Results

The results of this cross sectional, observational and non-randomized anthropometrical small scale area study, that was conducted for 1000 Egyptian children locally residing in Gharbia governorate in Lower Egypt collected over 18months and compiled and analyzed for another 9-12 months from may 2010 to October 2011 by the investigator. They are presented in the coming tables (1 to 45) and figures (1 to 38) as follows:

The distribution of ecological data including gender, level of education, residence, age, and socioeconomic status, feeding practices and morbidity status are shown in tables (1a, b and c). We found that most of our children were of low and moderate socioeconomic level (72.4%) ***(Olfat etal.1983and Darwish etal.1982).***

Table (1a): Frequency distribution of studied population according to gender, level of education, residence, age, mothers' age, and socioeconomic level.

		N	%
Gender	**Female**	484	48.40
	Male	516	51.60
Level of education of the mother	**Illiterate**	51	5.10
	Average	430	43.00
	Above average	313	31.30
	Qualified high	206	20.60
Residence	**Rural**	594	59.40
	Urban	406	40.60
Maternal age	**<25 years**	158	15.80
	25 - 30 years	559	55.90
	>30 - 35 years	241	24.10
	> 35 years	42	4.20
Mother work	**No**	794	79.40
	Yes	206	20.60
Order of sibling	**One**	167	16.70
	Two	401	40.10
	More than 2	432	43.20
Age	**6-11ms.**	320	32.00
	12-23ms.	368	36.8
	24-60ms.	312	31.2
Socio economic level	**Low**	200	20.00
	Moderate	524	52.4
	High	276	27.6

Table (1b): Frequency distribution of studied population according to feeding practices.

Initiation of breastfeeding	**1st hour**		178	17.80
	2-6h.		610	61.00
	6-12h.		160	16.00
	>12h.		52	5.20
Initiation of weaning	**at 6m.**		824	82.40
	9m.		131	13.1
	At 12 months		32	3.2
	Still breastfeeding		13	1.3
Family's diet	**Family's diet had high biological values**		200	20.0
	Family's diet had moderate biological values		524	52.4
	Family's diet had low biological values		276	27.6
Diary products intake 6-11 months	**Rural**		**Urban**	
	Total no.	**%**	**Total no.**	**%**
	594	**100%**	**406**	**100%**
Twice /week	238	40.0%	211	52.0%
Less than twice / week	149	25.0%	8	2.0%
Daily	207	35.0%	187	46.0%

Table (1c): Frequency distribution of studied population by gender according to morbidity

		Female		**Male**		**Total**		**Chi-square**	
		N	**%**	**N**	**%**	**N**	**%**	**X^2**	**P-value**
Children admitted to hospital	**No**	407	82.72	432	85.04	839	83.90	0.992	0.319
	Yes	85	17.28	76	14.96	161	16.10		
Children had chest infections in last 6 months:	**No**	178	36.18	182	35.83	360	36.00	0.013	0.908
	Yes	314	63.82	326	64.17	640	64.00		
And its frequency	**Less than 3 times**	196	93.33	214	94.27	410	93.82	0.166	0.684
	More than 3 times	14	6.67	13	5.73	27	6.18		
Children had GIT infections in last 6 months	**No**	284	57.72	280	55.12	564	56.40	0.690	0.406
	Yes	208	42.28	228	44.88	436	43.60		
And its frequency	**Less than 3 times**	196	93.33	214	94.27	410	93.82	0.166	0.684
	More than 3 times	14	6.67	13	5.73	27	6.18		
Children had parasitic infestation	**No**	436	88.62	424	83.46	860	86.00	5.513	0.019
	Yes	56	11.38	84	16.54	140	14.00		
And its frequency	**Less than 3 times**	56	98.25	80	94.12	136	95.77	1.437	0.231
	More than 3 times	1	1.75	5	5.88	6	4.23		

Table (2) and Figure (1) show the pattern of growth of the Weight/age (as shown by the shape of the curve). There is an evident overlap with the shape of the curve of the WHO growth standard with some apparent dippings at the peak that required smoothening by statistical adjustments, but they were of no statistical significant difference.

Table (2): Frequency distribution of the children (6-60) months by age period for Weight/age using the z-score combined WHO growth standards.

Age groups	N	Weight-for-age %			
		% < -3SD	% < -2SD	Mean	SD
Total (6-60)	1000	0.0	1.5	-0.11	0.89
(6-11)	320	0.0	1.2	-0.15	0.95
(12-23)	368	0.0	3.0	-0.03	0.91
(24-35)	122	0.0	0.0	-0.1	0.8
(36-47)	104	0.0	0.0	-0.16	0.77
(48-60)	86	0.0	0.0	-0.31	0.82

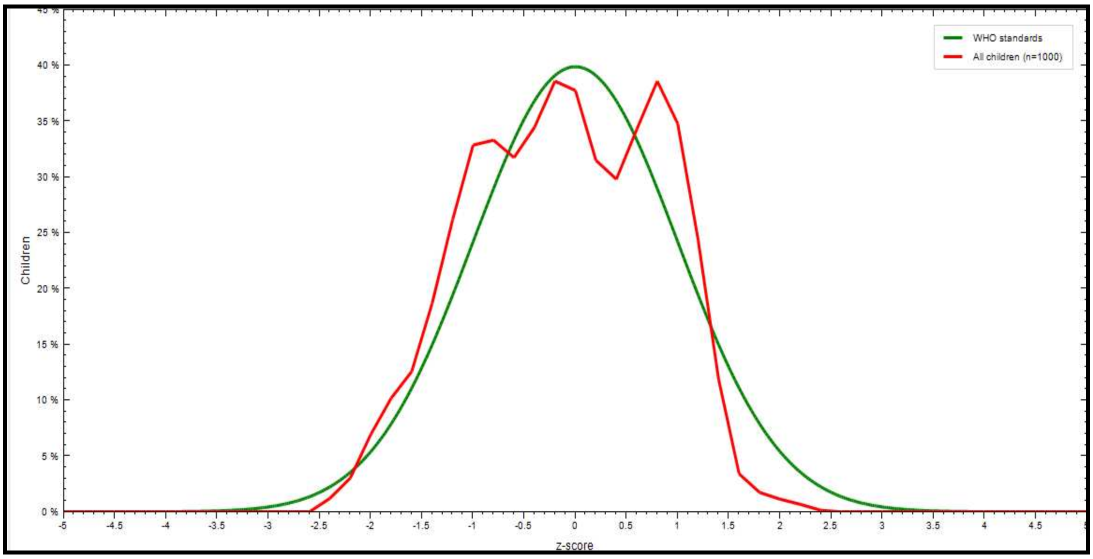


Fig.(1): Diagrammatic representation of the pattern of distribution of growth of the 6-60 months study population for the Weight/age. The shape of the curve overlaps with the shape of the WHO growth standard and there is no statistical significant difference.

Table (3) and Figure (2) show the pattern of growth of the Length/height-for-age (as shown by the shape of the curve) with a tendency to shift away (to the left of the curve) from the shape of the curve of the WHO growth standards. There is a statistical significant difference. The shift to the left indicates stunting in growth.

Table (3): Frequency distribution of the children (6-60) months for Length/height-for-age using the combined WHO growth standard for same age.

Age groups	N	Length/height-for-age %			
		% < -3SD	% < -2SD	Mean	SD
Total (6-60)	1000	0	1.7	-0.78	0.91
(6-11)	320	0	0.6	-0.75	0.9
(12-23)	368	0	2.7	-0.73	0.93
(24-35)	122	0	3.3	-0.85	0.94
(36-47)	104	0	0	-0.87	0.81
(48-60)	86	0	1.2	-0.85	0.94

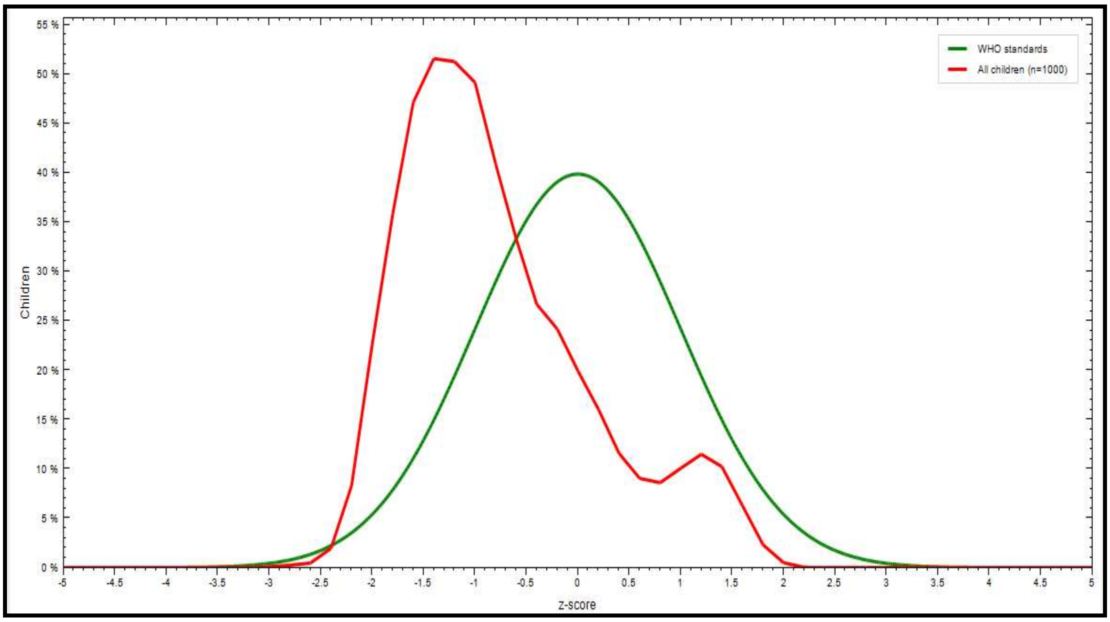


Fig.(2): Diagrammatic representation of the pattern of distribution of growth of the 6-60 months study population for the Length/height-for-age. The curve does not overlap with shape of the WHO growth standard with statistical significant difference P value is 0.00 <0.05.

Table (4) and Figure (3) show the pattern of growth for the Weight-for-length/height (as shown by the shape of the curve) as it overlaps with the shape of the curve of the WHO growth standard with a shift to the right but with no statistical significant difference at P>0.05.

Table (4): Frequency distribution of the children (6-60) months for Weight-for-length/height using the combined WHO growth standard for same age.

Age groups	N	Weight-for-length/height %					
		% < -3SD	% < -2SD	% > +2SD	% > +3SD	Mean	SD
Total (6-60)	1000	0	1.1	4.8	0	0.41	1.05
(6-11)	320	0	0	7.8	0	0.42	1.04
(12-23)	368	0	2.5	2.5	0	0.41	1.09
(24-35)	122	0	0.8	2.4	0	0.45	0.94
(36-47)	104	0	0	2.9	0	0.45	1.04
(48-60)	86	0	1.2	9.3	0	0.3	1.1

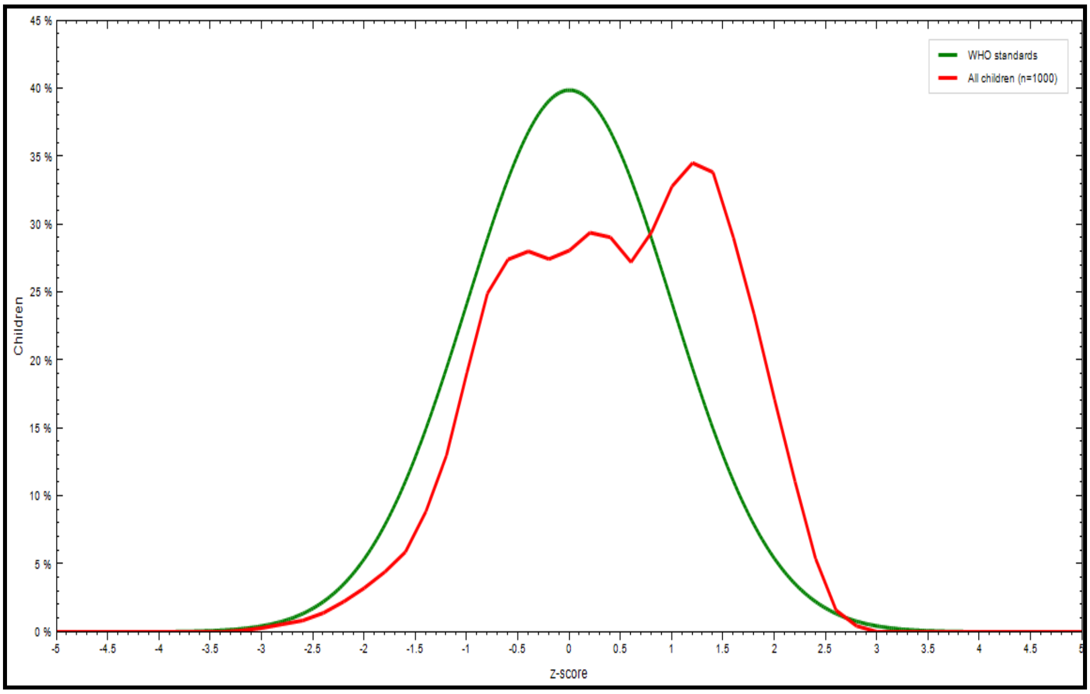


Fig.(3): Diagrammatic representation of the pattern of distribution of growth of the 6-60 months study population for the Weight-for-length/height with a deviation to the right towards indicating overweight.

Table (5) and Figure (4) show the pattern of growth of the Body Mass Index (as shown by the shape of the curve) overlaps with the shape of the curve of the WHO growth standard with deviation to the right indicating a tendency to overweight but with no statistical significant difference P>0.05.

Table (5): Compares of the distribution of the children (6-60) months for Body Mass Index using the combined WHO growth standard for same age.

Age groups	N	Body Mass Index-for – age					
		% < -3SD	% < -2SD	% > +2SD	% > +3SD	Mean	SD
Total (6-60)	1000	0	1.9	7.7	0	0.48	1.09
(6-11)	320	0	0.6	5.9	0	0.38	1.07
(12-23)	368	0	3.6	8.7	0	0.54	1.14
(24-35)	122	0	0.8	8.1	0	0.58	1
(36-47)	104	0	1.9	7.7	0	0.55	1.08
(48-60)	86	0	1.2	9.3	0	0.34	1.09

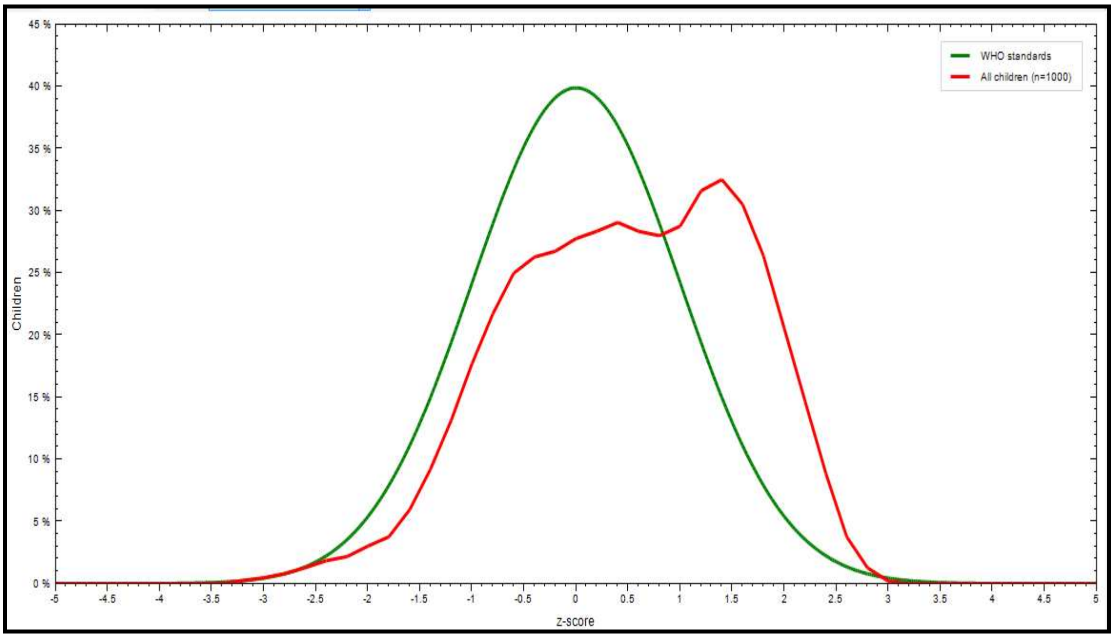


Fig.(4): Diagrammatic representation of the pattern of distribution of growth of the 6-60 months study population for the Body Mass Index (as shown by the shape of the curve).

Table (6) and Figure (5a) show the pattern of growth of the Weight/age for males (as shown by the shape of the curve) overlap the shape of the curve of the WHO growth standard with no statistical significant difference.

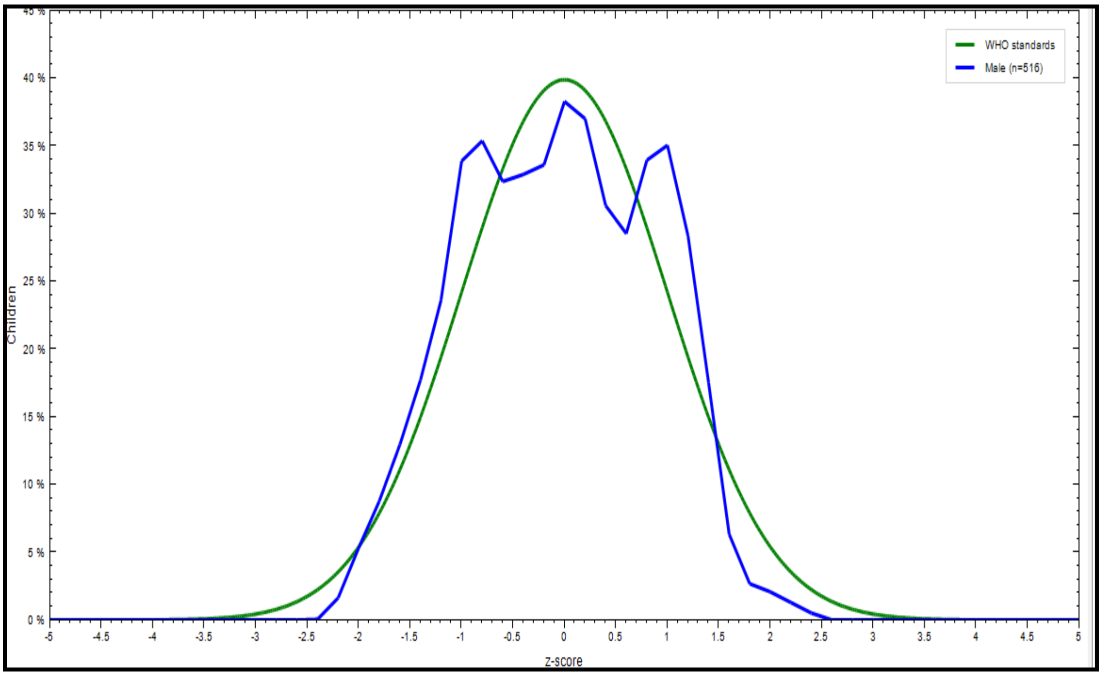
Table (6): Compares of the distribution of the children (6-60) months for Weight/age of males with the WHO growth standard for same age and sex group.

Age groups	N	Weight-for-age %			
		% < -3SD	% < -2SD	Mean	SD
Total (6-60)	516	0	0	-0.05	0.89
(6-11)	167	0	0	0.02	0.94
(12-23)	187	0	0	0.04	0.91
(24-35)	65	0	0	-0.13	0.83
(36-47)	52	0	0	-0.29	0.77
(48-60)	45	0	0	-0.29	0.79

Table (7) and Figure (5b) show the pattern of growth of the Weight-for-age for females (as shown by the shape of the curve) overlap the shape of the curve of the WHO growth standard with no statistical significant difference. There is stunting of growth, shifting to the left.

Table (7): Compares of distribution of the children (6-60) months for Weight-for-age of females using the WHO growth standard for same age and sex group.

Age groups	N	Weight-for-age %			
		% < -3SD	% < -2SD	Mean	SD
Total (6-60)	484	0	3.1	-0.18	0.88
(6-11)	153	0	2.6	-0.32	0.92
(12-23)	181	0	6.1	-0.1	0.9
(24-35)	57	0	0	-0.08	0.77
(36-47)	52	0	0	-0.02	0.75
(48-60)	41	0	0	-0.33	0.85



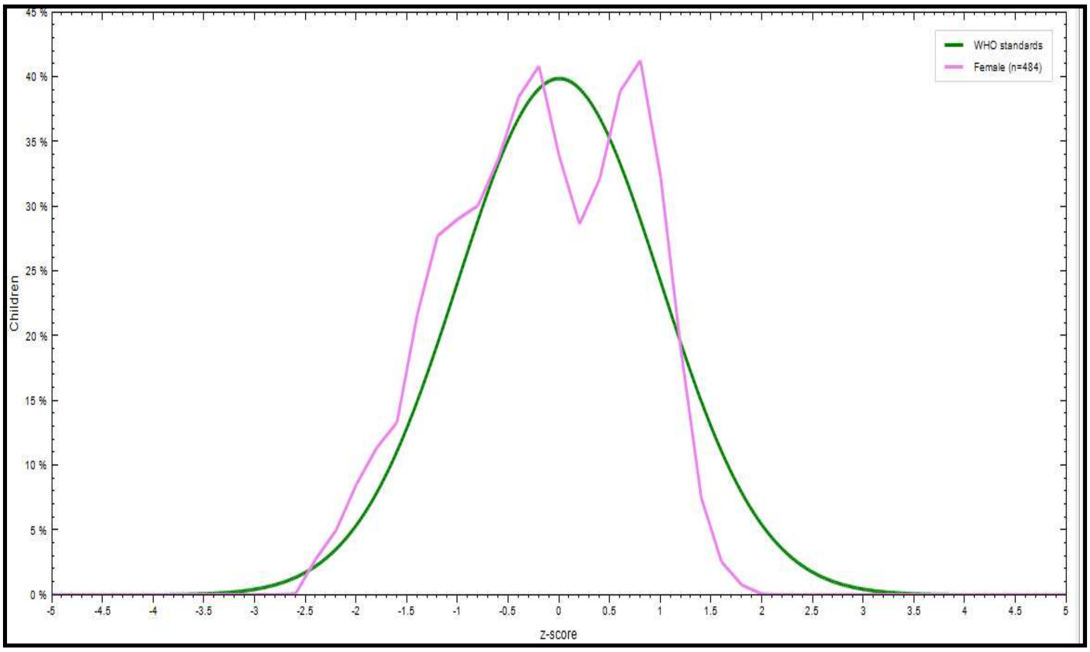


Fig.(5a,b): Diagrammatic representation of the pattern of distribution of growth of the 6-60 months study population for the Weight/age for males and females. There is overlap of our population with the WHO growth standard curve with no statistical significant difference at P>00.05.

Table (8) and Figure (6a) show the pattern of growth for Length/height-for-age of males (as shown by the shape of the curve). There is a shift to the left with no overlap, with the curve of the WHO growth standard indicating stunting of growth among males and females.

Table (8): Compares of the distribution of the children (6-60) months by Length/height-for-age for males with the WHO growth standard for same sex.

Age groups	N	Length/height-for-age %			
		% < -3SD	% < -2SD	Mean	SD
Total (6-60)	516	0	2.7	-0.81	0.89
(6-11)	167	0	1.2	-0.72	0.87
(12-23)	187	0	4.8	-0.81	0.93
(24-35)	65	0	3	-0.76	0.94
(36-47)	52	0	0	-1.02	0.71
(48-60)	45	0	2.2	-0.99	0.86

Table (9) and Figure (6b) show the pattern of growth of the Length/height-for-age for females (as shown by the shape of the curve) not overlapping the shape of the curve of the WHO growth standard with statistical significant difference. There is stunting of growth, shifting to the left.

Table (9) Compares of the distribution of the children (6-60) months for Length/height-for-age of females using the WHO growth standard.

