen	Egegnadzor	Vayots Dzor
64	Agndgadzor	Egegnadzor	Vayots Dzor
65	Bartsruni	Vaik	Vayots Dzor
66	Dilidjan # 6	c. Dilidjan	Taush
67	N. Karmir Agpiur	Taush	Taush
68	Bagratashen # 1	Noyemberian	Taush
69	Djudjevan	Noiemberian	Taush
70	Idjevan # 1	Idjevan	Taush
71	# 89	Yerevan	Yerevan
72	#179	Yerevan	Yerevan
73	Djrashen	Yerevan	Yerevan
74	#165	Yerevan	Yerevan
75	#2	Yerevan	Yerevan
76	#128	Yerevan	Yerevan
77	#125	Yerevan	Yerevan
78	#42	Yerevan	Yerevan

79	#15	Yerevan	Yerevan
80	#21	Yerevan	Yerevan
81	#76	Yerevan	Yerevan
82	#146	Yerevan	Yerevan
83	#74	Yerevan	Yerevan
84	#19	Yerevan	Yerevan
85	#72	Yerevan	Yerevan
86	#137	Yerevan	Yerevan

Table 17: Percentiles of weight (kg) by age for males and females of eight to twelve years.

Data are from the U.S NHANES I (1971-74) and NHANES II (1976-80) surveys and NHANES II (1976-80) surveys and were compiled by Frisancho.

Age (yr.)	Percentiles of weight (kg) by age							Percentiles of weight (kg) by age						
	5	**10**	**25**	**50**	**75**	**90**	**95**	**5**	**10**	**25**	**50**	**75**	**90**	**95**
8.0-8.9	21.5	22.7	24.5	26.8	29.7	33.6	37.3	20.9	21.9	24.0	26.9	30.4	35.1	39.9
9.0-9.9	23.6	24.7	27.1	30.3	33.6	40.3	43.2	23.7	24.8	26.8	30.7	34.7	41.7	46.5
10.0-10.9	26.2	27.7	30.2	33.8	38.6	45.6	53.1	25.6	27.0	29.6	33.9	39.2	46.5	52.4
11.0-11.9	28.3	30.0	33.4	37.6	43.3	52.3	58.6	29.1	30.5	34.3	39.8	46.3	56.9	61.9
12.0-12.9	30.8	32.8	36.6	42.2	49.0	59.0	66.9	32.5	34.3	39.1	45.9	53.0	61.2	66.7

Table 18: Percentiles of stature (cm) by age for males and females of eight to twelve years.

Data are from the U.S NHANES I (1971-74) and NHANES II (1976-80) surveys and NHANES II (1976-80) surveys and were compiled by Frisancho.

Age (yr.)	Percentiles of weight (kg) by age							Percentiles of weight (kg) by age						
	5	**10**	**25**	**50**	**75**	**90**	**95**	**5**	**10**	**25**	**50**	**75**	**90**	**95**
8.0-8.9	120.0	122.6	125.9	130.1	133.7	137.5	140.0	120.1	122.1	125.5	129.7	133.5	137.8	140.1
9.0-9.9	126.0	128.7	131.4	135.8	139.9	143.0	145.	125.7	127.5	130.5	135.6	140.4	143.9	147.2

							0							
10.0-10.9	130.2	132.3	136.1	140.9	145.8	150.1	152.7	129.5	132.2	136.3	141.6	146.0	150.9	154.4
11.0-11.9	134.3	136.6	141.6	146.4	151.5	155.0	158.1	134.7	138.1	142.3	148.4	153.4	158.0	162.1
12.0-12.9	139.7	141.9	146.4	151.4	157.9	162.3	166.0	143.0	145.2	149.6	154.6	159.3	164.0	165.5

Table 19: Percentiles for weight (kg) of Canadians by age.

Data are from Nutrition Canada (1980). Anthropometry Report- Height, Weight and Body Dimensions. Bureau of Nutritional Sciences, Health Protection Branch, Health and Welfare, Ottawa. Reproduced with permission of the Minister of Supply and Services Canada.

Age (yr.)	Male subjects							Female subjects						
	5	10	25	50	75	90	95	5	10	25	50	75	90	95
8	20.4	21.4	23.3	24.9	27.5	32.5	35.8	18.8	19.8	22.9	24.8	29.0	30.8	31.1
9	19.1	19.8	23.8	28.3	35.5	39.8	43.0	21.4	23.2	25.5	28.0	30.2	35.5	37.1
10	25.6	26.4	27.3	30.4	33.3	39.5	44.9	24.1	24.5	27.8	31.0	38.7	44.1	44.2
11	27.2	27.6	30.4	33.0	38.0	45.1	45.1	26.8	28.7	31.2	36.2	40.8	48.7	55.7
12	29.7	31.2	33.0	37.6	44.2	51.1	54.8	27.0	31.2	34.7	40.3	44.9	54.1	59.5

Table 20: Percentiles for stature (cm) of Canadians by age.

Data are from Nutrition Canada (1980). Anthropometry Report- Height, Weight and Body Dimensions. Bureau of Nutritional Sciences, Health Protection Branch, Health and Welfare, Ottawa.

Reproduced with permission of the Minister of Supply and Services Canada.

Age (yr.)	Male subjects							Female subjects						
	5	10	25	50	75	90	95	5	10	25	50	75	90	95
8	116.5	119.2	121.9	126.6	131.0	132.0	134.3	114.2	117.3	120.7	125.6	128.8	134.4	136.4
9	[illegible]	[illegible]	[illegible]	[illegible]	140.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	130.3	132.6	136.0	140.9
10	[illegible]	[illegible]	[illegible]	[illegible]	139.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	128.6	131.3	136.2	139.0	145.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	152.6	159.2	166.1	135.5	137.3	141.3	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]: Flow Cha[illegible]ethodology

STAGE I

Sample size
(constraint)
n = 2000

Cluster size
(assumption)
n_1 @ 25 ± 5

# of Clusters
(assumption)
n / n_1 @ 80

# of 10 year schools
(list of schools from MEE)
n_2 = 1148

Sampling interval
(calculated)
$I_1 = n_2 / 80$ @ 14

# of Clusters
(each 14th school)
n_3 = 86

# of classes per school
(constraint & convenient)
# of age groups*one class per each age
$C_{\#2} = A_{\#g} * 1 = 5*1 = 5$

Sampling interval
(calculated)
$I_2 = n_1 / A_{\#g}$
(25 ± 5) / 5 = 5 ± 1

# of children per class
(each 5th pupil)
$A_{\#} = n_1 / A_{\#g}$
(25 ± 5) / 5 = 5 ± 1

ANTHROPOMETRIC DATA

1. CLUSTER #__________________

2. GENDER
Male
Female

3. NATIONALITY________________

4. BIRTHDATE ________________
(dd/mm/yy)

5. WEIGHT_____________________
(*kilos)*

6. HEIGHT_____________________
(*cm)*

7. VISITDATE_____________
(*dd/mm/yy)*

ANTHROPOMETRIC DATA

{NAME}/ID <A >   SEX <A>   NATIONALITY<A >

{AGE} mos ###.##   BIRTHDATE <dd/mm/yy> dd/mm/yy
yrs ###.##   VISITDATE <dd/mm/yy> dd/mm/yy

{WEIGHT}kilos ###.##   PERCENTILE   Z-SCORE   %MEDIAN

{HAP} ###.##   HAZ ###.##   HAM ###.##

{HEIGHT}cm ###.##   {WAP} ###.##   WAZ ###.##   WAM ###.##

{WHP} ###.##   WHZ ###.##   WHM ###.##

Record {Flag} #