Age groups	N	Length/height-for-age %			
		% < -3SD	% < -2SD	Mean	SD
Total (6-60)	484	0	0.6	-0.74	0.93
(6-11)	153	0	0	-0.78	0.93
(12-23)	181	0	0.6	-0.65	0.93
(24-35)	57	0	3.5	-0.95	0.94
(36-47)	52	0	0	-0.72	0.88
(48-60)	41	0	0	-0.7	1.02

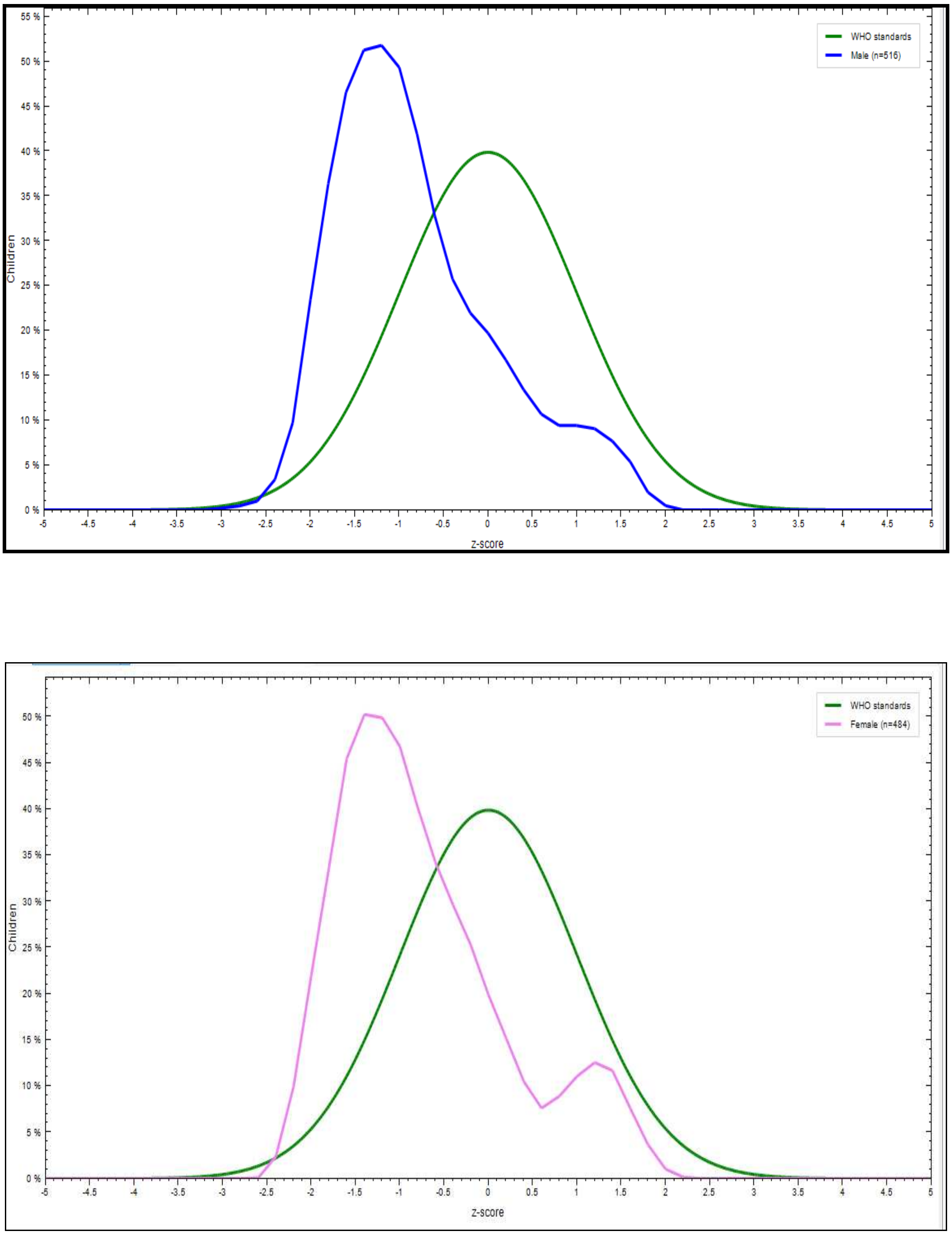


Fig.(6a,b): Diagrammatic representation of the pattern of distribution of growth of the 6-60 months study population for Length/height-for-age of males and females. There is a significant shift in Length/height-for-age curve at P value is 0.00 <0.05.

Table (10) and Figure (7a) show The pattern of growth of the Weight-for-length/height for males (as shown by the shape of the curve) with a tendency for deviation to the right but with no statistical significant difference P>0.05.

Table (10): Compares of the distribution of the children (6-60) months for Weight-for-length/height of males using the WHO growth standard for same sex age.

Age groups	N	Weight-for-length/height %					
		% < -3SD	% < -2SD	% > +2SD	% > +3SD	Mean	SD
Total (6-60)	516	0	0.8	6.2	0	0.52	1.03
(6-11)	167	0	0	9.6	0	0.6	1.04
(12-23)	187	0	1.6	3.8	0	0.56	1.06
(24-35)	65	0	0	1.5	0	0.37	0.9
(36-47)	52	0	0	1.9	0	0.38	0.96
(48-60)	45	0	2.2	15.6	0	0.46	1.17

Table (11) and Figure (7b) show the pattern of growth of the Weight-for-length/height (as shown by the shape of the curve) as it overlaps with the shape of the curve of the WHO growth standard with some deviation to the right that is of no statistical significant difference P>0.05.

Table (11): Compares of the distribution of the children (6-60) months for weight for length Weight-for-length/height of females using the combined WHO growth standard.

Age groups	Weight-for-length/height %					
	% < -3SD	% < -2SD	% > +2SD	% > +3SD	Mean	SD
Total (6-60)	0	1.4	3.3	0	0.3	1.05
(6-11)	0	0	5.8	0	0.22	1
(12-23)	0	3.3	1.1	0	0.26	1.1
(24-35)	0	1.8	3.5	0	0.55	0.98
(36-47)	0	0	3.8	0	0.52	1.11
(48-60)	0	0	2.4	0	0.13	0.99

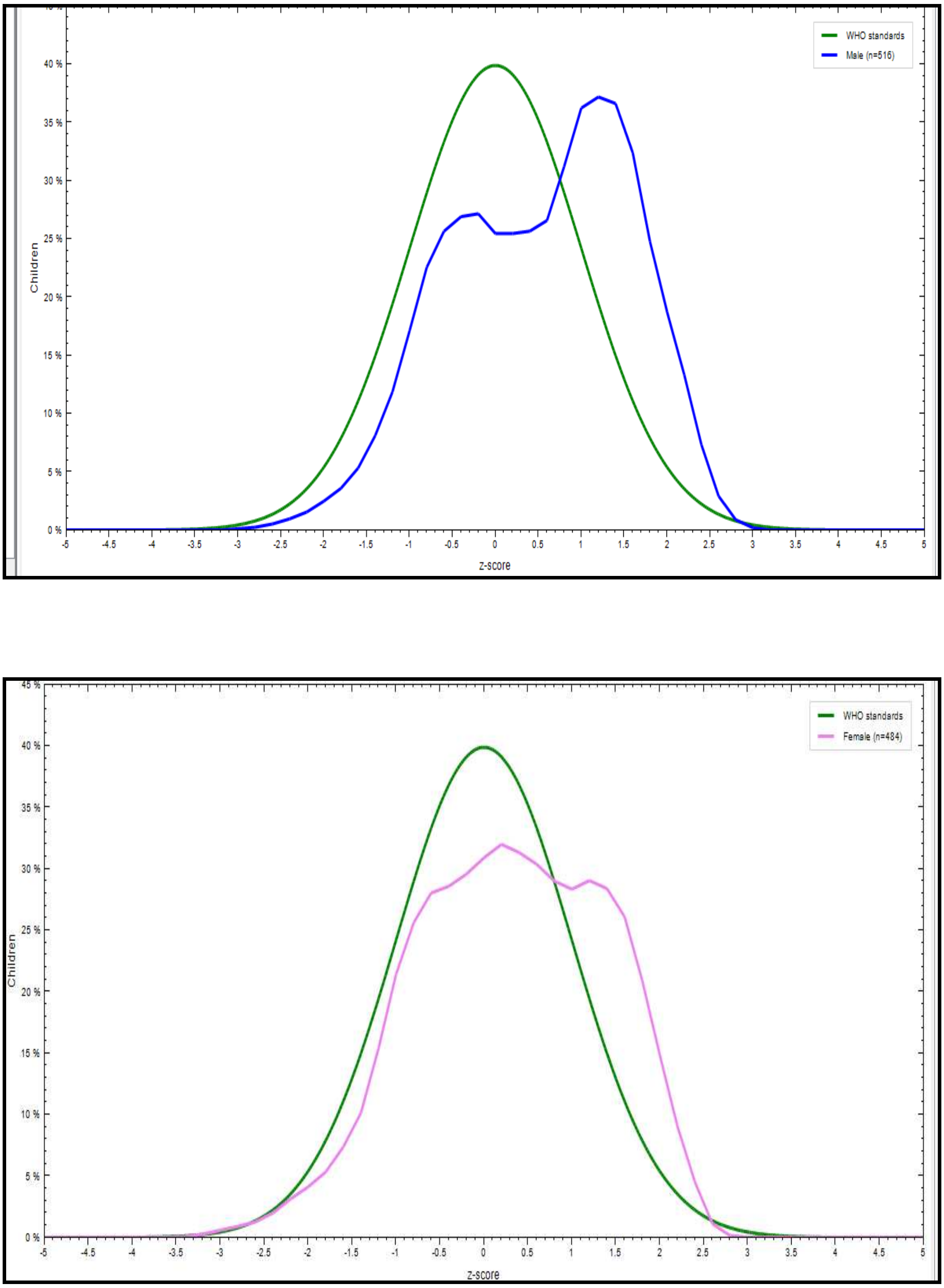


Fig.(7a,b)*:* Diagrammatic representation of the pattern of distribution of growth of the 6-60 months study population for the Weight-for-length/height of males and females P>0.05.

Table (12) and Figure (8a) show the pattern of growth of the Body Mass Index for males (as shown by the shape of the curve) overlaps with the shape of the curve of the WHO growth standard with deviation to the right with no statistical significant difference P>0.05.

Table (12): Compares of the distribution of the children (6-60) months by Body Mass Index for males with the WHO growth standard for same sex and age.

Age groups	N	Body Mass Index					
		% < -3SD	% < -2SD	% > +2SD	% > +3SD	Mean	SD
Total (6-60)	516	0	1.6	9.3	0	0.6	1.07
(6-11)	167	0	1.2	10.2	0	0.58	1.06
(12-23)	187	0	2.7	10.8	0	0.71	1.11
(24-35)	65	0	0	3	0	0.49	0.94
(36-47)	52	0	0	3.8	0	0.52	0.98
(48-60)	45	0	2.2	15.6	0	0.51	1.17

Table (13) and Figure (8b) show the pattern of growth of the Body Mass Index (as shown by the shape of the curve) overlaps with the shape of the curve of the WHO growth standard with deviation to the right with no statistical significant difference P>0.05.

Table (13): Compares of the distribution of the children (6-60) months by Body Mass Index of females with the WHO growth standard for same age. There's deviation towards obesity.

Age groups	N	Body Mass Index					
		% < -3SD	% < -2SD	% > +2SD	% > +3SD	Mean	SD
Total (6-60)	484	0	2.3	6	0	0.35	1.1
(6-11)	153	0	0	1.3	0	0.16	1.04
(12-23)	181	0	4.4	6.7	0	0.37	1.15
(24-35)	57	0	1.8	14	0	0.69	1.06
(36-47)	52	0	3.8	11.5	0	0.59	1.18
(48-60)	41	0	0	2.4	0	0.14	0.96

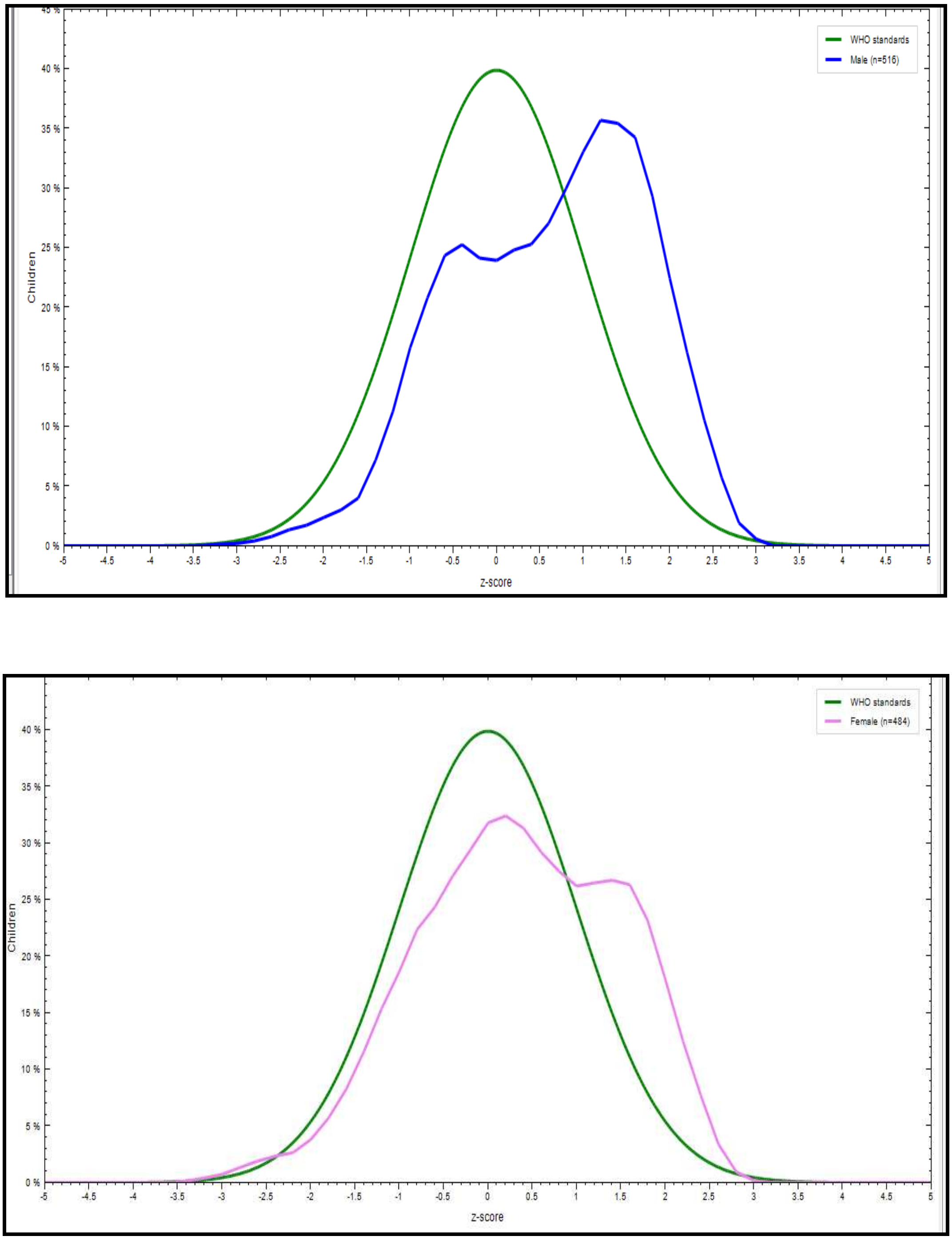


Fig.(8a,b): Diagrammatic representation of the pattern of distribution of growth of the 6-60 months study population for the Body Mass Index for males and females. The shape of the curve overlaps with shape of the WHO growth standard with some deviation to the right towards (overweight) at P>0.05.

Table (14): Distribution of the mid upper arm circumference for age (MUAC/A) of children aged (6-60) months using the WHO standards.

	Age 6-11 month		Age 12-23 month		Age 24-60 month	
MUAC/A	**WHO**		**WHO**		**WHO**	
%	**No.**	**%**	**No.**	**%**	**No.**	**%**
<3rd	3	0.9	3	0.81	1	0.3
3rd - 5th	14	4.3	6	1.63	15	4.8
>5th- 10th	28	8.75	27	7.33	21	6.73
>10th- 25th	76	23.75	50	13.58	67	21.47
>25th -50th	69	21.56	85	23.09	97	31.08
>50th -75th	82	25.66	155	42.1	68	21.79
>75th-90th	43	13.4	36	9.7	39	12.5
>90th-95th	4	1.25	2	0.5	4	1.28
>95th - 97th	1	0.3	2	0.5	-	-
>97th	-	-	2	0.5	-	-

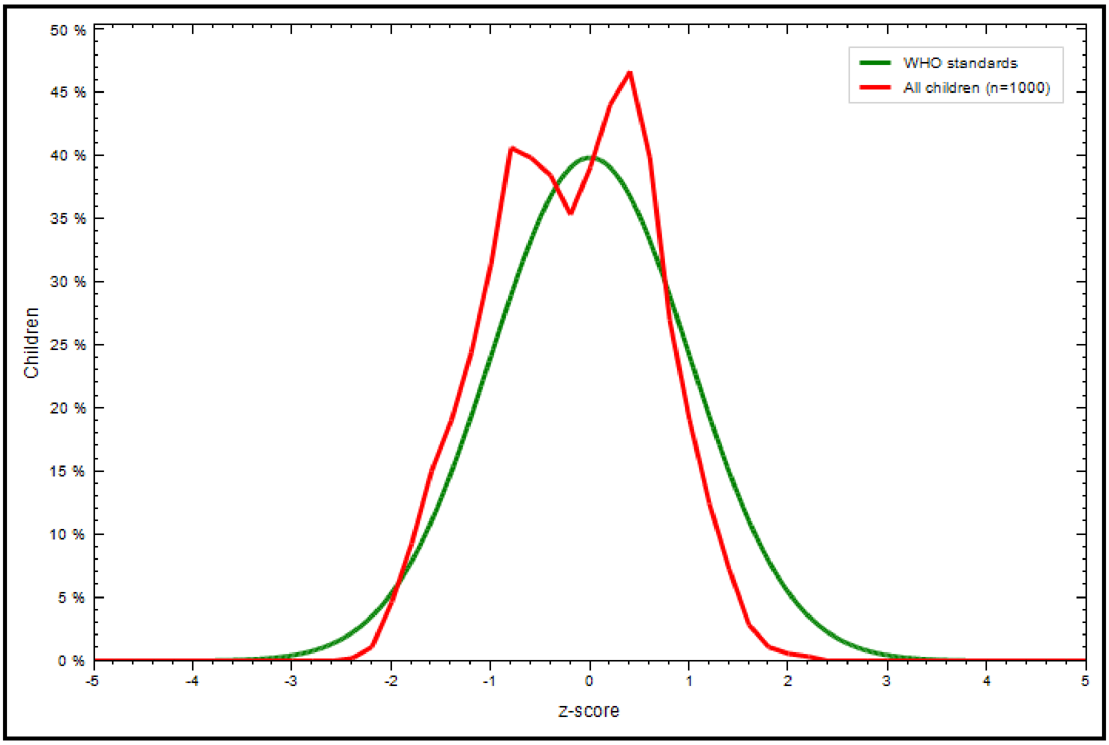


Fig. (9): Diagrammatic representation of the pattern of growth of the 6-60 months study population for MUAC/A for children aged (6-60) months according to the WHO.

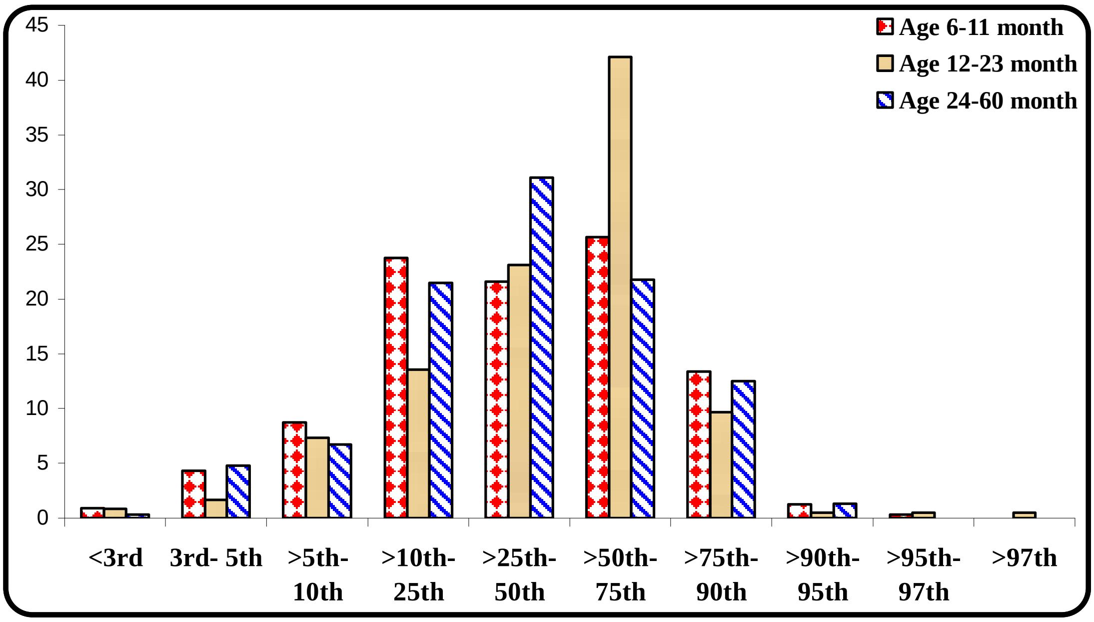


Fig. (10): Diagrammatic representation of the distribution of growth of the 6-60 months study population for mid upper arm circumference for age for children aged (6-60) months according to the WHO.

Table (15) and Figure (11) compare Weight-for-age for 6-11months age group plotted on the Egyptian growth standard and WHO growth standard. The difference in the distribution in-between centiles is highly significant (P value was 0.00).

Table (15): Compares Weight-for-age for the 6-11 months age group against Egyptian growth standard (EgGS) and WHO child growth standard (WHO CGS).

Weight-for-age 6-11ms.		* Egyptian growth standard (EgGS)		*WHO-CGS	
		N	%	N	%
<3rd		0	0.00	4	1.25
3rd to 5th		1	0.31	19	5.94
>5th to10th		1	0.31	26	8.13
>10th to25th		28	8.75	57	17.81
>25th to 50th		48	15.00	67	20.94
>50th to 75th		113	35.31	53	16.56
>75th to 90th		75	23.44	86	26.88
>90th to 95th		14	4.38	7	2.19
>95th to 97th		35	10.94	1	0.31
>97th		5	1.56	0	0.00
Total		320	100.00	320	100.00
Chi-square	X^2	118.264			
	P-value	0.000			

*** Egyptian growth standard (EgGS).**
***World health organization (WHO-CGS).**

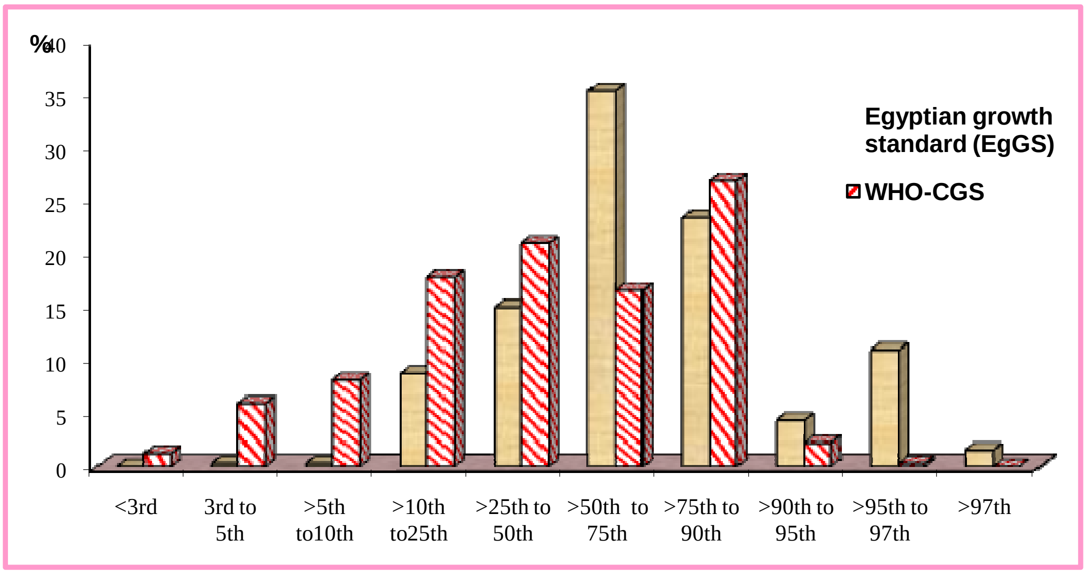


Fig. (11): Diagrammatic representation of the distribution of growth of study population for Weight-for-age for children aged (6-11) months plotted against Egyptian growth standard and WHO child growth standard.

Table (16) and Figure (12) compare Weight-for-age for 12-23 months age group plotted on the Egyptian growth standard and the WHO child growth standard. The difference in the distribution across the centiles is highly significant (P value was 0.001).

Table (16): Compares Weight-for-age for the 12-23 months age group against Egyptian growth standard (EgGS)and WHO child growth standard (WHO- CGS).

Weight-for-age 12-23ms.		Egyptian growth Standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		8	2.17	11	2.99
3rd to 5th		6	1.63	13	3.53
>5th to10th		20	5.43	4	1.09
>10th to25th		74	20.11	74	20.11
>25th to 50th		89	24.18	69	18.75
>50th to 75th		103	27.99	100	27.17
>75th to 90th		63	17.12	90	24.46
>90th to 95th		5	1.36	2	0.54
>97th		0	0.00	5	1.36
Total		368	100.00	368	100.00
Chi-square	X^2	27.346			
	P-value	0.001			

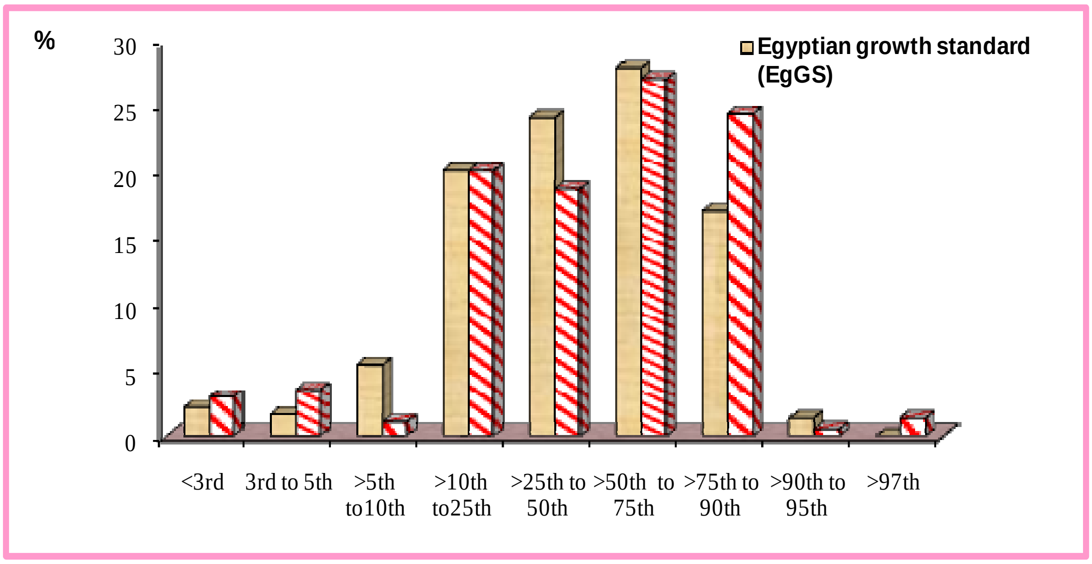


Fig. (12): Diagrammatic representation of the distribution of growth of study population for Weight-for-age for children aged (12-23) months plotted against Egyptian growth standard and WHO child growth standard.

Table (17) and Figure (13) compare Weight-for-age for the 24-60 months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is highly significant (P value was 0.000).

Table (17): Compares Weight-for-age for the 24-60 months age group against Egyptian standard growth chart (EgGS) and WHO child growth standard (WHO-CGS).

Weight-for-age 24-60ms.		Egyptian growth standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		11	3.53	0	0.00
3rd to 5th		21	6.73	10	3.21
>5th to10th		27	8.65	11	3.53
>10th to25th		81	25.96	75	24.04
>25th to 50th		92	29.49	104	33.33
>50th to 75th		58	18.59	63	20.19
>75th to 90th		21	6.73	46	14.74
>90th to 95th		1	0.32	2	0.64
>95th to 97th		0	0.00	1	0.32
Total		312	100.00	312	100.00
Chi-square	X^2	33.474			
	P-value	0.000			

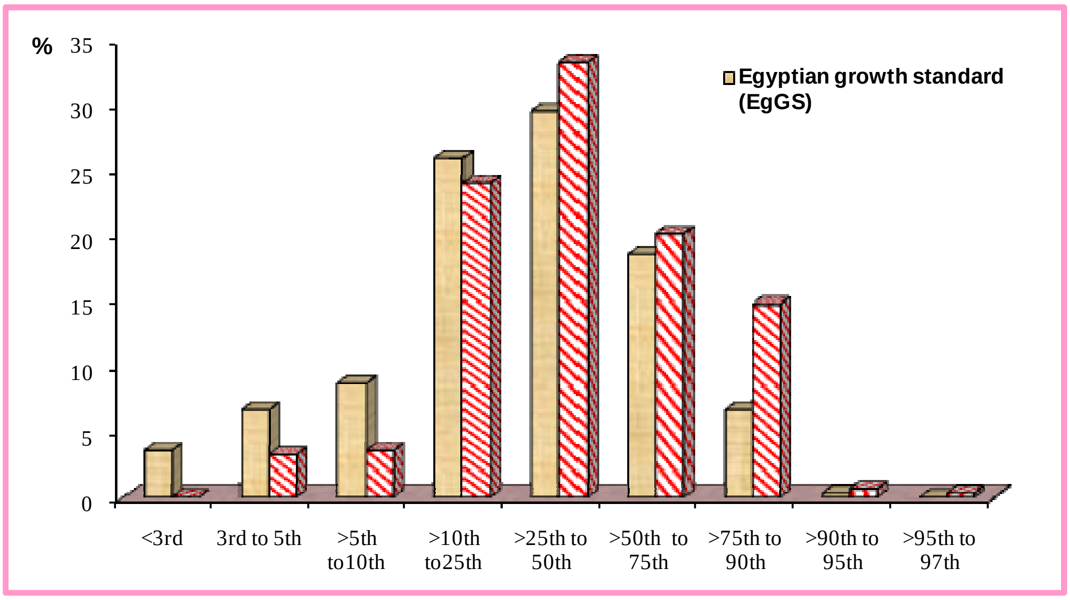


Fig. (13): Diagrammatic representation of the distribution of growth of study population for Weight-for-age for children aged (24-60) months plotted against Egyptian growth standard and WHO child growth standard.

Table (18) and Figure (14) compare Length-for-age for 6-11 months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is highly significant (P value was 0.000).

Table (18): Compares Length-for-age for the 6-11 months age group against Egyptian standard growth chart (EgGS) and WHO child growth standard (WHO-CGS).

Length-for-age 6-11ms.		Egyptian growth Standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		0	0.00	2	0.63
3rd to 5th		0	0.00	49	15.31
>5th to10th		1	0.31	73	22.81
>10th to25th		121	37.81	83	25.94
>25th to 50th		111	34.69	51	15.94
>50th to 75th		58	18.13	31	9.69
>75th to 90th		29	9.06	19	5.94
>90th to 95th		0	0.00	12	3.75
Total		320	100.00	320	100.00
Chi-square	X^2	172.629			
	P-value	0.000			

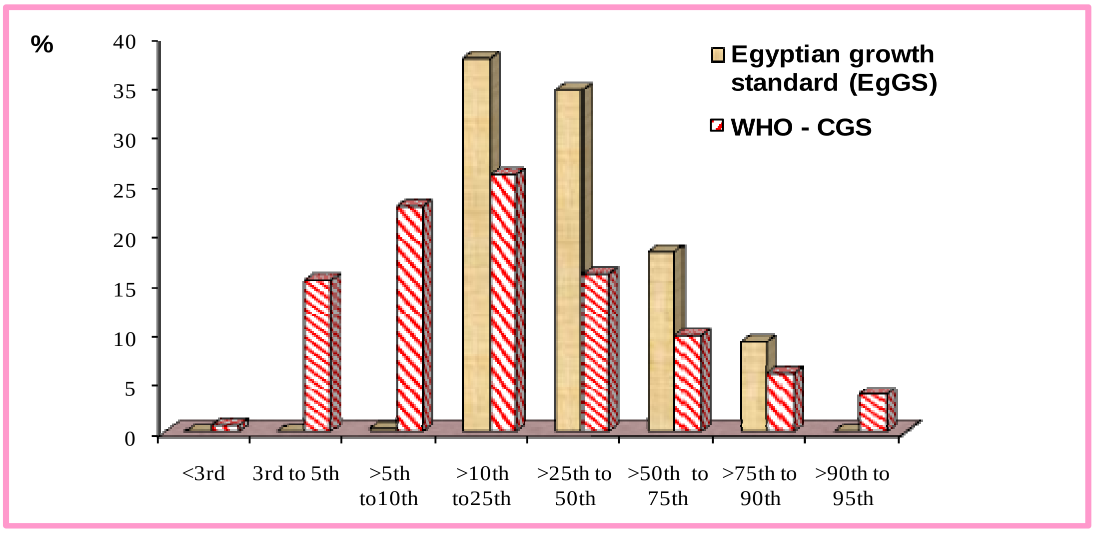


Fig. (14): Diagrammatic representation of the distribution of growth of study population for Length-for-age for children aged (6-11) months plotted against Egyptian growth standard and WHO child growth standard.

Table (19) and Figure (15) compare Length-for-age for 12-23months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution hn-between centiles is highly significant (P value was 0.00).

Table (19): Compares Length-for-age for the 12-23 months age group with Egyptian growth standard(EgGS) and WHO child growth standard(WHO-CGS).

Length-for-age 12-23ms.		Egyptian growth Standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		0	0.00	10	2.72
3rd to 5th		0	0.00	75	20.38
>5th to10th		3	0.82	42	11.41
>10th to25th		125	33.97	86	23.37
>25th to 50th		136	36.96	84	22.83
>50th to 75th		63	17.12	31	8.42
>75th to 90th		41	11.14	27	7.34
>90th to 95th		0	0.00	13	3.53
Total		368	100.00	368	100.00
Chi-square	X^2	165.075			
	P-value	0.000			

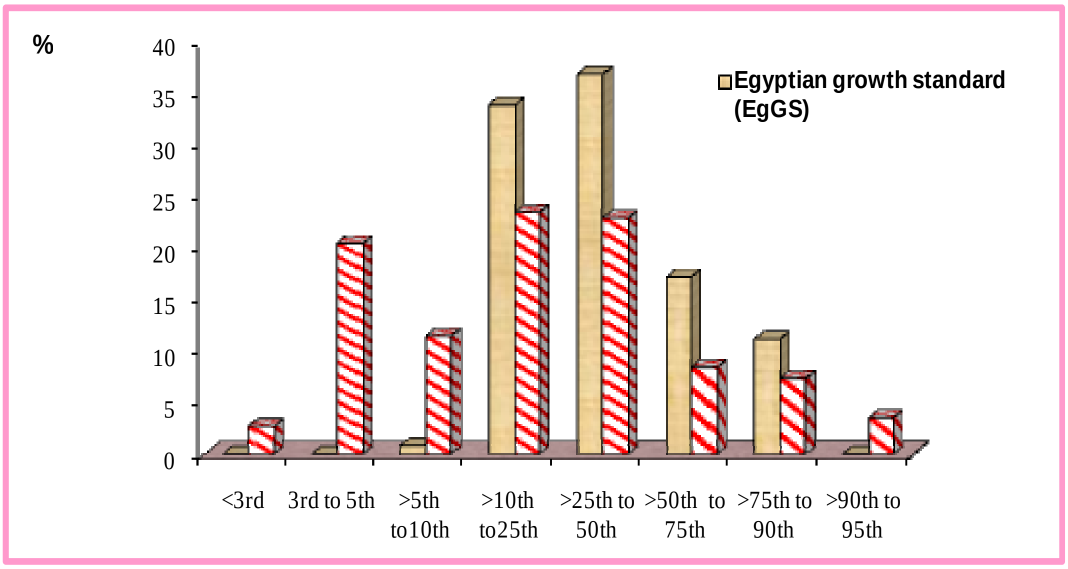


Fig. (15): Diagrammatic representation of the distribution of growth of study population for Length-for-age for children aged (12-23) months plotted against Egyptian growth standard and WHO child growth standard.

Table (20) and Figure (16) compare height-for-age for 24-60 months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is highly significant (P value was 0.00).

Table (20): Compares height-for-age for the 24-60 months age group with Egyptian growth standard (EgGS) and WHO child growth standard (WHO-CGS).

height-for-age 24-60ms.		Egyptian growth Standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		0	0.00	5	1.60
3rd to 5th		1	0.32	58	18.59
>5th to10th		18	5.77	51	16.35
>10th to25th		103	33.01	109	34.94
>25th to 50th		112	35.90	38	12.18
>50th to 75th		39	12.50	25	8.01
>75th to 90th		23	7.37	13	4.17
>90th to 95th		11	3.53	13	4.17
>95th to 97th		5	1.60	0	0.00
Total		312	100.00	312	100.00
Chi-square	X^2	123.53			
	P-value	0.000			

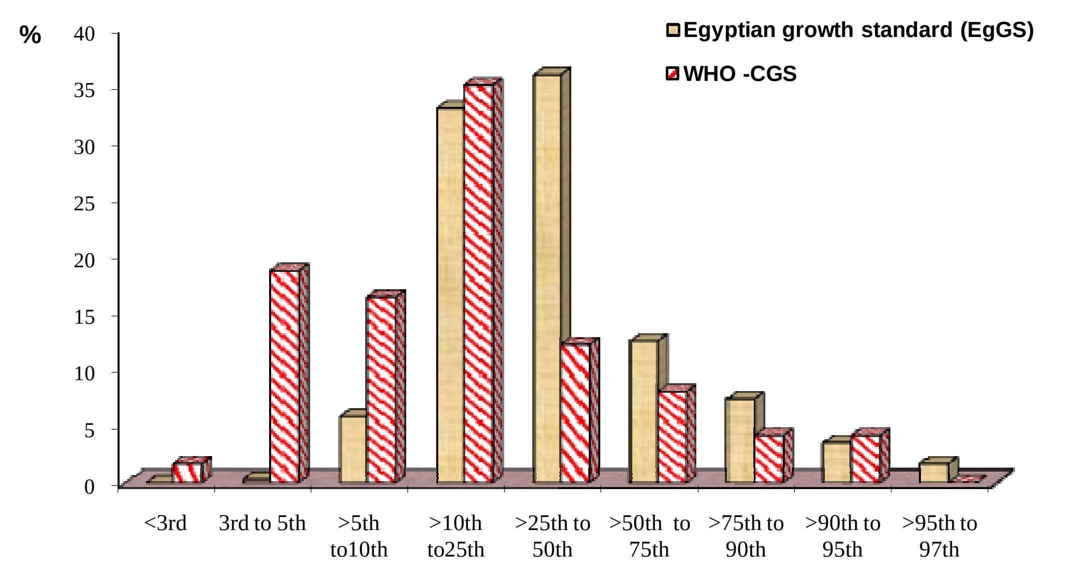


Fig. (16): Diagrammatic representation of the distribution of growth of study population for height-for-age for children aged (24-60) months plotted against Egyptian growth standard and WHO child growth standard.

Table (21) and Figure (17) compare Weight-for-length for 6-11months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is insignificant (P value was 0.115).

Table (21): Compares Weight-for-length for the 6-11 months age group with Egyptian growth standard (EgGS) and WHO child growth standard (WHO-CGS).

Weight-for-length 6-11ms.		Egyptian growth standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		0	0.00	0	0.00
3rd to 5th		0	0.00	4	1.25
>5th to10th		3	0.94	8	2.50
>10th to25th		31	9.69	46	14.38
>25th to 50th		81	25.31	68	21.25
>50th to 75th		62	19.38	53	16.56
>75th to 90th		63	19.69	63	19.69
>90th to 95th		29	9.06	34	10.63
>95th to 97th		17	5.31	19	5.94
>97th		34	10.63	25	7.81
Total		320	100.00	320	100.00
Chi-square	X^2	12.914			
	P-value	0.115			

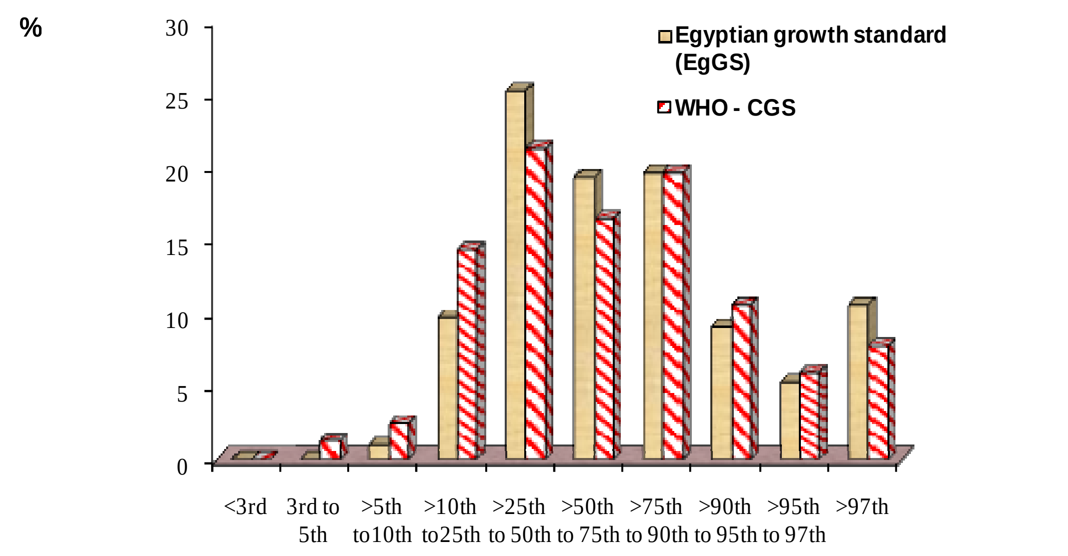


Fig. (17): Diagrammatic representation of the distribution of growth of study population for Weight-for-length for children aged (6-11) months plotted against Egyptian growth standard and WHO child growth standard.

Table (22) and Figure (18) compare Weight-for-length for 12-23 months age group between Egyptian growth standard and WHO child growth standard. The difference in the distribution in –between centiles is insignificant (P value was 0.291).

Table (22): Compares Weight-for-length for the 12-23 months age group with Egyptian growth standard (EgGS) and WHO child growth standard (WHO-CGS).

Weight-for-length 12-23ms.		Egyptian growth standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		4	1.09	9	2.45
3rd to 5th		6	1.63	10	2.72
>5th to10th		10	2.72	9	2.45
>10th to25th		44	11.96	39	10.60
>25th to 50th		65	17.66	53	14.40
>50th to 75th		90	24.46	84	22.83
>75th to 90th		74	20.11	81	22.01
>90th to 95th		44	11.96	44	11.96
>95th to 97th		16	4.35	30	8.15
>97th		15	4.08	9	2.44
Total		368	100.00	368	100.00
Chi-square	X^2	10.781			
	P-value	0.291			

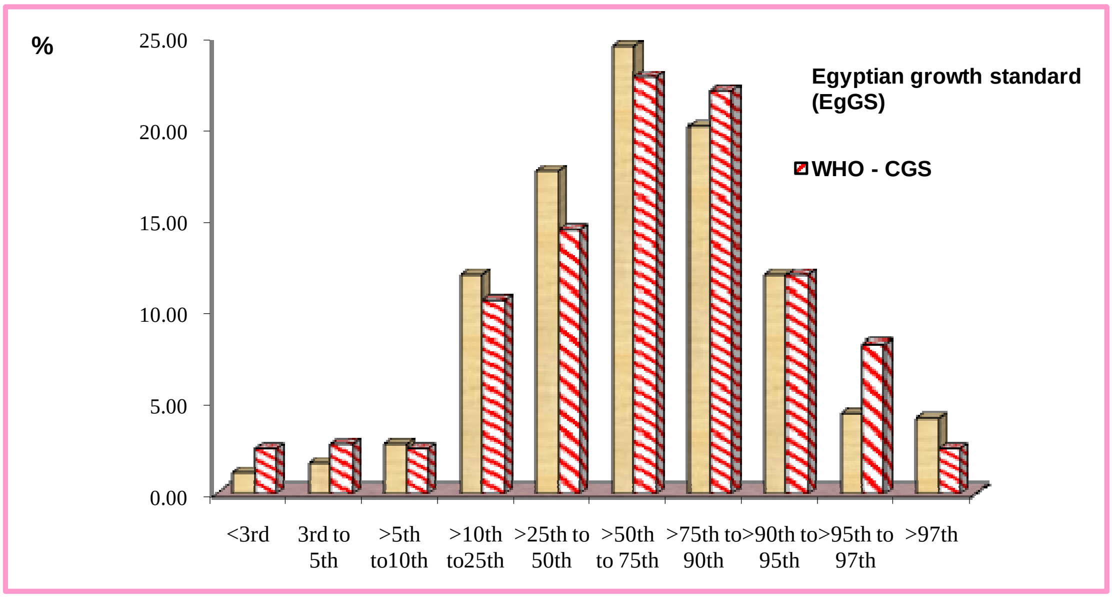


Fig. (18): Diagrammatic representation of the distribution of growth of study population for Weight-for-length for children aged (12-23) months plotted against Egyptian growth standard and WHO child growth standard .

Table (23) and Figure (19) compare Weight-for-height for 24-36 months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is insignificant. (P value was 0.796).

Table (23): Compares Weight-for-height for the 24-36 months age group with Egyptian growth standard (EgGS) and WHO child growth standard (WHO-CGS).

Weight-for-height 24-36 ms.		Egyptian growth Standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		1	0.63	1	0.63
3rd to 5th		0	0.00	2	1.26
>5th to10th		2	1.26	2	1.26
>10th to25th		15	9.43	16	10.06
>25th to 50th		34	21.38	27	16.98
>50th to 75th		53	33.33	44	27.67
>75th to 90th		32	20.13	37	23.27
>90th to 95th		12	7.55	17	10.69
>95th to 97th		7	4.40	10	6.29
>97th		3	1.89	3	1.89
Total		159	100.00	159	100.00
Chi-square	X^2	5.424			
	P-value	0.796			

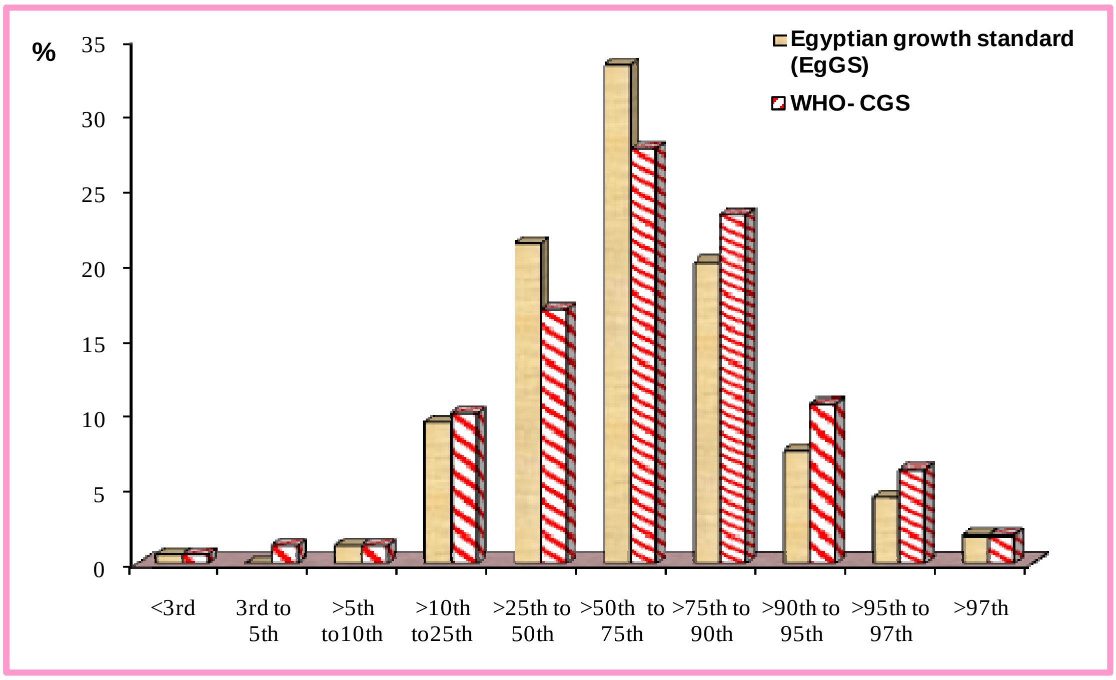


Fig. (19): Diagrammatic representation of the distribution of growth of study population for Weight-for-height for children aged (24-36) months plotted against Egyptian growth standard and WHO child growth standard

Table (24) and Figure (20) compare Body Mass Index for 24-60 months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is highly significant (P value was 0.000).

Table (24): Compares Body Mass Index for the 24-60 months age group with Egyptian growth standard (EgGS) and WHO child growth standard (WHO-CGS).

Body Mass Index 24-60ms.		Egyptian growth standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		15	4.81	4	1.28
3rd to 5th		9	2.88	8	2.56
>5th to10th		15	4.81	3	0.96
>10th to25th		47	15.06	31	9.94
>25th to 50th		70	22.44	58	18.59
>50th to 75th		61	19.55	65	20.83
>75th to 90th		61	19.55	54	17.31
>90th to 95th		30	9.62	42	13.46
>95th to 97th		4	1.28	17	5.45
>97th		0	0.00	30	9.62
Total		312	100.00	312	100.00
Chi-square	X^2	59.435			
	P-value	0.000			

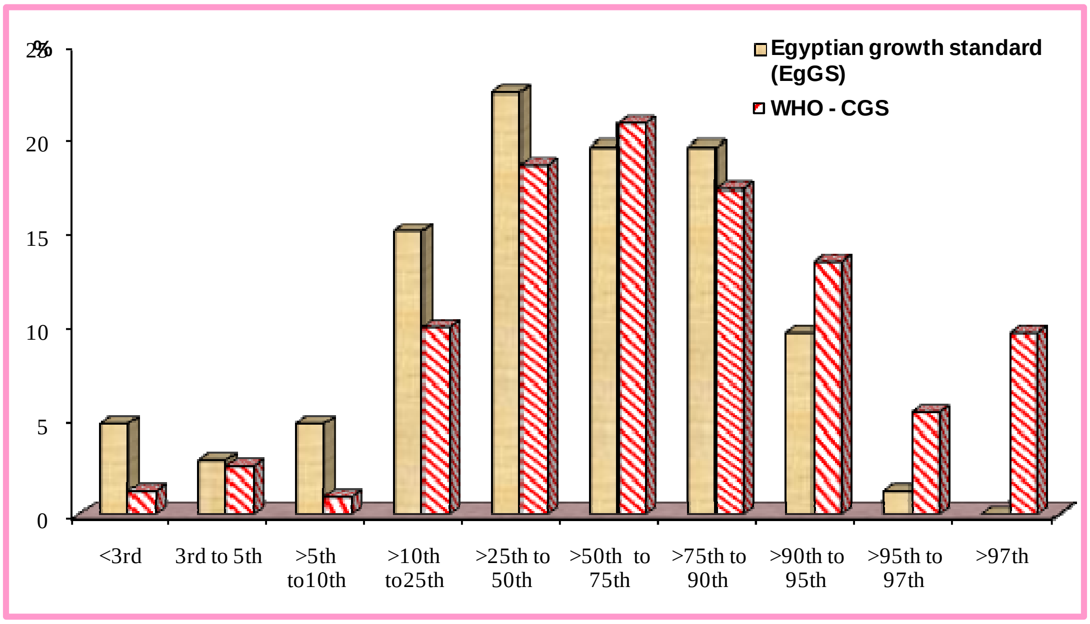


Fig. (20): Diagrammatic representation of the distribution of growth of study population for Body Mass Index for children aged (24-60) months plotted against Egyptian growth standard and WHO child growth standard.

Table (25) and Figure (21) compare Head Circumference for 6-11months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is highly significant (P value was 0.00).

Table (25): Compares Head Circumference for the 6-11 months age group with Egyptian growth standard (EgGS) and WHO child growth standard (WHO-CGS).

Head Circumference 6-11ms.		Egyptian growth standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		0	0.00	4	1.25
3rd to 5th		0	0.00	18	5.63
>5th to10th		11	3.44	27	8.44
>10th to25th		47	14.69	69	21.56
>25th to 50th		111	34.69	86	26.88
>50th to 75th		74	23.13	62	19.38
>75th to 90th		51	15.94	37	11.56
>90th to 95th		24	7.50	15	4.69
>95th to 97th		1	0.31	1	0.31
>97th		1	0.31	1	0.31
Total		320	100.00	320	100.00
Chi-square	X^2	41.445			
	P-value	0.000			

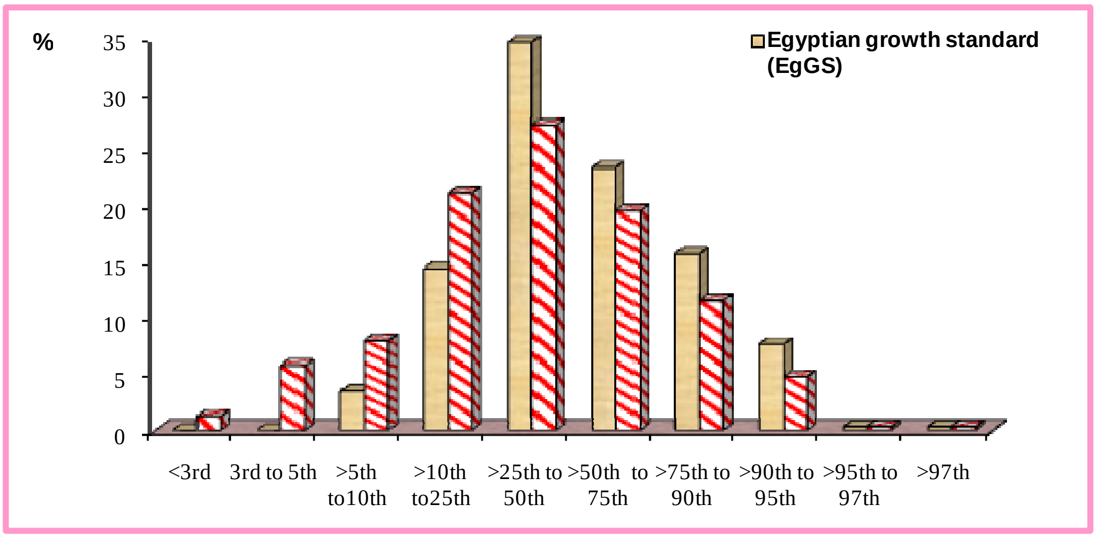


Fig. (21): Diagrammatic representation of the distribution of growth of study population for Head Circumference for children aged (6-11) months plotted against Egyptian growth standard and WHO child growth standard.

Table (26) and Figure (22) compare Head Circumference for12-23months age group plotted on the Egyptian growth standard and WHO child growth standard Head Circumference. The difference in the distribution in-between centiles is highly significant (P value was 0.00).

Table (26): Compares Head Circumference for the 12-23 months age group with Egyptian growth standard (EgGS) and WHO child growth standard (WHO-CGS).

Head Circumference 12-23ms.		Egyptian growth standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		0	0.00	1	0.27
3rd to 5th		0	0.00	21	5.71
>5th to10th		15	4.08	27	7.34
>10th to25th		63	17.12	85	23.10
>25th to 50th		80	21.74	66	17.93
>50th to 75th		77	20.92	95	25.82
>75th to 90th		92	25.00	56	15.22
>90th to 95th		38	10.33	14	3.80
>97th		3	0.82	3	0.82
Total		368	100.00	368	100.00
Chi-square	X^2	51.759			
	P-value	0.000			

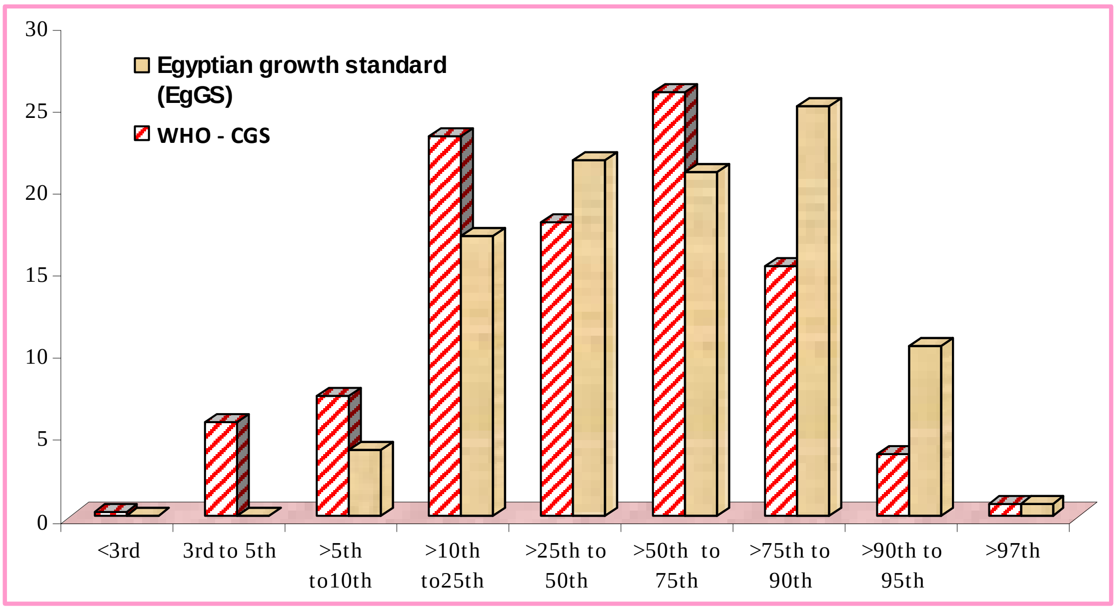


Fig. (22): Diagrammatic representation of the distribution of growth of study population for Head Circumference for children aged (12-23) months plotted against Egyptian growth standard and WHO child growth standard.

Table (27) and Figure (23) compare Head Circumference for 24-60 months age group plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is highly significant (P value was 0.00).

Table (27): Compares Head Circumference for the 24-36 months age group with Egyptian growth standard (EgGS) and WHO child growth chart (WHO-CGS).

Head Circumference 24-60ms.		Egyptian growth Standard (EgGS)		WHO-CGS	
		N	%	N	%
<3rd		6	3.03	0	0.00
3rd to 5th		7	3.54	18	9.09
>5th to10th		20	10.10	11	5.56
>10th to25th		31	15.66	35	17.68
>25th to 50th		47	23.74	57	28.79
>50th to 75th		42	21.21	56	28.28
>75th to 90th		34	17.17	18	9.09
>90th to 95th		8	4.04	0	0.00
>95th to 97th		0	0.00	1	0.51
>97th		3	1.52	2	1.01
Total		198	100.00	198	100.00
Chi-square	X^2	30.780			
	P-value	0.000			

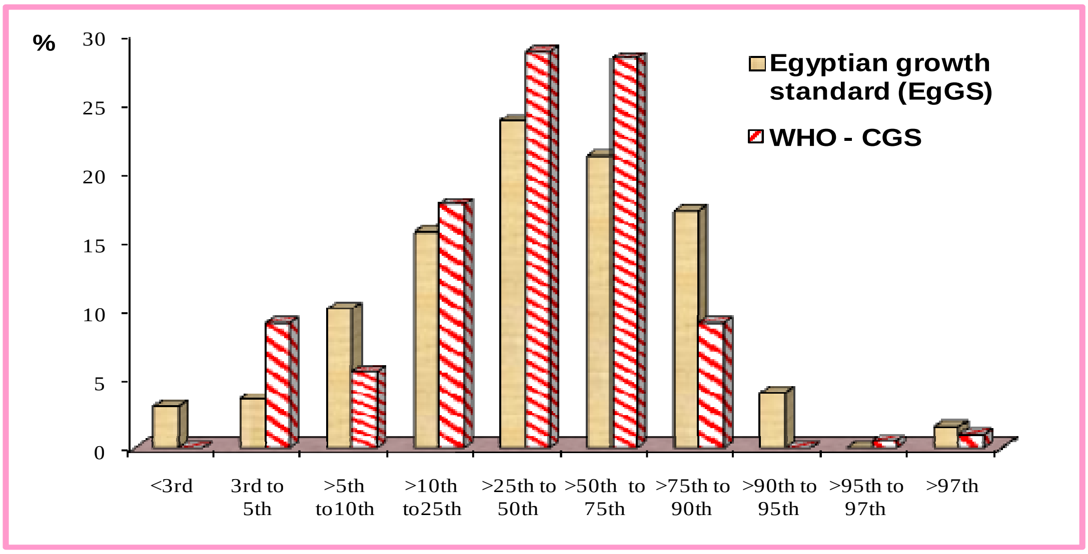


Fig. (23): Diagrammatic representation of the distribution of growth of study population for Head Circumference for children aged (24-36) months plotted against Egyptian growth standard and WHO child growth standard.

Table (28) and Figure (24a & 24b) compare between male Weight-for-age in the EgGS and the WHO-CGS. And female Weight-for-age in the EgGS and the WHO-CGS was highly significant (P value was 0.000).

Table (28): Compares distribution of Weight-for-age across the centiles against the EgGS and the WHO-CGS by gender

Weight-for-age		Female		Male	
		N	%	N	%
Egyptian standard growth chart	<3rd	8	1.63	11	2.17
	3rd to 5th	17	3.46	11	2.17
	>5th to10th	29	5.89	19	3.74
	>10th to25th	121	24.59	62	12.20
	>25th to 50th	65	13.21	164	32.28
	>50th to 75th	143	29.54	131	25.38
	>75th to 90th	76	15.45	83	16.34
	>90th to 95th	1	0.20	19	3.74
	>95th to 97th	19	3.86	16	3.15
	>97th	5	1.02	0	0.00
	Total	484	100.00	516	100.00
WHO	<3rd	15	3.05	0	0.00
	3rd to 5th	18	3.66	24	4.72
	>5th to10th	23	4.67	18	3.54
	>10th to25th	92	18.70	114	22.44
	>25th to 50th	134	27.24	106	20.87
	>50th to 75th	97	20.04	119	23.06
	>75th to 90th	101	20.53	121	23.82
	>90th to 95th	4	0.81	7	1.38
	>95th to 97th	0	0.00	2	0.39
	>97th	0	0.00	5	0.98
	Total	484	100.00	516	100.00
Chi-square	X^2	68.321		72.800	
	P-value	0.000		0.000	

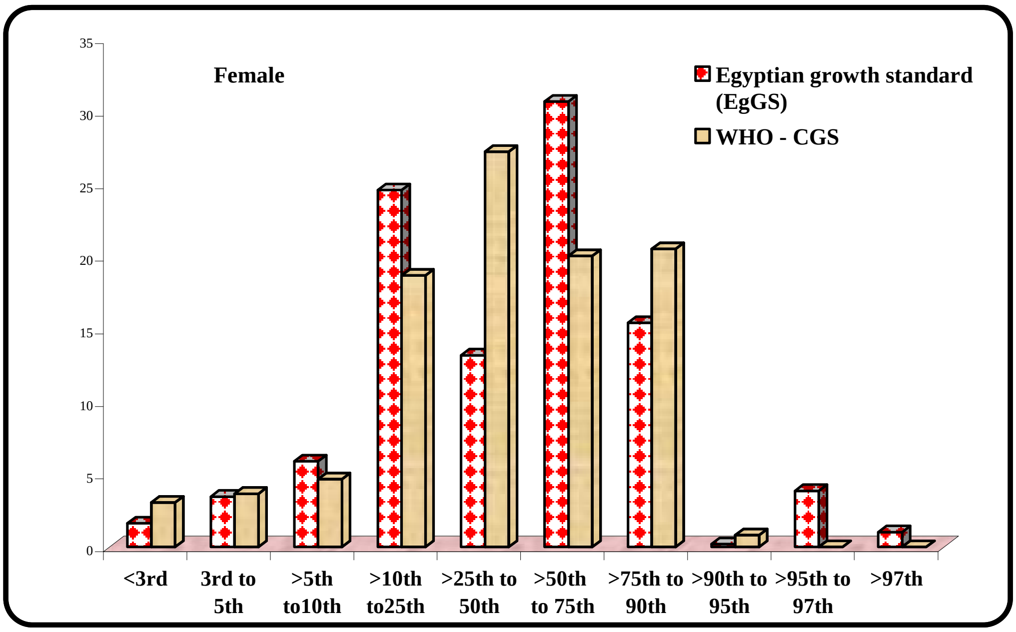


Fig. (24a): Diagrammatic representation of distribution of Weight-for-age in females using the EgGS and the WHO-CGS.

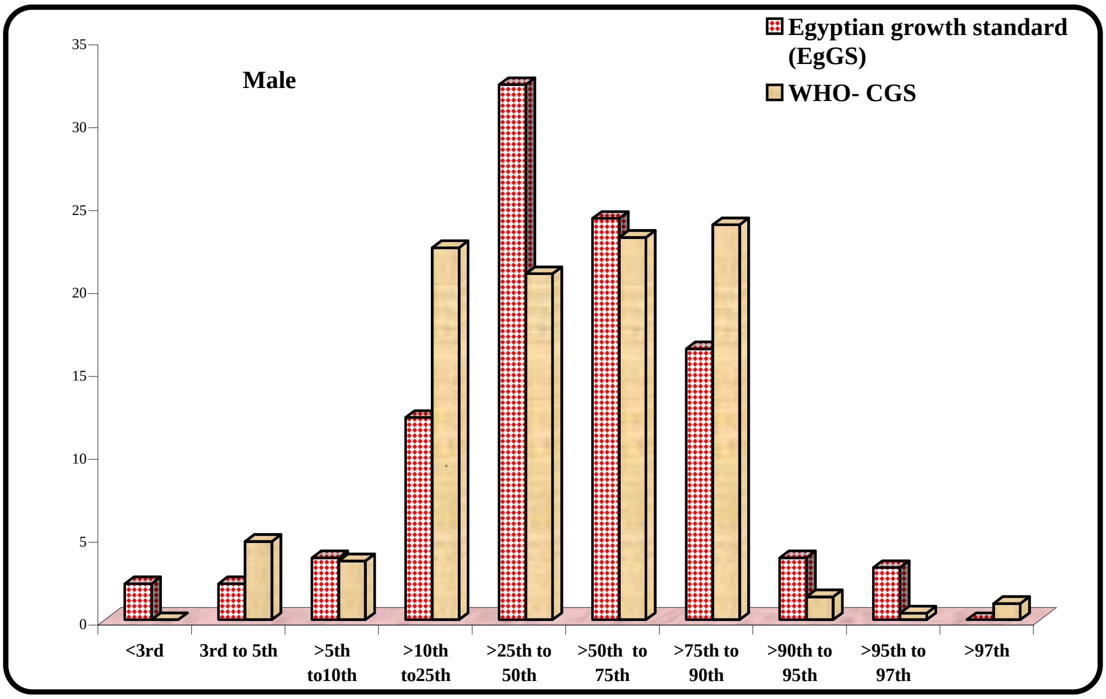


Fig.(24b): Diagrammatic representation of distribution of Weight-for-age in males using WHO -CGS and the EgGS.

Table (29) and Figure (25a & 25b) compare between males Length/height-for-age in the EgGS and the WHO-CGS. And female Length/height-for-age in the EgGS and the WHO-CGS. Which is significant (P value was 0.000) .

Table (29): Compares distribution of Length/height-for-age across the centiles against the EgGS and the WHO-CGS by gender.

Length/height-for-age		**Female**		**Male**	
		N	**%**	**N**	**%**
Egyptian standard growth chart	**3rd to 5th**	0	0.00	1	0.19
	>5th to10th	13	2.63	9	1.74
	>10th to25th	174	35.15	175	33.91
	>25th to 50th	170	34.34	189	36.63
	>50th to 75th	67	13.84	93	18.02
	>75th to 90th	49	9.90	44	8.53
	>90th to 95th	6	1.21	5	0.97
	>95th to 97th	5	1.01	0	0.00
	Total	484	100.00	516	100.00
WHO	**<3rd**	3	0.62	14	2.71
	3rd to 5th	86	17.77	96	18.60
	>5th to10th	88	18.18	78	15.12
	>10th to25th	126	26.03	152	29.46
	>25th to 50th	99	20.45	74	14.34
	>50th to 75th	27	5.58	60	11.63
	>75th to 90th	32	6.61	27	5.23
	>90th to 95th	23	4.75	15	2.91
	>95th to 97th	0	0.00	0	0.00
	Total	484	100.00	516	100.00
Chi-square	X^2	206.66		229.85	
	P-value	0.000		0.000	

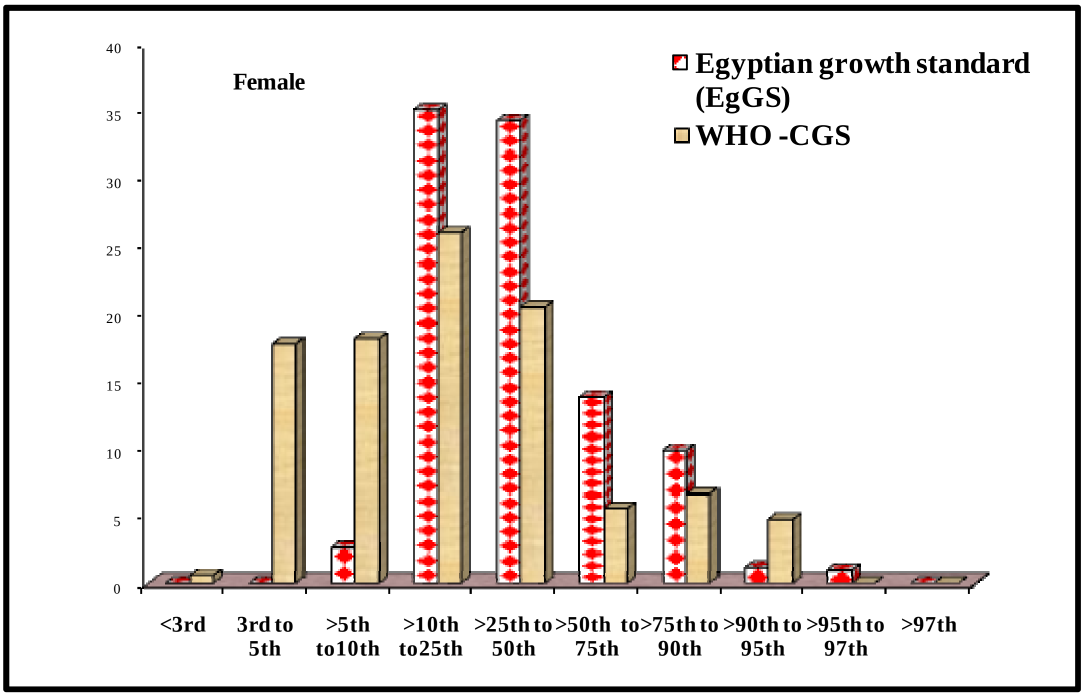


Fig. (25a): Diagrammatic representation of distribution of females Length/height-for-age using the EgGS and the WHO-CGS.

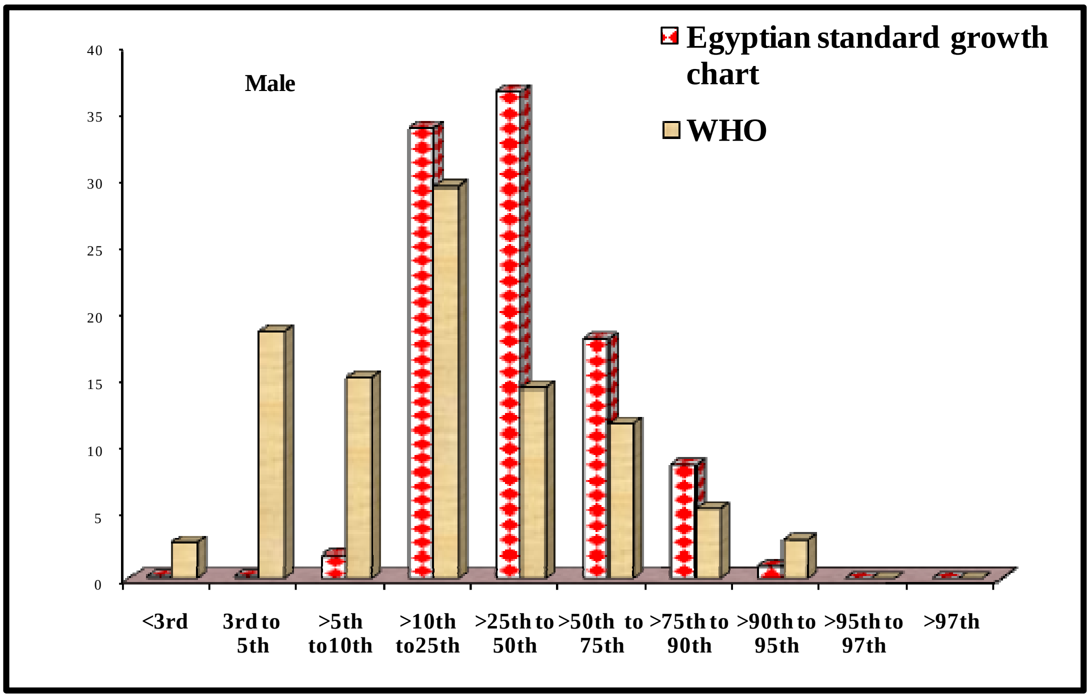


Fig. (25b): Diagrammatic representation of distribution of males Length/height-for-age using the EgGS and the WHO-CGS.

Table (30) and Figure (26a & 26b) compare the distribution of Weight-for-length/height between males and females in the EgGS and the WHO-CGS. Comparison between females in the EgGS and the WHO-CGS. is insignificant (P value was 0.085 for females and P value was 0.236 in males).

Table (30): Compares distribution of Weight-for-length/height against the EgGS and the WHO-CGS by gender.

Weight-for-length/height		**Female**		**Male**	
		N	**%**	**N**	**%**
Egyptian standard growth chart	**<3rd**	4	0.96	1	0.23
	3rd to 5th	3	0.72	3	0.69
	>5th to10th	7	1.69	8	1.85
	>10th to25th	52	12.53	38	8.80
	>25th to 50th	94	22.65	86	19.91
	>50th to 75th	112	26.99	93	21.53
	>75th to 90th	69	16.63	100	23.15
	>90th to 95th	36	8.67	49	11.34
	>95th to 97th	18	4.34	22	5.09
	>97th	20	4.82	32	7.41
	Total	415	100.00	432	100.00
WHO	**<3rd**	6	1.45	4	0.93
	3rd to 5th	10	2.41	6	1.39
	>5th to10th	9	2.17	10	2.31
	>10th to25th	57	13.73	44	10.19
	>25th to 50th	70	16.87	78	18.06
	>50th to 75th	108	26.02	73	16.90
	>75th to 90th	70	16.87	111	25.69
	>90th to 95th	53	12.77	42	9.72
	>95th to 97th	22	5.30	37	8.56
	>97th	10	2.41	27	6.25
	Total	415	100.00	432	100.00
Chi-Square	**X^2**	15.22		11.61	
	P-value	0.085		0.236	

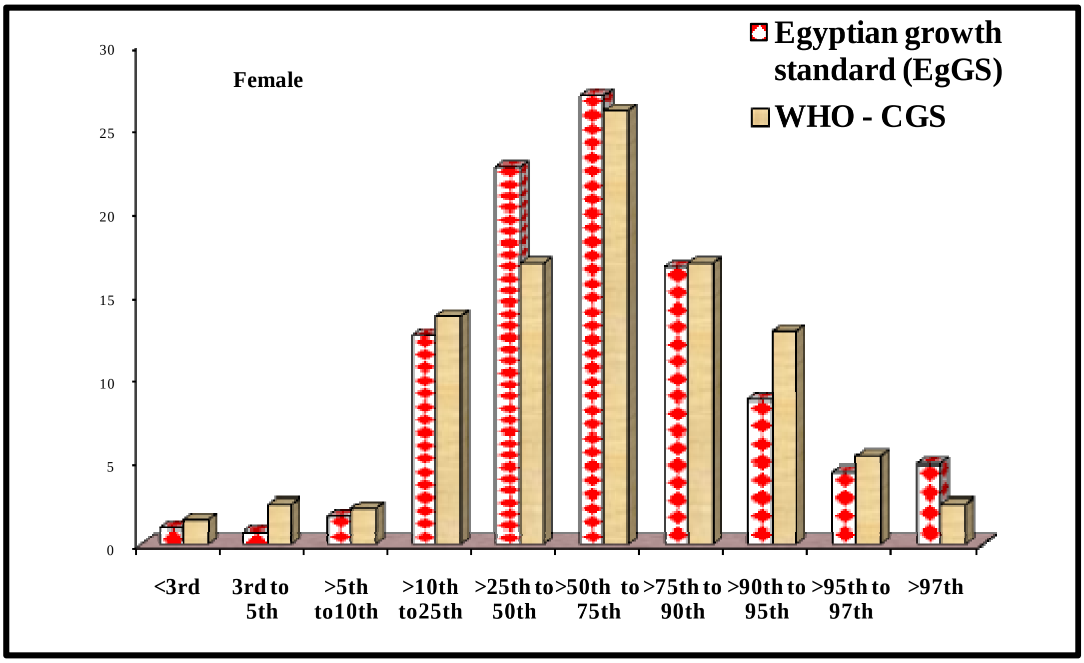


Fig. (26a): Diagrammatic representation of distribution of Weight-for-length/height in the females using the EgGS and the WHO-CGS.

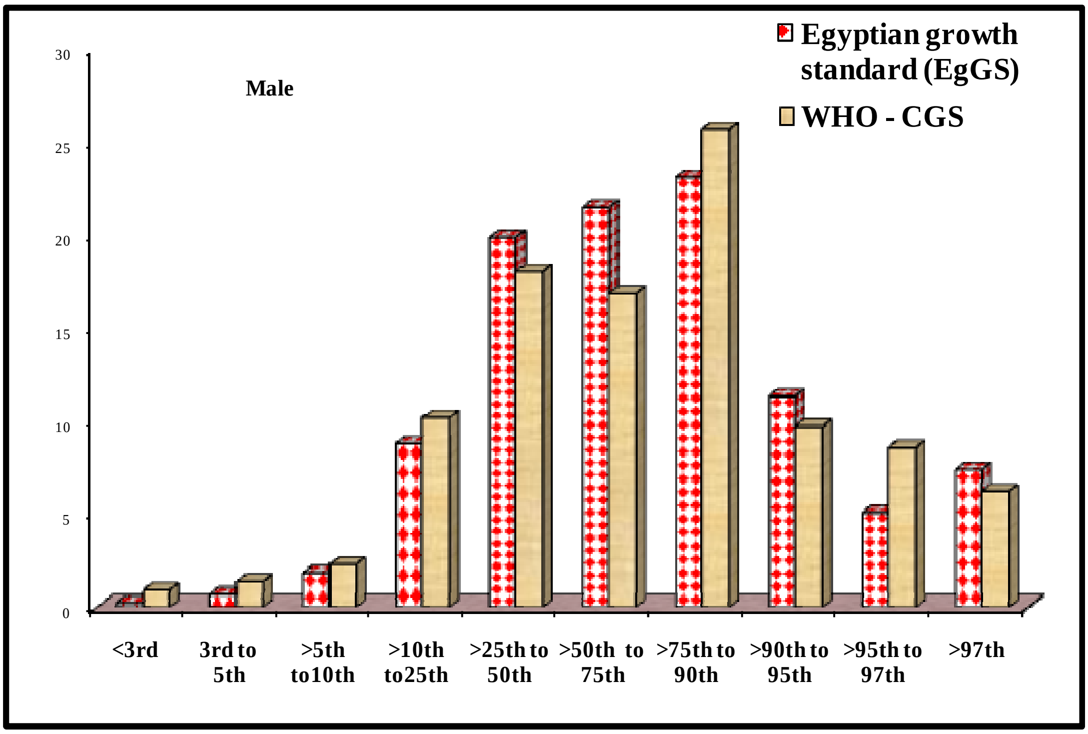


Fig.(26b): Diagrammatic representation of distribution of Weight-for-length/height in males using WHO-CGS and the EgGS.

Table (31) and Figure (27a & 27b) compare distribution of Body Mass Index for the males in the EgGS and the WHO-CGS. And Body Mass Index for females in the EgGS and the WHO-CGS. Which is significant (P value was 0. 00) in both.

Table (31): Compares distribution of Body Mass Index across the centiles against the EgGS and the WHO-CGS by gender.

Body Mass Index		Female		Male	
		N	%	N	%
Egyptian standard growth chart	<3rd	8	5.37	7	4.29
	3rd to 5th	2	1.34	7	4.29
	>5th to10th	6	4.03	9	5.52
	>10th to25th	25	16.78	22	13.50
	>25th to 50th	33	22.15	37	22.70
	>50th to 75th	23	15.44	38	23.31
	>75th to 90th	32	21.48	29	17.79
	>90th to 95th	17	11.41	13	7.98
	>95th to 97th	3	2.01	1	0.61
	Total	149	100.00	163	100.00
WHO	<3rd	3	2.01	1	0.61
	3rd to 5th	4	2.68	4	2.45
	>5th to10th	1	0.67	2	1.23
	>10th to25th	14	9.40	17	10.43
	>25th to 50th	28	18.79	30	18.40
	>50th to 75th	33	22.15	32	19.63
	>75th to 90th	26	17.45	28	17.18
	>90th to 95th	18	12.08	24	14.72
	>95th to 97th	12	8.05	5	3.06
	>97th	10	6.71	20	12.27
	Total	149	100.00	163	100.00
Chi-square	X^2	27.85		37.61	
	P-value	0.000		0.000	

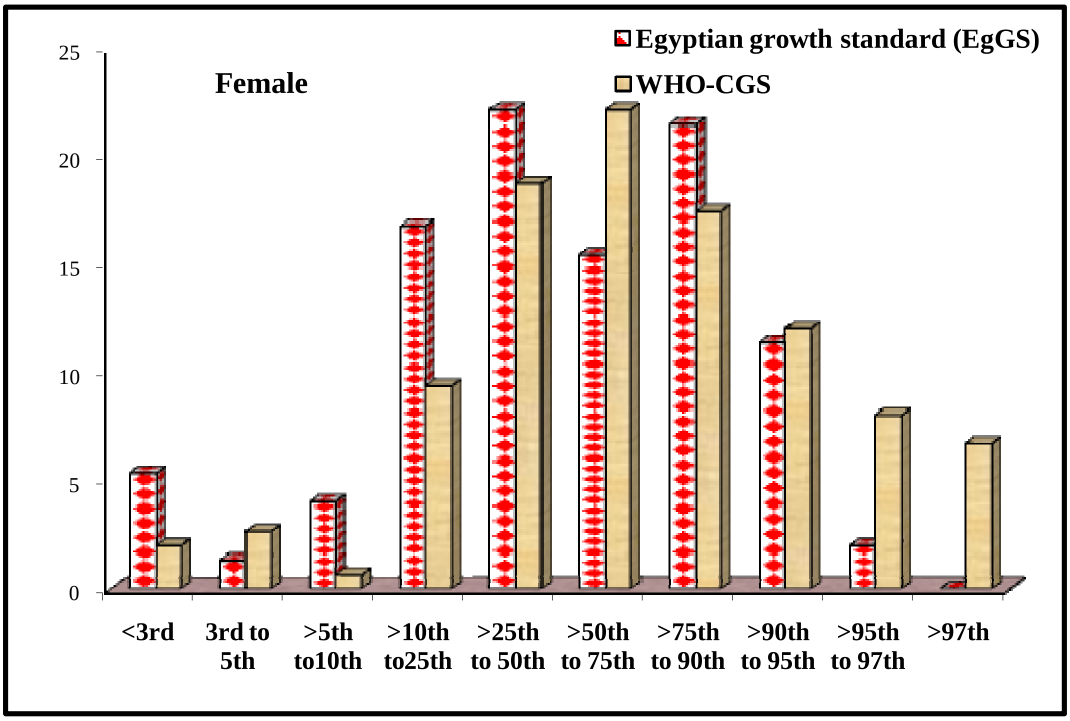


Fig. (27a): Diagrammatic representation of distribution of Body Mass Index in females using WHO-CGS and the EgGS.

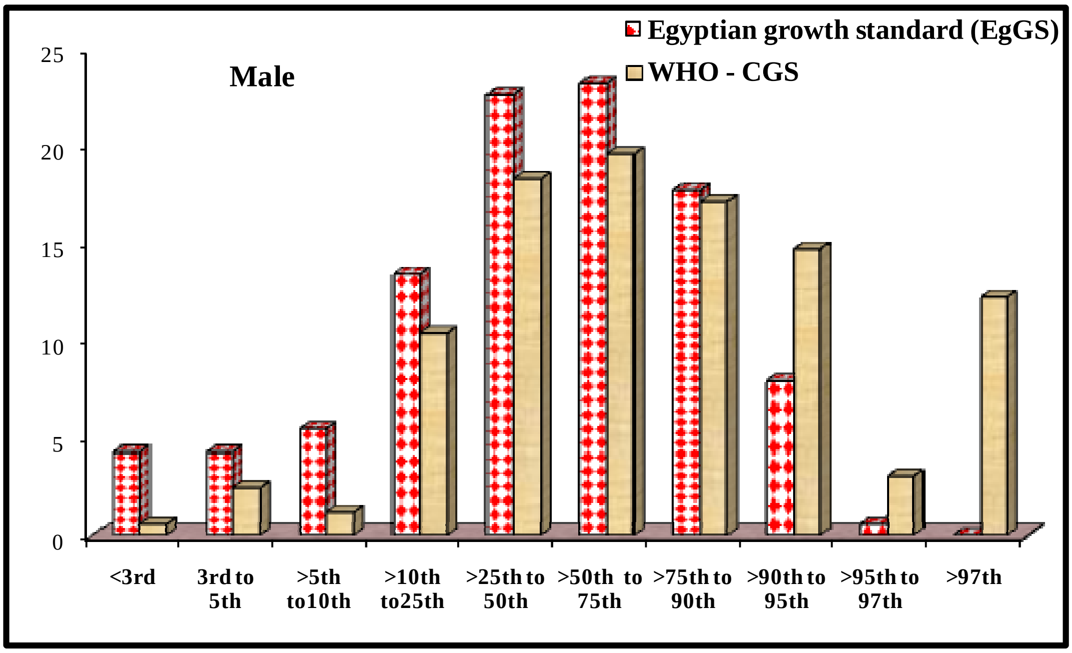


Fig. (27b): Diagrammatic representation of distribution of Body Mass Index in males using WHO-CGS and the EgGS.

Table (32) and Figure (28a & 28b) compare male and female Head Circumference plotted on the Egyptian growth standard and WHO child growth standard. The difference in the distribution in-between centiles is highly significant (P value was (0.000).

Table (32): Compares distribution of Head Circumference- age across the centiles against the EgGS and the WHO-CGS by gender.

Head Circumference- age		Female		Male	
		N	%	N	%
Egyptian standard growth chart	<3rd	6	1.38	0	0.00
	3rd to 5th	0	0.00	7	1.55
	>5th to10th	26	5.99	20	4.42
	>10th to25th	87	20.05	54	11.95
	>25th to 50th	103	23.73	135	29.87
	>50th to 75th	117	26.96	76	16.81
	>75th to 90th	57	13.13	120	26.55
	>90th to 95th	35	8.06	35	7.74
	>95th to 97th	1	0.23	0	0.00
	>97th	2	0.46	5	1.11
	Total	434	100.00	452	100.00
WHO	<3rd	4	0.92	1	0.22
	3rd to 5th	19	4.38	38	8.41
	>5th to10th	51	11.75	14	3.10
	>10th to25th	106	24.42	83	18.36
	>25th to 50th	76	17.51	133	29.42
	>50th to 75th	116	26.73	97	21.46
	>75th to 90th	48	11.06	63	13.94
	>90th to 95th	11	2.53	18	3.98
	>95th to 97th	1	0.23	1	0.22
	>97th	2	0.46	4	0.88
	Total	434	100.00	452	100.00
Chi-square	X^2	46.757		56.435	
	P-value	0.000		0.000	

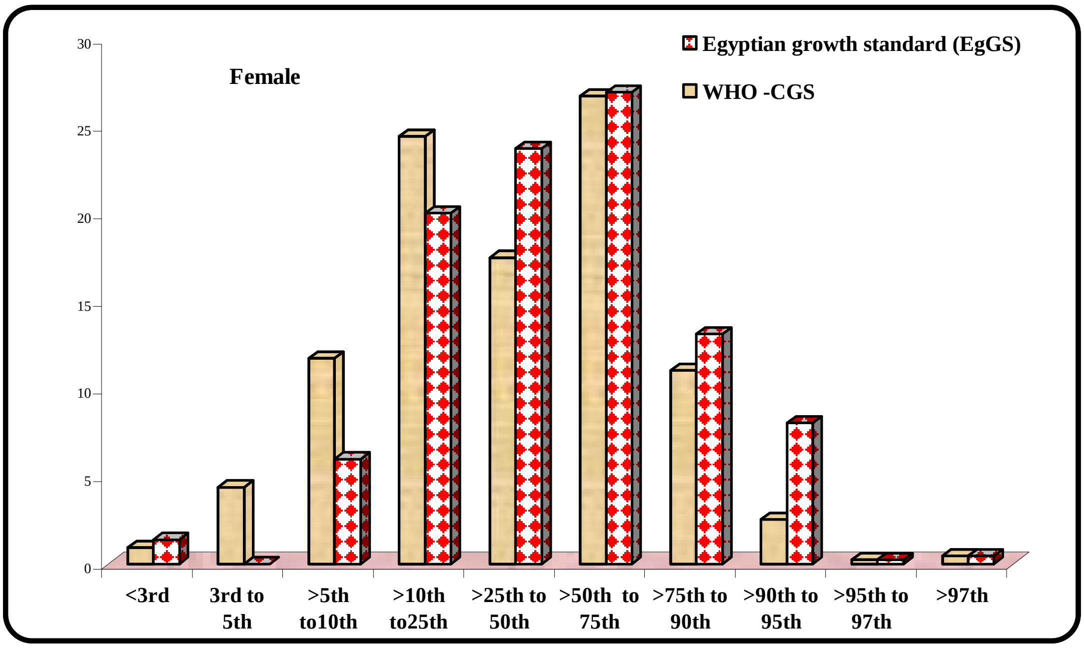


Fig (28a): Diagrammatic representation of distribution of Head Circumference – age among females against the EgGS and the WHO-CGS.

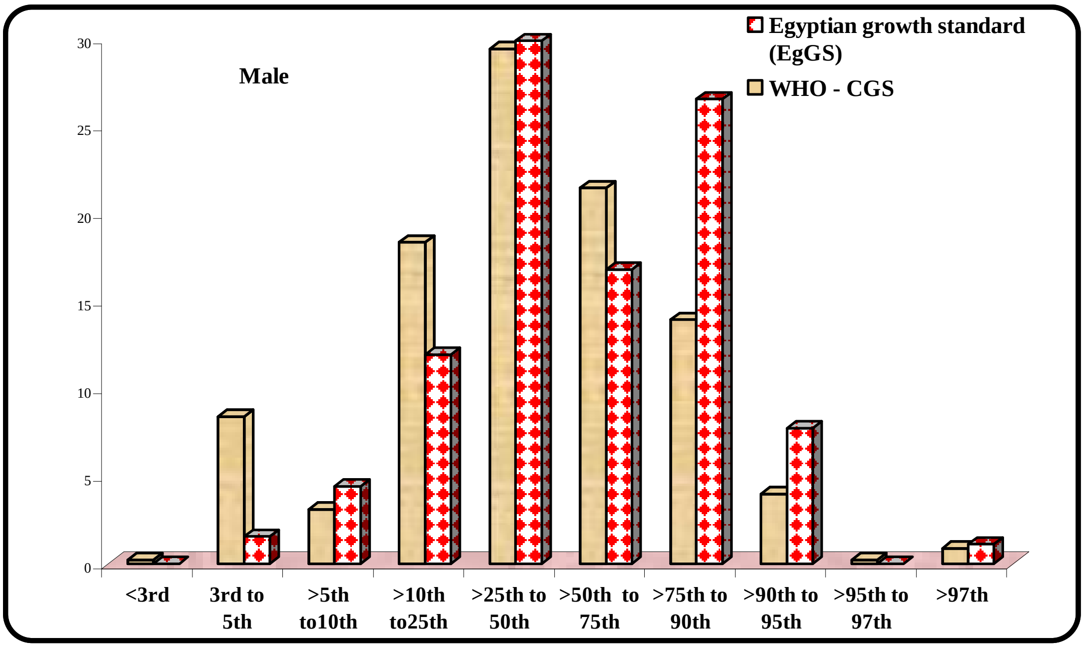


Fig. (28b): Diagrammatic representation of distribution of Head Circumference –age among females against the EgGS and the WHO-CGS.

Table (33) and Figure (29a & 29b) compare distribution of Weight-for-age between rural and urban is insignificant (P is 0.675) in Egyptian growth standard. WHO child growth standard is significant (P value was 0.030).

Table (33): Compares distribution of Weight-for-age between rural and urban against Egyptian growth standard and WHO child growth standard.

Weight-for-age		Rural N	Rural %	Urban N	Urban %	Chi-square X^2	P-value
Egyptian standard growth chart	<3rd	9	1.52	10	2.46	6.637	0.675
	3rd to 5th	19	3.20	9	2.22		
	>5th to10th	28	4.71	20	4.93		
	>10th to25th	111	18.69	72	17.73		
	>25th to 50th	135	22.73	94	23.15		
	>50th to 75th	169	28.45	105	25.86		
	>75th to 90th	92	15.49	67	16.50		
	>90th to 95th	13	2.19	7	1.72		
	>95th to 97th	16	2.69	19	4.68		
	>97th	2	0.34	3	0.74		
	Total	594	100.00	406	100.00		
WHO	<3rd	4	0.67	11	2.71	18.456	0.030
	3rd to 5th	25	4.21	17	4.19		
	>5th to10th	30	5.05	11	2.71		
	>10th to25th	134	22.56	72	17.73		
	>25th to 50th	132	22.22	108	26.60		
	>50th to 75th	132	22.22	84	20.69		
	>75th to 90th	128	21.55	94	23.15		
	>90th to 95th	7	1.18	4	0.99		
	>95th to 97th	1	0.17	1	0.25		
	>97th	1	0.17	4	0.99		
	Total	594	100.00	406	100.00		

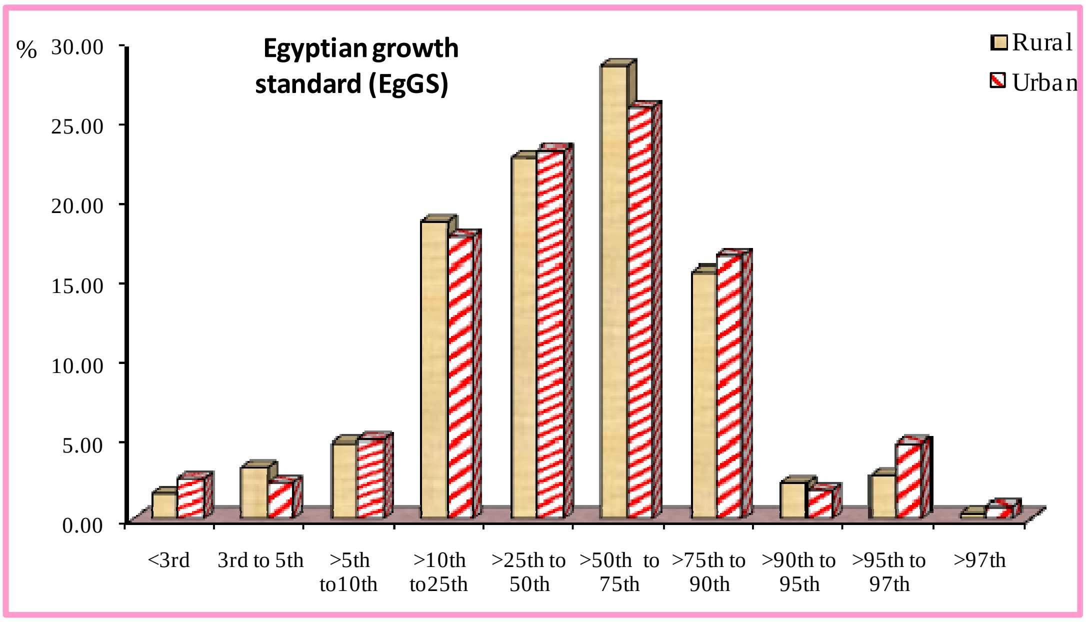


Fig. (29a): Diagrammatic representation of distribution of Weight-for-age of our study population of children (6-60 months) growth across the centiles by rural and urban residence the EgGS.

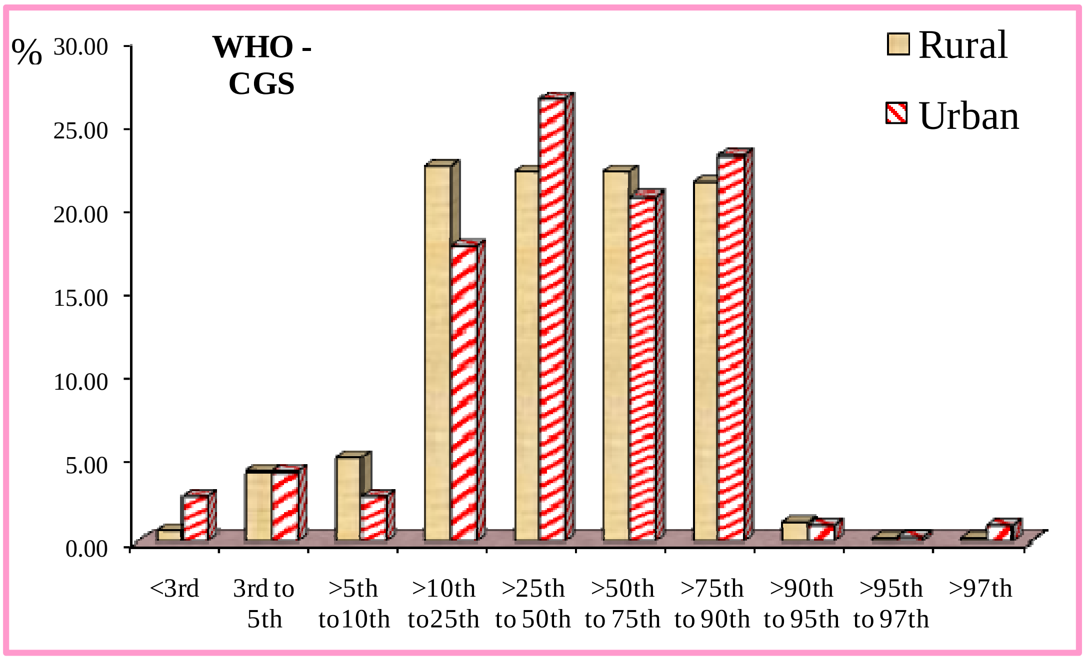


Fig. (29b): Diagrammatic representation of distribution of Weight-for-age of our study population of children (6-60 months) growth across the centiles by rural and urban residence using WHO-CGS.

Table (34) and Figures (30a & 30b) compare distribution of Length/height-for-age between rural and urban is insignificant (P is 0 .400) in the EgGS, and Compares between rural and urban Length/height-for-age is insignificant (P value was 0.163)in WHO -CGS.

Table (34): Compares distribution of Length/height-for-age between rural and urban against the WHO-CGS and the EgGS.

Length/height-for-age		**Rural**		**Urban**		**Chi-square X^2**	**P-value**
		N	**%**	**N**	**%**		
Egyptian standard growth chart	**3rd to 5th**	1	0.17	0	0.00	7.27	0.400
	>5th to10th	13	2.19	9	2.22		
	>10th to25th	209	35.19	140	34.48		
	>25th to 50th	212	35.69	147	36.21		
	>50th to 75th	90	15.15	70	17.24		
	>75th to 90th	63	10.61	30	7.39		
	>90th to 95th	4	0.67	7	1.72		
	>95th to 97th	2	0.34	3	0.74		
	Total	594	100.00	406	100.00		
WHO	**<3rd**	8	1.35	9	2.22	10.48	0.163
	3rd to 5th	120	20.20	62	15.27		
	>5th to10th	91	15.32	75	18.47		
	>10th to25th	168	28.28	110	27.09		
	>25th to 50th	94	15.82	79	19.46		
	>50th to 75th	51	8.59	36	8.87		
	>75th to 90th	41	6.90	18	4.43		
	>90th to 95th	21	3.54	17	4.19		
	>95th to 97th	0	0.00	0	0.00		
	Total	594	100.00	406	100.00		

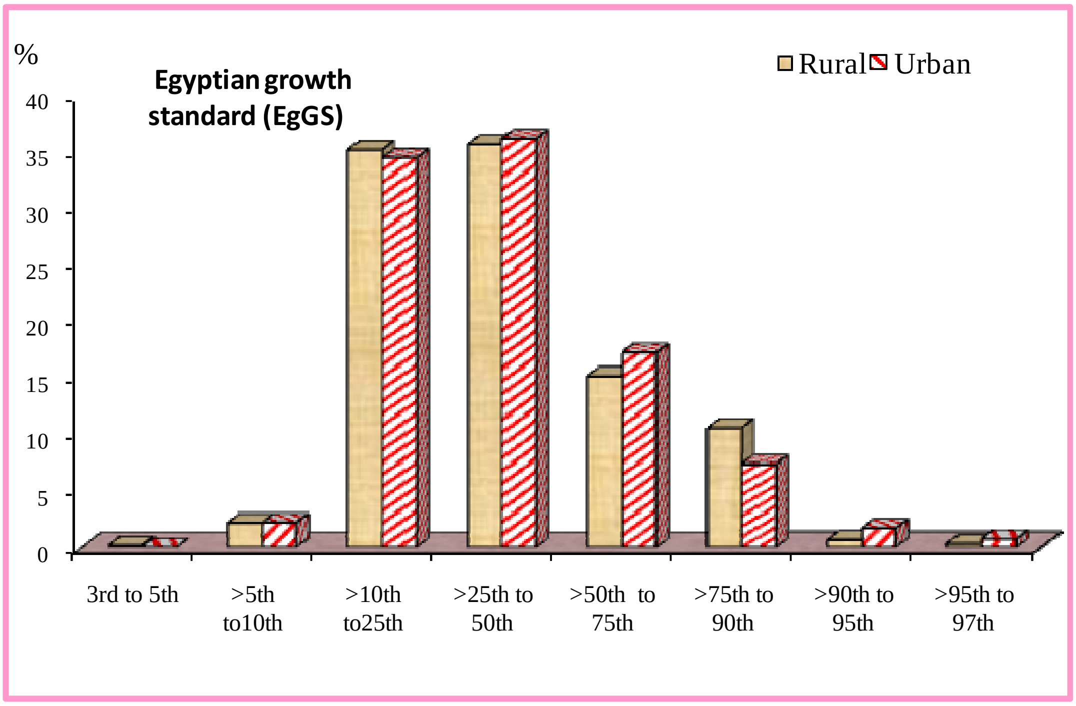


Fig. (30a): Diagrammatic representation of distribution of Length/height-for-age of our study population of children (6-60 months) growth across the centiles by rural and urban residence using the EgGS.

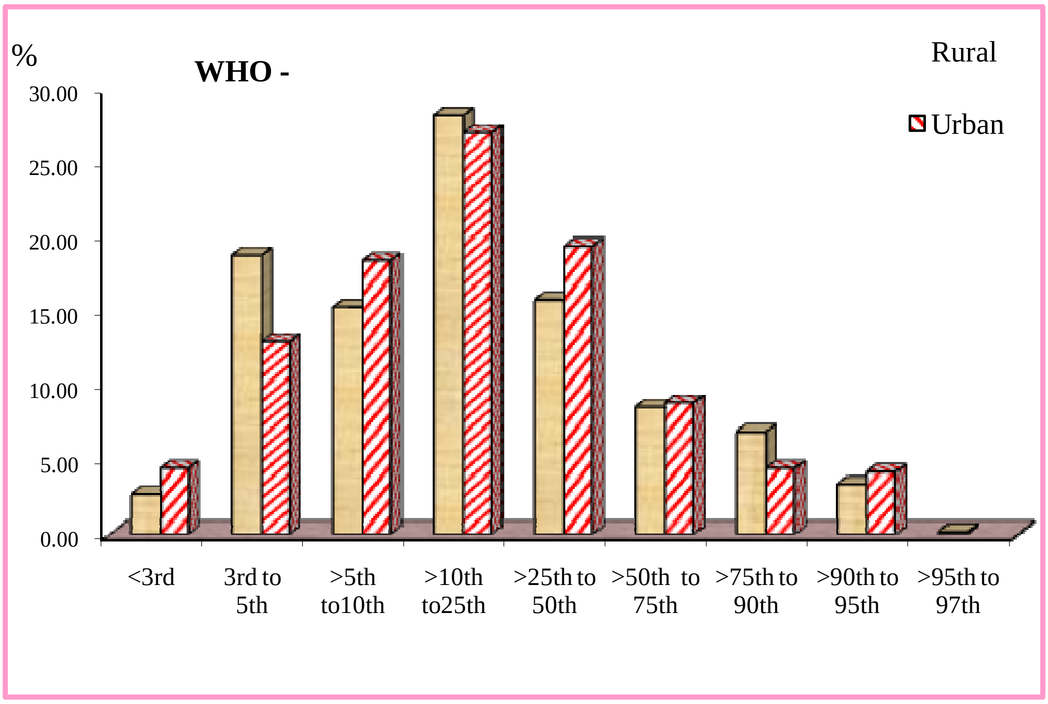


Fig. (30b): Diagrammatic representation of distribution of Length/height-for-age of our study population of children (6-60 months) growth across the centiles by rural and urban residence using WHO-CGS.

Table (35) and Figure (31a & 31b) compare distribution of Weight-for-length/height between rural and urban population plotted on Egyptian growth standard and WHO child growth standard. The difference is insignificant (P value was 0.306) in Egyptian growth standard and in WHO significant (P value was 0.0 15).

Table (35): Compares distribution of Weight-for-length/height between rural and urban population against the EgGS and the WHO-CGS.

Weight-for-length/height		**Rural**		**Urban**		**Chi-square X^2**	**P-value**
		N	**%**	**N**	**%**		
Egyptian standard growth chart	**$<3^{rd}$**	2	0.39	3	0.89	10.56	0.306
	3rd to 5^{th}	2	0.39	4	1.2		
	>5th to10th	9	1.77	6	1.78		
	>10th to25th	53	10.41	37	10.95		
	>25th to 50th	122	24. 00	58	17.16		
	>50th to 75th	123	24.17	82	24.26		
	>75th to 90th	98	19.25	71	21.01		
	>90th to 95th	51	10.02	34	10.06		
	>95th to 97th	24	4.32	16	4.44		
	$>97^{th}$	25	5.11	27	8.58		
	Total	509	100.00	338	100.00		
WHO	**$<3^{rd}$**	3	0.59	7	2.07	20.52	0.015
	3rd to 5^{th}	10	1.96	6	1.78		
	>5th to10th	12	2.36	7	2.07		
	>10th to25th	58	11.39	43	12.72		
	>25th to 50th	103	20.24	45	13.31		
	>50th to 75th	112	22.00	69	20.41		
	>75th to 90th	103	20.24	78	23.08		
	>90th to 95th	57	11.20	38	11.24		
	>95th to 97th	37	7.27	22	6.51		
	$>97^{th}$	13	2.55	24	7.10		
	Total	509	100.00	338	100.00		

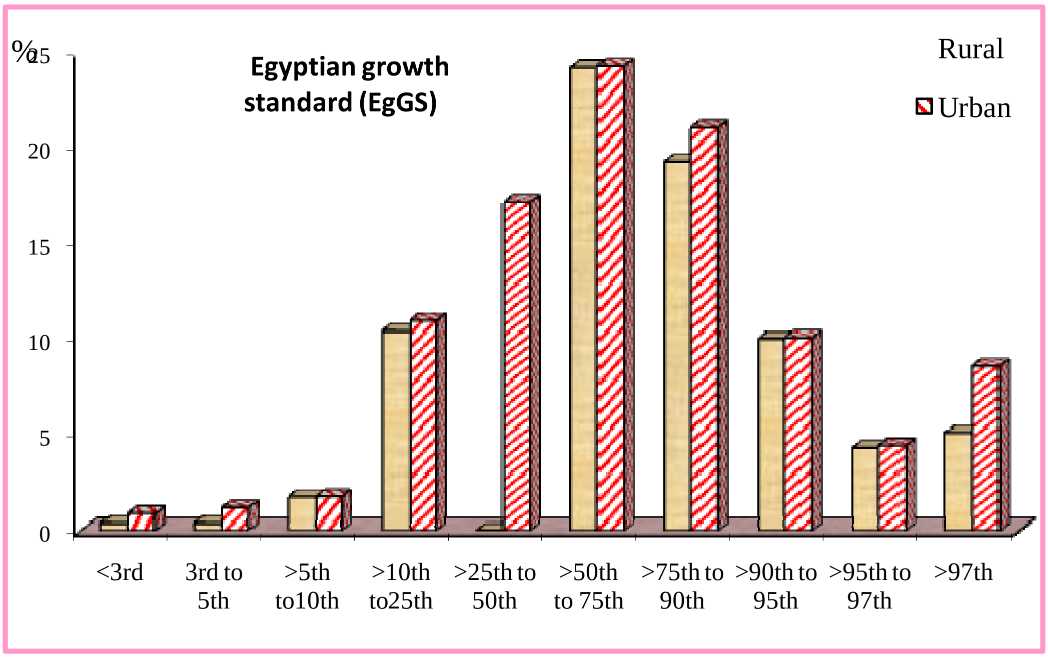


Fig. (31a): Diagrammatic representation of distribution of Length/height-for-age of our study population of children (6-60 months) growth across the centiles by rural and urban residence using the EgGS.

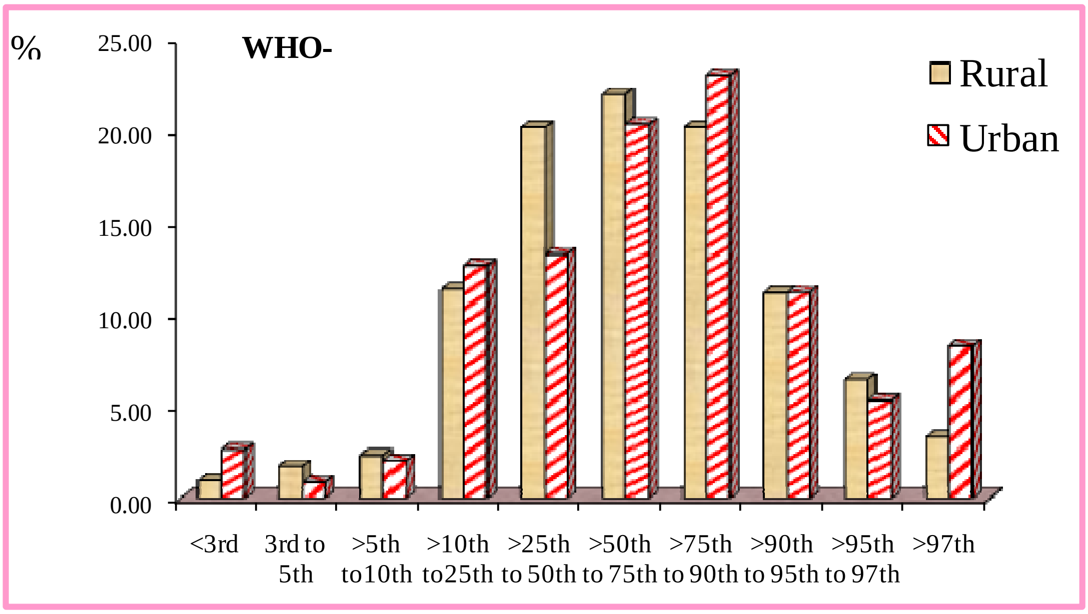


Fig. (31b): Diagrammatic representation of distribution of Weight-for-length/height of our study population of children (6-60 months) growth across the centiles by rural and urban residence using WHO growth chart.

Table (36) and Figure (32a & 32b) compare distribution of Body Mass Index between rural and urban population. When plotted against the EgGS (P is 0.843) which is insignificant and the WHO-CGS the difference is also insignificant at P >0.05.

Table (36): Compares distribution of Body Mass Index between rural and urban population against Egyptian growth standard and WHO child growth standard.

Body Mass Index		Rural N	Rural %	Urban N	Urban %	Chi-square X^2	P-value
Egyptian standard growth chart	<3rd	9	5.06	6	4.48	4.154	0.843
	3rd to 5th	5	2.81	4	2.99		
	>5th to10th	7	3.93	8	5.97		
	>10th to25th	28	15.73	19	14.18		
	>25th to 50th	43	24.16	27	20.15		
	>50th to 75th	29	16.29	32	23.88		
	>75th to 90th	37	20.79	24	17.91		
	>90th to 95th	18	10.11	12	8.96		
	>95th to 97th	2	1.12	2	1.49		
	Total	178	100.00	134	100.00		
WHO	<3rd	2	1.12	2	1.49	5.338	0.804
	3rd to 5th	6	3.37	2	1.49		
	>5th to10th	1	0.56	2	1.49		
	>10th to25th	17	9.55	14	10.45		
	>25th to 50th	31	17.42	27	20.15		
	>50th to 75th	41	23.03	24	17.91		
	>75th to 90th	29	16.29	25	18.66		
	>90th to 95th	30	16.85	12	8.96		
	>95th to 97th	7	3.93	10	7.46		
	>97th	14	7.87	16	11.94		
	Total	178	100.00	134	100.00		

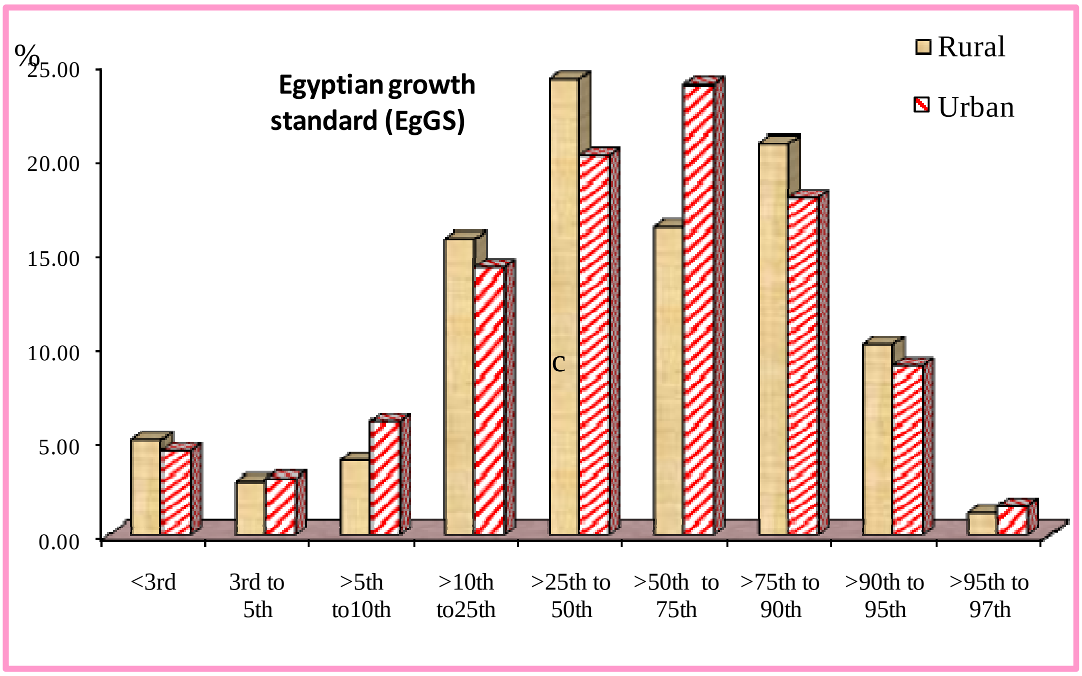


Fig. (32a): Diagrammatic representation of distribution of Body Mass Index of our study population of children (6-60 months) growth across the centiles by rural and urban residence using the EgGS.

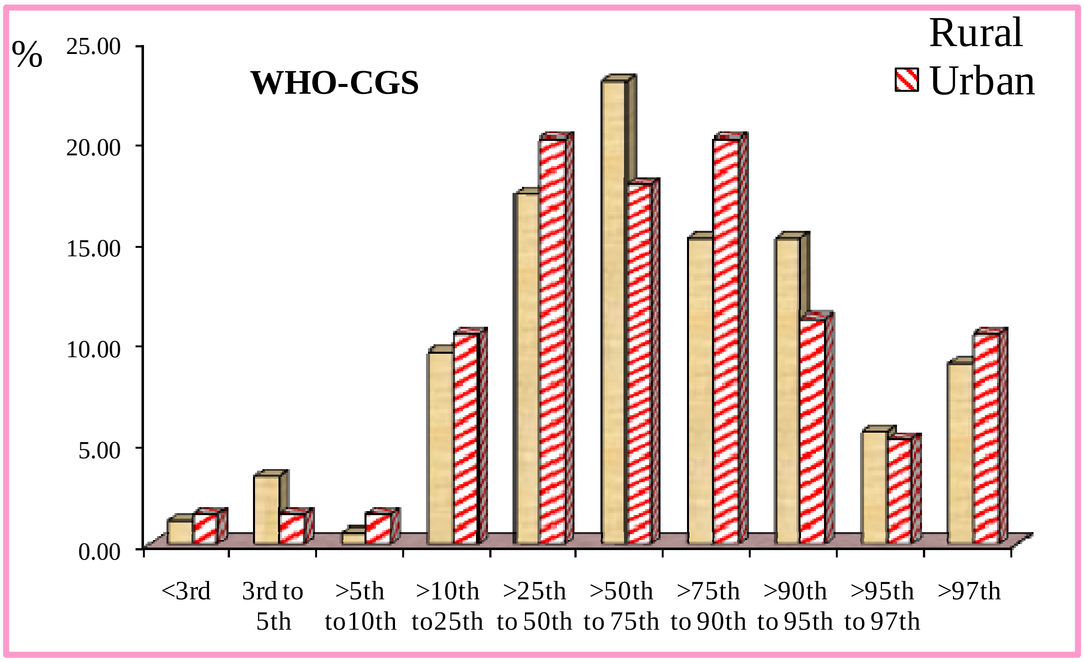


Fig. (32b): Diagrammatic representation of distribution of Body Mass Index of our study population of children (6-60 months) growth across the centiles by rural and urban residence using WHO-CGS.

Table (37) and Figure (33a & 33b) compare distribution of Head Circumference rural and urban in Egyptian growth standard is insignificant (P is.073) and in WHO is insignificant (P value was 0.080).

Table (37): Compares distribution of Head Circumference between rural and urban against Egyptian standard growth chart and WHO growth chart.

Head Circumference		**Rural**		**Urban**		**Chi-square X^2**	**P-value**
		N	**%**	**N**	**%**		
Egyptian standard growth chart	**<3rd**	4	0.75	2	0.56	15.700	0.073
	3rd to 5th	5	0.94	2	0.56		
	>5th to10th	22	4.15	24	6.74		
	>10th to25th	86	16.23	55	15.45		
	>25th to 50th	141	26.60	97	27.25		
	>50th to 75th	126	23.77	67	18.82		
	>75th to 90th	111	20.94	66	18.54		
	>90th to 95th	32	6.04	38	10.67		
	>95th to 97th	1	0.19	0	0.00		
	>97th	2	0.38	5	1.40		
	Total	530	100.00	356	100.00		
WHO	**<3rd**	1	0.19	4	1.12	15.424	0.080
	3rd to 5th	34	6.42	23	6.46		
	>5th to10th	42	7.92	23	6.46		
	>10th to25th	111	20.94	78	21.91		
	>25th to 50th	130	24.53	79	22.19		
	>50th to 75th	135	25.47	78	21.91		
	>75th to 90th	64	12.08	47	13.20		
	>90th to 95th	10	1.89	19	5.34		
	>95th to 97th	1	0.19	1	0.28		
	>97th	2	0.38	4	1.12		
	Total	530	100.00	356	100.00		

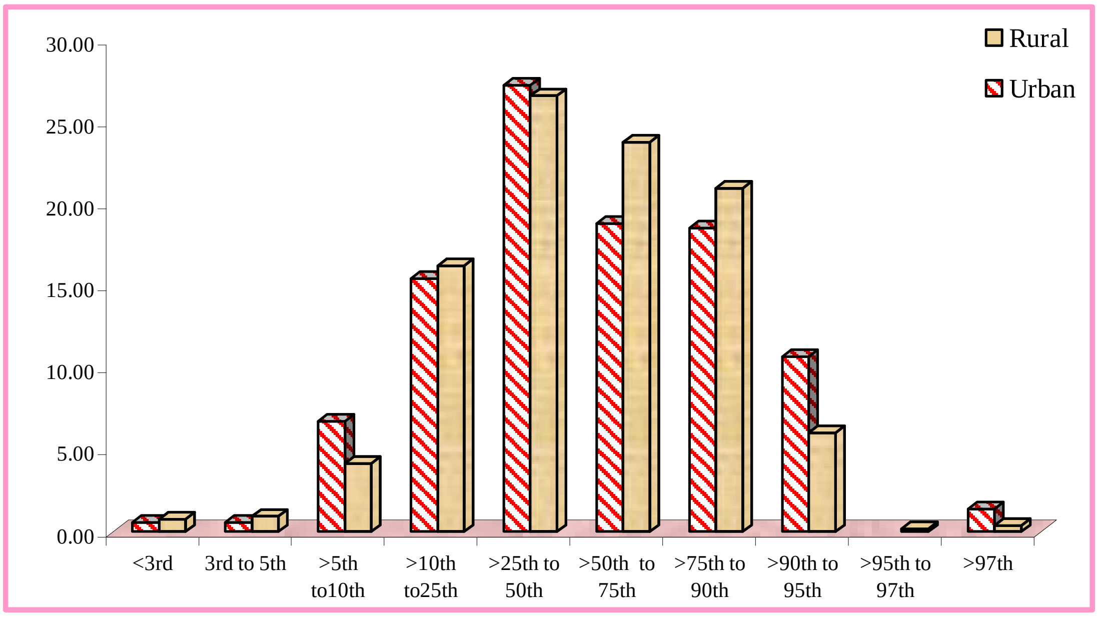


Fig. (33a): Diagrammatic representation of distribution of Head Circumference- age of our study population of children (6-60 months) growth across the centiles by rural and urban residence using the EgGS.

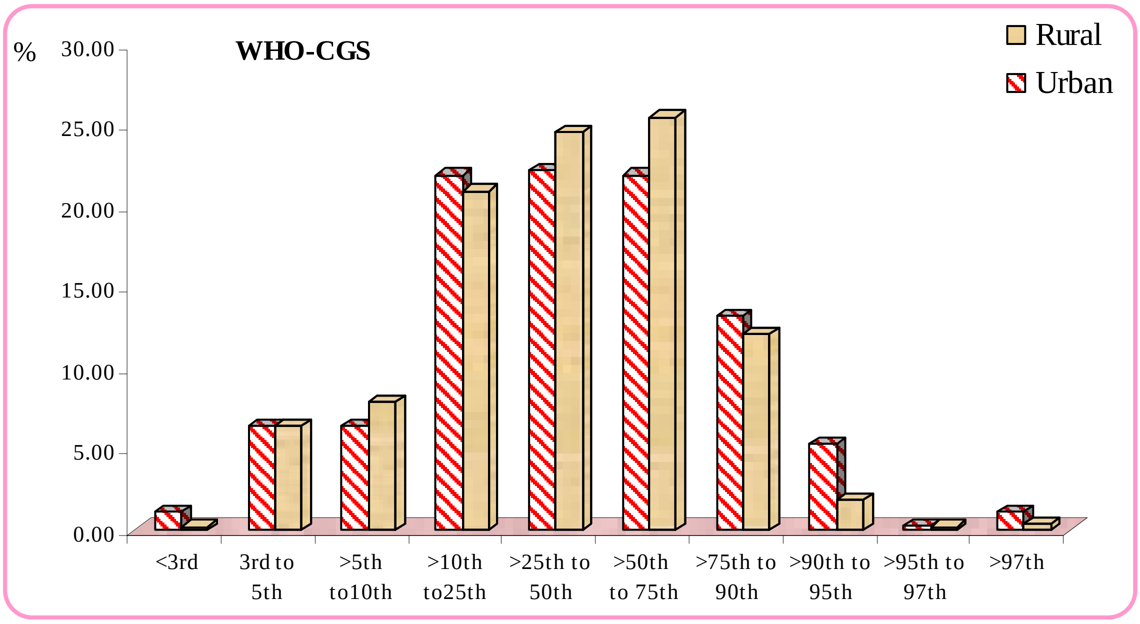


Fig. (33b): Diagrammatic representation of distribution of Head Circumference – age of our study population of children (6-60 months) growth across the centiles by rural and urban residence using the WHO-CGS.

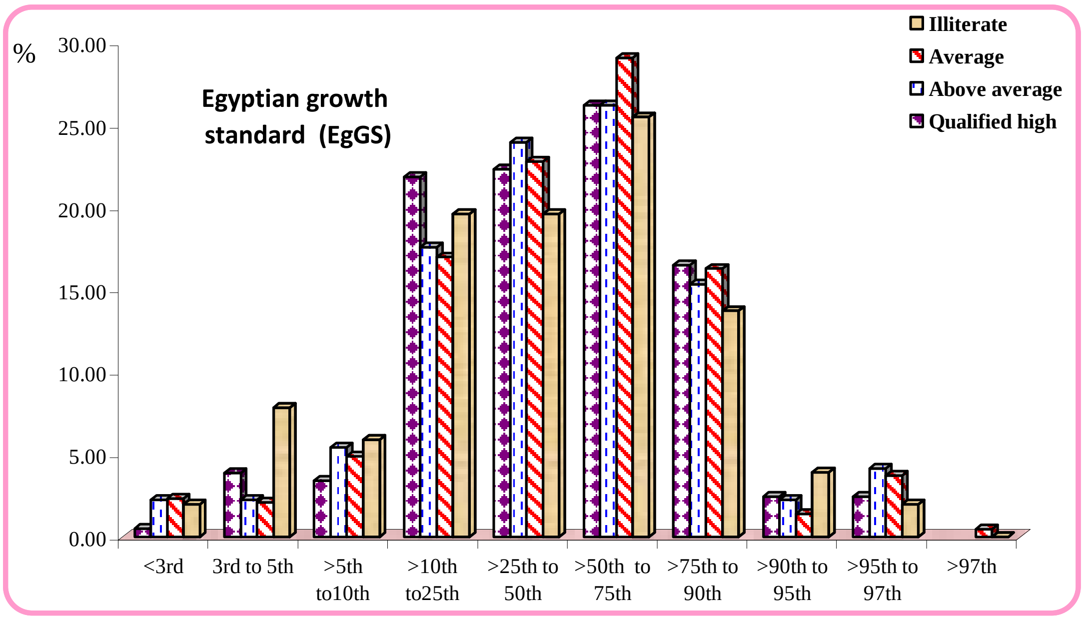


Fig. (34a): Diagrammatic representation of distribution of Weight-for-age of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the EgGS.

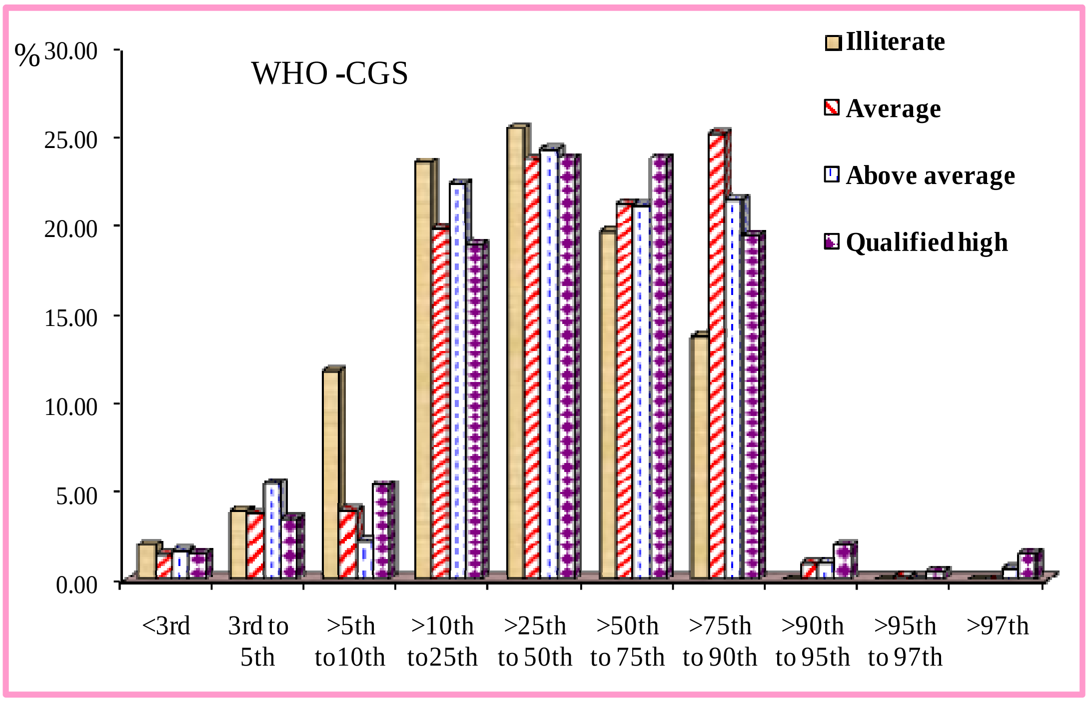


Fig. (34b): Diagrammatic representation of distribution of Weight-for-age of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the WHO-CGS.

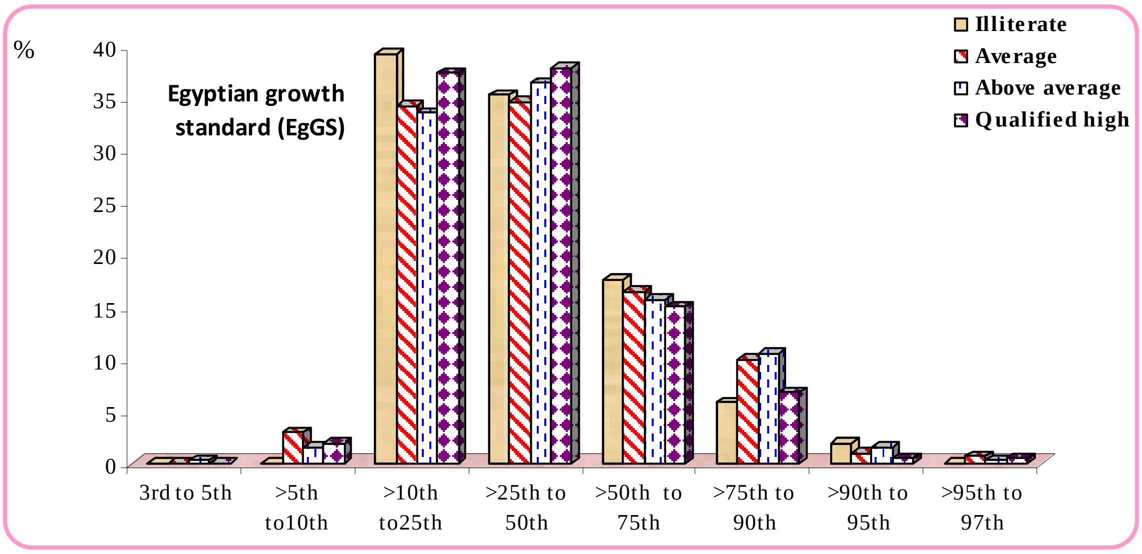


Fig. (35a): Diagrammatic representation of distribution of Length/height-for-age of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the EgGS.

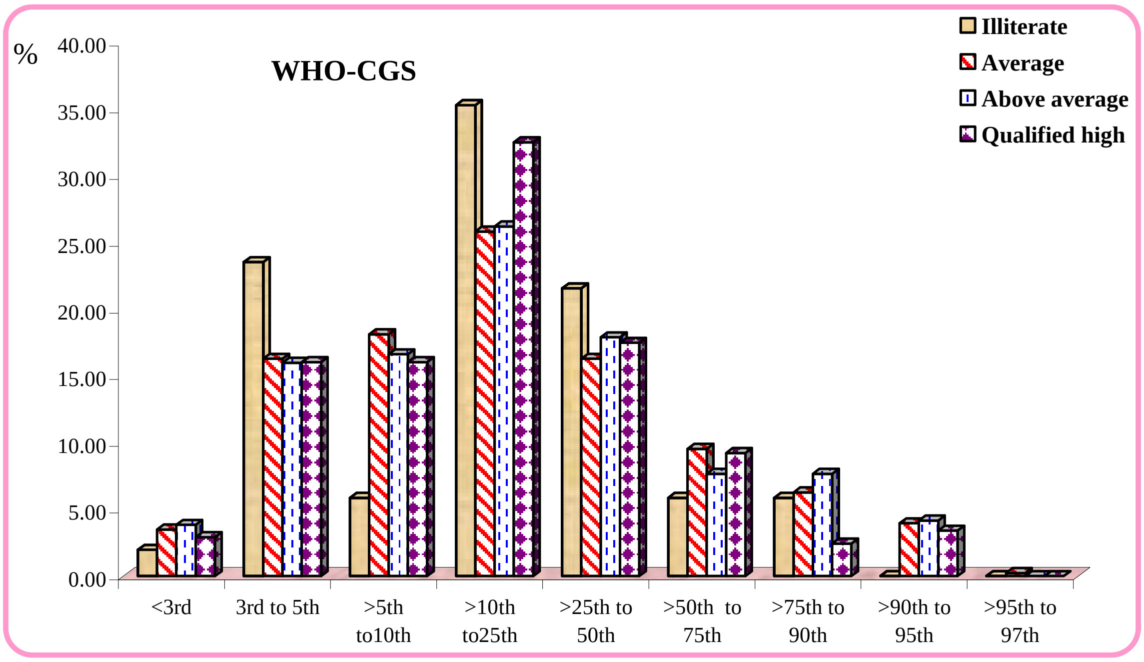


Fig.(35b): Diagrammatic representation of distribution of Length/height-for-age of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the WHO-CGS.

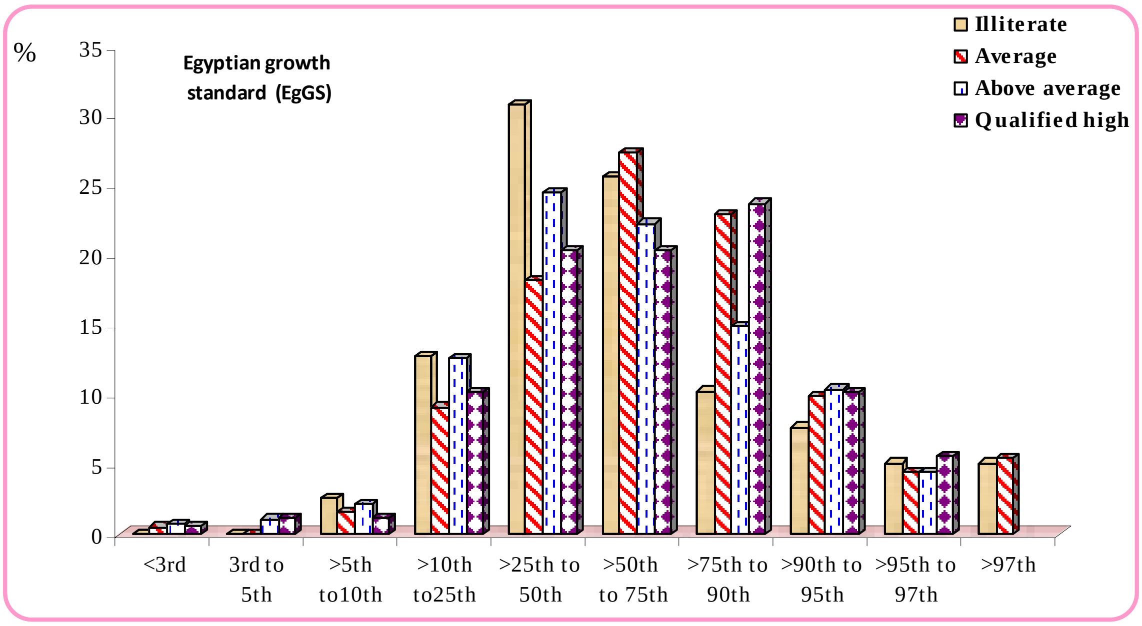


***Fig.(36a)*:** Diagrammatic representation of distribution of Weight-for-length/height of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the EgGS.

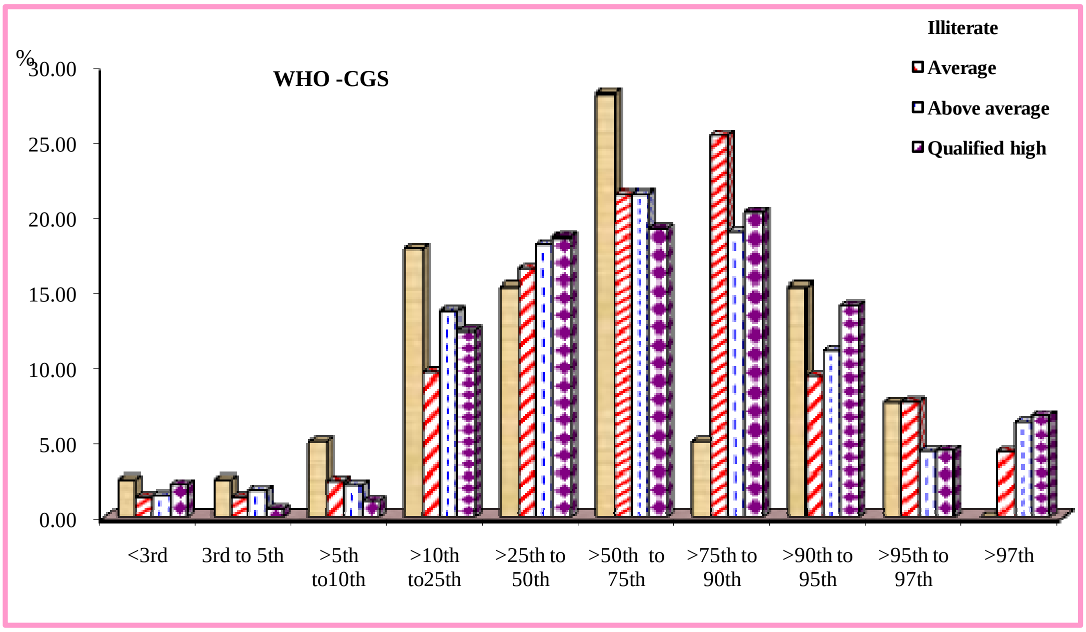


Fig.(36b): Diagrammatic representation of distribution of Weight-for-length/height of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the WHO-CGS.

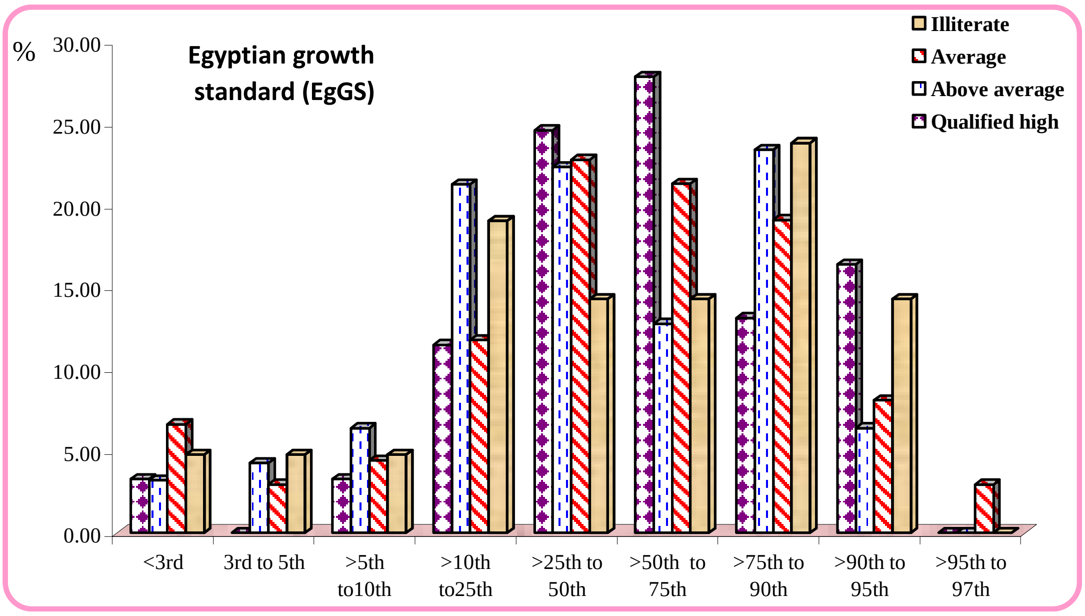


Fig. (37a): Diagrammatic representation of distribution of Body Mass Index of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the EgGS.

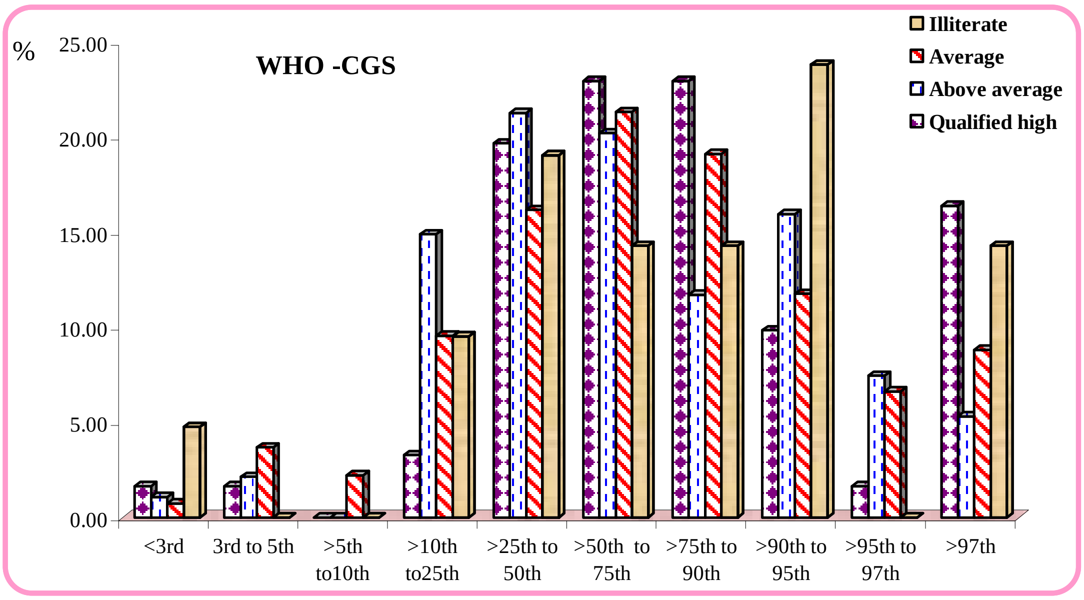


Fig. (37b): Diagrammatic representation of distribution of Body Mass Index of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the WHO-CGS.

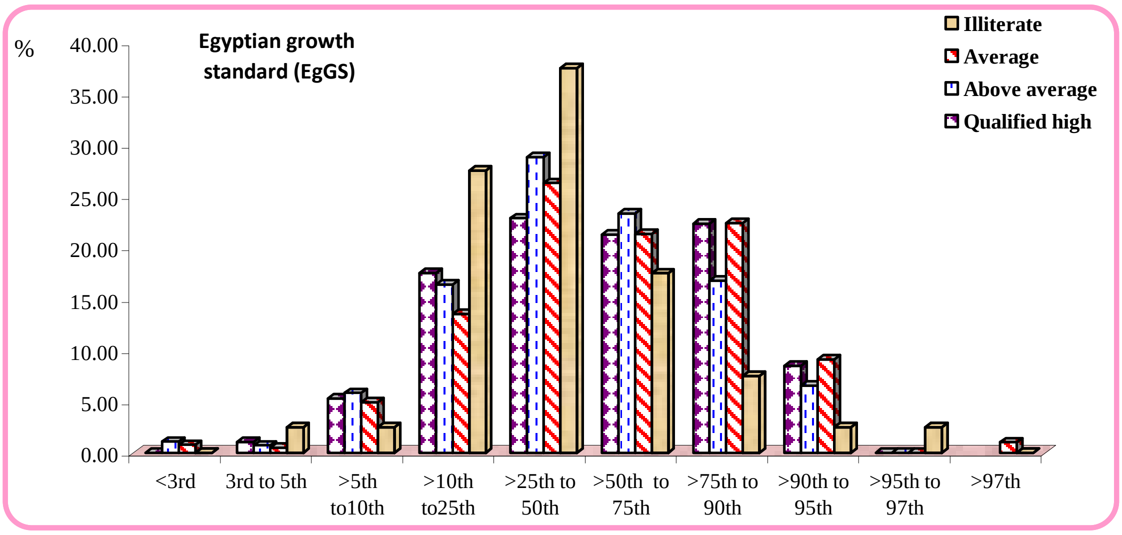


Fig. (38a): Diagrammatic representation of distribution of Head Circumference-age of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the EgGS.

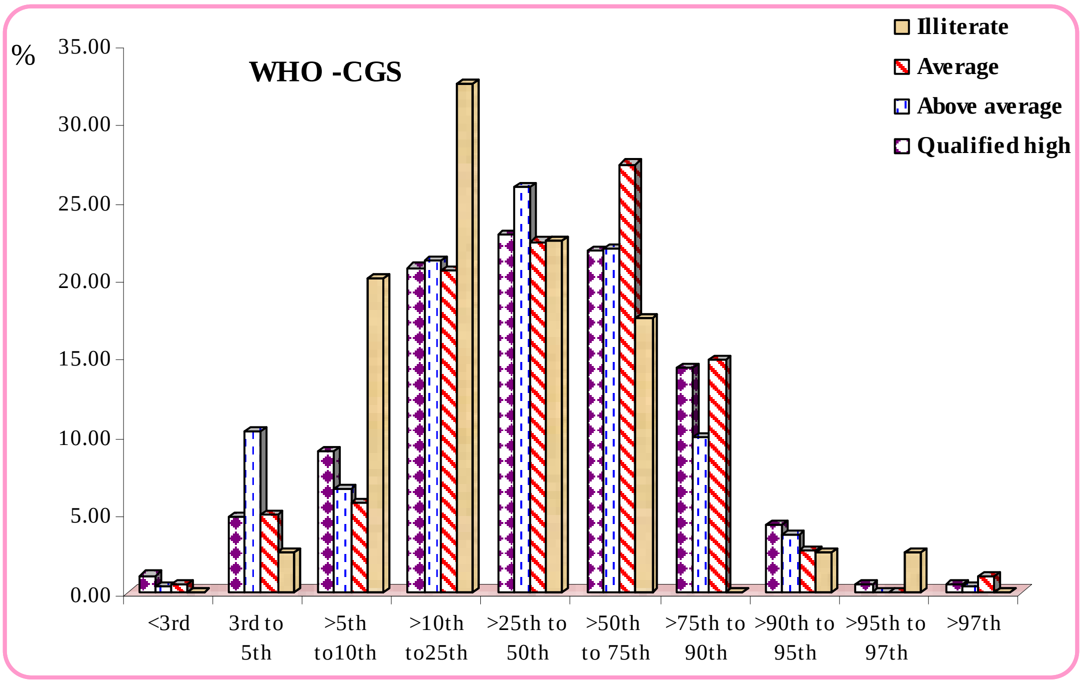


***Fig.(38b*):** Diagrammatic representation of distribution of Head Circumference- age of our study population of children (6-60 months) growth across the centiles by level of education of the mothers using the WHO-CGS.

Table (43a & b): Summarized the nutritional status of children by children's characteristics as age, gender, residence and education of mothers. The table represents the percentage of children under five who are classified as malnourished according to four anthropometric indices of nutritional status: Height-for-age, weight-for-age, weight-for-height and Body mass index by the background characteristics of the child according to the Z-score system of WHO-CGS, the percentile system of WHO-CGS and EgGS.

Table (43a): Nutritional status of the under five population by their characteristics according to the Z-score system of WHO growth standards.

Age groups	Weight-for-age %	Length/height-for-age %	Weight-for-length/height %		BMI-for-age
	% < -2SD	% < -2SD	% < -2SD	% > +2SD	% > +2SD
Total (6-60)	1.5	1.7	1.1	4.8	7.7
(6-11)	1.2	0.6	0	7.8	5.9
(12-23)	3	2.7	2.5	2.5	8.7
(24-35)	0	3.3	0.8	2.4	8.1
(36-47)	0	0	0	2.9	7.7
(48-60)	0	1.2	1.2	9.3	9.3
Gender	**(male)**				
Total (6-60)	0	2.7	0.8	6.2	9.3
(6-11)	0	1.2	0	9.6	10.2
(12-23)	0	4.8	1.6	3.8	10.8
(24-35)	0	3	0	1.5	3
(36-47)	0	0	0	1.9	3.8
(48-60)	0	2.2	2.2	15.6	15.6
Gender	(female)				
Total (6-60)	3.1	0.6	1.4	3.3	6
(6-11)	2.6	0	0	5.8	1.3
(12-23)	6.1	0.6	3.3	1.1	6.7
(24-35)	0	3.5	1.8	3.5	14
(36-47)	0	0	0	3.8	11.5
(48-60)	0	0	0	2.4	2.4

Discussion

It is important to monitor the growth of children especially in the first five years of life in order to ensure their health and nutritional status. Growth charts are the most sensitive, practical and effective way to detect growth and nutritional problems in growing children. The new WHO Child Growth Standards are prescriptive. They describe how children should grow, rather than how children under certain conditions actually grow It is important to monitor the growth of children especially in their first 5 years of life in order to ensure their health and nutritional status. Growth charts are the most sensitive, practical and cost effective way to monitor the growth of a child. However the choice of the most appropriate growth chart that can provide accurate information about the growth of children is of utmost importance in child welfare clinics ***(Alemzadeh and Wyatt, 2007;Cattaneoet al., 2002-).***.

The growth patterns of healthy infants during the first years of life and the standards for their assessment have been important subjects of research among nutritionists and child health workers in recent decades ***(Aarts et al., 2003)***.

It is well-established that human milk is the optimal form of infant nutrition. Breastfeeding confers immunologic, psychological, and developmental benefits to the infant ***(Mortensen et al., 2002)***.

Growth charts are used to assess the nutritional and health status of children, to monitor individual growth, and also for research

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efforts to calculate prevalence estimates and z scores, compare populations, monitor trends, evaluate interventions, and define nutritional outcomes ***(Ogden et al., 2002)***.

Several studies have examined the effect of breastfeeding on infant growth**.** Breastfed infants show higher growth rates in their early life compared with formula-fed infants ***(Kramer et al, 2003)***.

To our knowledge there is no study that compared the differences between World Health Organization – Child Growth Standard (WHO-CGS) and Egyptian Growth Charts (EgGS) particularly in relation to early infant feeding practices. Hence the aim of this study is to compare a group of children who were exclusively breastfed —for six months, according to the WHO and UNICEF criteria for optimal infant feeding, in relation to WHO-CGS and the local EgGS.

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Such a study may help in identifying the growth monitoring tools that would be most suitable for detecting children who may be having growth problems and need to be referred for further investigations.

We must understand that when we are comparing our population to both the international and local charts that in the our population of the WHO-CGS we are dealing with a heterogeneous population with wide diversity in racial and ethnic, genetic make up. While the EgGS reflects a narrow scope of genes. However our main concern is to show the

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actual prevalence of malnutrition in a community that is fed optimally in the first six months. Also the determinants that influence the growth standard and the most sensitive growth charts that can be used to detect abnormal deviations in growth.

In the coming discussion, we will compare our study population of children under 5 years of age using the z-score system with the results of the EDHS (2005) which used the National Center for Health and Statistics (NCHS) reference curves. Furthermore we will compare the EDHS findings of the year 2008 which used the WHO-CGS as their reference.

Also, in Egypt used their local growth charts in University hospitals but the Egyptian MOH used the NCHS/WHO charts for nutrition surveillance ***(Abul-Fadl et al.,2010)***.

–The main differences between our population and that of EDHS (2005) and (2008) is that exclusive breastfeeding for the first 6 months in the former was 16.7% and in the latter was 30% compared to 100% our population.

Next we will examine the differences in the distribution of our population under study using the WHO standards and the Egyptian reference with each age group and compare between them with regards the nutritional indicators, classification used, i.e. z-score and percentile system. Also the effect of maternal education and the residence of the population under study, especially that all of our study population were exclusively breastfed as in the WHO reference.

~~Discussion~~

This study is a cross sectional study, hence, it is not possible to determine the secular trend of Egyptian children at this stage. Changes in the prevalence estimated from the test samples used in this study are indicative of what may be expected in populations with similar nutritional status profiles, variations in the ages of children studied, average attained length, height and proportions with excess or deficient weight-for-length/height make it impossible to define any algorithm that could be used to derive WHO standards-based prevalence from Egyptian reference-based estimates. It is only possible to compare the significant differences in the distribution of our population against the centiles of each reference curve to detect differences in the extreme ranges of these our population that would indicate abnormality i.e. malnutrition or disease.

We noticed that during early infancy the pattern of growth of our population fitted more closely with the WHO Growth Standards at this age group as shown by the even distribution of our cases over the WHO but on the Egyptian references as they had a narrow distribution mostly between 10th to 90th centiles. This is probably related to statistical construction and shape of each curve.

Early infant nutrition is now understood to have significant short and long-term health consequences for an individual. Nutritional interventions early in life are important in protecting the infant against infection and promoting healthy immune system development ***(Howie et al., 1990*** and ***Bhandari et al., 2003)*** and are thought to have life time programming effects on cardiovascular health, metabolism, bone health,

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immune function, and neurological development ***(Singhal and Lucas, 2004).***

Regarding maternal age most of mothers (80%) were at age of 25-35 years, as the mean age of marriage was 25-35 years. But in the past, the mean age was below 20 years. This change was due to socioeconomic level of the country and the Egyptian family. This agrees with ***Farahat et al., (2007)*** who found that (79%) of mothers were at age of 20-34 years. ~~***Mitchell 2003***~~***Singerman and Ibrahim, (2001)*** suggested that rising age at marriage is a consequence of declining economic opportunities for men coupled with increased costs of marriage. Regarding maternal education (94.9 %) of mothers were educated while (5.10%) of mothers were illiterate, as most families did not accept illiteracy even with female. This concept was changed by mass media as any person should continue the education even to basic and the community refuse the idea of illiteracy. This agrees with ***Farahat et al., (2008)***, who reported that most of mothers (42%) of his study had secondary school~~***(Kean Mitchell 2003***~~. Regarding mother occupation, most of mothers (79.4%) were housewives. ~~—~~This agrees with ***Farahat et al., (2008)***, who reported that (76%) of mothers were housewives ~~***Hoffman***~~. The number of siblings of families of the studied group was variable and (40.10%) of families had two siblings. The idea of having many children was decreased. This was referred the effect of family planning program and health education of impact of large family on the health status of all members of family especially mothers and children. This also was due to effect of mass media.

The anthropometric measurements obtained in the study for

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Discussion

exclusive breastfed infants as well as information on the children's ages used to construct the following indices of physical growth: (1) weight-for-age; (2) height-for-age; (3) weight-for-height; (4) Body mass index; (5) head circumference and (6) mid upper arm circumference as shown in the tables presented in the results of this study. The anthropometric indices derived from the study were compared against new growth standards generated by WHO and Egyptian growth charts. Also, our results were compared against the findings of EDHS 2008 and EDHS 2005.

Weight-for-age charts (W/A):

~~***Weight-for-age (W/A):***~~

When using the Z-score system of WHO-CGS, the weight-for-age (W/A) for the age 6 to 11 months of our population in the study showed that none of them fell below -3SD and 1.2 % fell below -2SD as shown in table (2) compared with the more recent EDHS of 2008 that used the WHO-CGS as a reference showed in this age group underweight 5.2 to 5.5% at -2SD and 0.6 to 2.9% at -3SD. While the EDHS of 2005, which used the NCHS as a reference, showed that underweight was 8.7 to 9.8 % at -2SD and 2.7 to 3.3% at -3SD. Taking in our consideration that EDHS data are for all children .So it is an indicator in prevalence of malnutrition.

The W/A of our population aged 12 to 23 months in the study showed that none of cases were below -3SD and 3% fell below - 2SD as shown in table (2) compared with the more recent EDHS 2008 that showed in this age group underweight 4.4 to 7.5% at -2SD and 0.6 to 2.3% at -3SD. While the EDHS of 2005 showed that underweight was 7 to 9.3 % at -2SD and 0.9 to 1.3 % at -3SD.

The W/A of our population aged 24 to 35 months in the study showed that none of cases were below -3SD and -2SD as shown in table (2) compared with the more recent EDHS 2008 that showed in this age group underweight was 6.5% at -2SD and 0.9% at -3SD. While the EDHS of 2005 showed that underweight was 6.4 % at -2SD and 1.3 % at -3SD.

The W/A of our population aged 36 to 47 months in the study showed that none of cases were below -3SD and -2SD as shown in table (2) compared with the more recent EDHS 2008 showed in this age group underweight 6% at -2SD and 1.5% at -3SD. While the EDHS of 2005 showed that underweight was 4.2 % at -2SD and 0.7% at -3SD.

The W/A of our population aged 48 to 59 months in the study showed that none of cases were below -3SD and -2SD as shown in table (2) compared with the more recent EDHS 2008 showed in this age group underweight 5.9% at -2SD and 1.2% at -3SD. While the EDHS of 2005 showed that underweight was 4.9 % at -2SD and 0.3 % at -3SD.

The significant difference in underweight between the demographic survey in 2005 and that in 2008 cannot be explained by the differences in the growth charts used only, but The main differences between our population and that of EDHS (2005) and (2008) is that exclusive breastfeeding for the first 6 months in the former was 16.7% and in the latter was 30% compared to 100% our population.

When using the percentile system of WHO-CGS and EgGS, the W/A of our population aged 6 to 11 showed that 1.25 % fell below the 3rd centile of WHO-CGS and none of cases were plotted on EgGS.

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~~Discussion~~

While 0% of this group were above the 97^{th} centile of WHO-CGS compared to 1.56% when plotted on EgGS as shown in table (15). The differences may be related to the statistical construction of each curve.

When comparing our population aged 12 to 23 months, we found that 2.99% of cases were below the 3^{rd} centile of WHO-CGS and 2.17 % when plotted on EgGS. While 1.36 % of this group were above the 97^{th} centile of WHO-CGS compared to none when plotted on EgGS as shown in table (16). the increasing of our population plotted on lower centiles at this period indicating poor nutritional practices and faulty weaning after 6 months of age.

When comparing our population aged 24 to59 months, we found that none of cases were below the 3^{rd} centile of WHO-CGS and 3.53% when plotted on EgGS. While none of this group were above the 97^{th} centile on the WHO-CGS and the EgGS as shown in table (17). The increasing of our population plotted on lower centiles at this period indicating poor nutritional practices and faulty weaning after 6 months of age. While (0.32%) of our children fell above 95^{th} – 97^{th} – centile according to the WHO-CGS compared to none on the EgGS. Hence according to the EgGS more of our population were underweight and this was not detected by WHO – CGS at this age group as shown in figure (13) and table (17). That the WHO growth charts would be ideal for assessing growth in the first 2 years of life, while the local Egyptian growth charts would be more ideal for assessing the growth of older children from 3 to 5 years of age. For the assessment of underweight, our findings indicate that exclusive breastfeeding for six months protects from malnutrition and underweight in children probably by preventing repeated exposure to infective episodes that cause growth faltering and lead to underweight. When plotting our population against the EgGS and the WHO-CGS, we found that under weight was detected on the WHO-CGS and none on the EgGS for the age groups 6-11. And for age groups 12-23 and 24-60 months were 2.99% and none on the WHO-CGS respectively while, 2.17% and 3.53% on the EgGS respectively. Overweight was detected by W/A growth standard for the age group 6-11 months on the EgGS was 1.56% and none of our population for the age groups 12-23 and 24-60 months. While overweight on the WHO-CGS were none for the age groups 6-11months and 24-60 months, while 1.36% for the age group 12-23 months.

When we used the WHO Growth Chart Z-score system, we found that there are a few percentages of underweight. For example, in the age group 6-11 months, we found only 1.2% under -2SD. This indicates that breastfeeding helps the healthy growth of children. Also, when we used the WHO-GCS, the rates of underweight were few. These rates increased with age. This is explained by the children's infection diseases such as acute chest infections and gastroenteritis.

This agreed with Lartey and others, they followed 216 normal Ghanian children from one month of age to 18 months. They observed that the rates of diarrhea increased if the complementary foods were introduced between four and six months. They stressed that introducing complementary feeding after six months of age improved growth by lessening morbidity ***(Lartey et al., 2000)***.

Our study showed that the percentage of cases above the 97th centile of WHO-CGS in the age groups 6-11 months, 12-23 months and 24-59 months, the proportion was 0.0%, 1.36% and 0.8%. This is explained by the protective effect of exclusively breastfeeding against

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overweight in children. It confirmed by using the EgGS, the age group 6-11showed 1.56% fell above the 97th centile decreasing to 0% in the age groups 12-23 months and 24-59 months.

De Onis et al (2006) compared the WHO Growth Standard with NCHS growth reference on a study population in Bangladesh. They noted that the prevalence of underweight during the first six months was much higher when based on the WHO standard ***(deOnis et al., 2006)***.

Also, Dewey et al (2001) showed that breastfeeding had a major role on the growth of infants especially in the first three months and most of the breastfed cases were growing well and fitted to higher centiles. Dewey (2001) explained their results by the fact that breast milk contains sufficient energy and nutrients that ensure suitable growth for infants in the first six months ***(Dewey et al., 2001)***.

The comparative findings between WHO-CGS and EgGS, we noticed that the EgGS detects more cases of underweight in our population than the WHO-CGS especially in advanced ages. This difference indicates that the EgGS was based on a population that had higher W/A than the population used for the development of the WHO -CGS. The diversity of racial and ethnic origins in the latter charts may also be other factor that explains such differences.

When a study was done in Kingdom of Saudi Arabia (KSA) to compare between the Saudi and NCHS growth standards, they found that the Saudi children below 5 years were lighter than the reference population ***(Al-Mazrou et al., 2003)***.

In our study using the z-score system of the WHO-CGS we found that none fell below the 3 SD while the EDHS (2008), which used the

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WHO-CGS as their reference, showed that for children aged 6-11 months the W/A at -3 SD was 0.6%-2.9%. Again in our study using WHO-CGS the W/A of children aged 12-23 months none fell below -3 SD, while the W/A in the EDHS (2008) was 0.6%-2.3% for this age group at -3 SD. This indicates that the population of the EDHS (2008) were severely underweight.

In our children aged 24-35months in the study using the Z-score system of the WHO-CGS, we found that none fell below the -3 Z-score. While the EDHS (2008) showed that for the same age group **underweight** below -3 SD was 0.9%. Again in our study using WHO-CGS the W/A of children aged 36-47 months none fell below -3 SD, while the W/A in the EDHS (2008) was 1.5% for this group at -3 SD. In our study using the Z-score system of the WHO-CGS we found that none fell below the -3 SD while in the EDHS (2008) showed that for children aged 48-60 months the W/A at -3 SD was 1.2% ***(EDHS, 2008)***.

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In our study, using the Z-score system of the WHO-CGS, we found that 1.2% of children aged 6-11 fell below the -2 SD. While for the same age group 5.2%-5.5% of children in the EDHS (2008) were at -2 SD . Again in our study using WHO-CGS 3% of our children aged 12-23 months; fell below -2 SD, compared to 4.4% to 7.5%. in the population of the EDHS (2008).

In our study none of the children 24-35, 36-47 and 48 to 60 months fell below the -2 Z-score of the WHO-CGS. While the EDHS (2008) showed that for same age group the W/A at -2 Z-score was 6.5%

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for the 24-35 months age group and 6% for children aged 36-47months and 5.9% for children aged 48-60 months ***(EDHS, 2008).***

While the EDHS(2005) which used the NCHS as a reference showed that for children aged 6-11 months the W/A at -3 z-score was from 2.7% to 3.3% and for children aged 12-23 months W/A below -3 SD was from 0.9% to 1.3% and for children aged 24-35 months 1.3% fell below -3 SD .and for children aged 36-47 and 48 to 60 months was 0.7% and 0.3% fell at -3 SD respectively.

The EDHS(2005) which used the NCHS as a reference showed that for children aged 6-11 months the W/A at -2 Z-score was from 8.9% to 9.8%, for children aged 12-23 months it was from 7.0% to 9.3% at -2 SD, and for children aged 24-35 months it was 6.4% for children aged 36-47 months was 4.2% the children aged 48-60 months was 4.9% at -2 SD ***(EDHS, 2005)***.

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The significant difference in underweight between the demographic survey in 2005 and that in 2008 cannot be explained by the differences in the growth charts used only, but rather the improvement in the early feeding practices that was seen with the doubling in the exclusive breastfeeding rates. The latter was associated with one half to one third decreases in the underweight. While further increase of exclusive breastfeeding, as shown in our study, can have a significant effect on prevention of underweight. In a study conducted by UNICEF, it was shown that promoting breastfeeding and appropriate complementary practices resulted in a 19% improvement in child health as compared to

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other intervention programs in child health ***(Prudhon et al.,UNICEF, 2006)***.

In our study we found that underweight below the 3rd centile for the 6-11 months age group was (1.25%) when plotted against the WHO CGS compared to none on the EgGS. While (1.56%) of our children were above the 97th according to EgGS compared to none on the WHO CGS figure (23) and table (21). The differences may be related to the statistical construction of each curve.

Other workers showed that when comparing the WHO growth standards with the NCHS growth reference showed that most of the breastfed population were growing well and fitted to higher centiles. 0.7% and 0.3% fell at -3 SD respectively.

They also showed that breastfeeding had a major role on the growth of infants especially in the first three months of life ***(Dewey et al (2001)***.

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Discussion

The W/A for the (12-23) months showed that 2.99% of our children fell below the 3rd centile using the WHO-CGS compared to (2.17%) on the EgGS. Hence according to WHO - CGS more of our population were **underweight** and this also was detected by the EgGS at this age group. While (1.36%) of our children fell above the 97th according to the WHO-CGS compared to none on the EgGS figure.(24) and table (22). the increasing of our population plotted on lower centiles at this period indicating poor nutritional practices and faulty weaning after 6 months of age.

The W/A of the (24-60) months age group of our study showed that (3.53%) fell below the 3rd centile, according to the EgGS compared to none on the WHO-CGS. Hence according to the EgGS more of our population were underweight and this was not detected by WHO - CGS at this age group figure.(25) and table(23).

Height/Length-for-age charts (H/A):

When using the Z-score system of WHO-CGS, the height/length-for-age (H/A) for the age 6 to 11 months of our population in the study showed that none of cases were below -3SD and 0.6% fell below -2SD as shown in table (3). The most recent EDHS of 2008 which used the WHO-CGS as a reference showed that for this age group the rate of stunting was 21.9 to 22% at -2SD and 10.6 to 11% at -3SD. While the EDHS of 2005, which used the NCHS as a reference, showed that stunting was 20.3 to 22 % at -2SD and 5.4 to 6.5 % at -3SD.

The H/A of our population aged 12 to 23 months in the study showed that none of cases were below -3SD and 2.7 % fell below -2SD

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as shown in table (3) compared with the more recent EDHS of 2008 showed in this age group stunting 28.1to 40.8 % at -2SD and 14.2 to 22.9 % at -3SD. While the EDHS of 2005 showed that stunting was 21.3 to 24.2 % at -2SD and 6.9 to 10.3 % at -3SD.

The H/A of our population aged 24 to 35 months in the study showed that none of cases were below -3SD and 3.3% were below -2SD as shown in table (3) compared with the more recent EDHS of 2008 showed in this age group stunting 34.9 % at -2SD and 16.8 % at -3SD.While the EDHS of 2005 showed that stunting was 18.6% at -2SD and 8.3% at -3SD.

The H/A of our population aged 36 to 47 months in the study showed that none of cases were below -3SD and -2SD as shown in table (3) compared with the more recent EDHS of 2008 showed that for the same age group the rate of stunting was 31.8 % at -2SD and 14.9 % at -3SD. While the EDHS of 2005 showed that stunting was 16.1 % at -2SD and 6.8 % at -3SD.

The H/A of our population aged 48 to 59 months in the study showed that none of cases were below -3SD and 1.2 % fell below -2SD as shown in table (3). The more recent EDHS of 2008 showed that for the same age group the rate of stunting was 24.3% at -2SD and 10.5 % at -3SD and the EDHS of 2005 showed that stunting was 13.6 % at -2SD and 3.5% at -3SD.

The main differences between our population and the EDHS is in the infant feeding practices, where all of our children were exclusively breastfeeding compared to only 15% of the EDHS population as at 4-5 months. This means that improving infant feeding practices by encouraging exclusive breastfeeding in the first 6 months can drastically

Discussion

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improve the severe malnutrition in our population.

When using the percentile system of WHO-CGS and EgGS, the H/A of our population aged 6 to 11 showed that 0.63 % fell below the 3rd centile of WHO-CGS and none of cases when plotted on EgGS. While none of this group were above the 97th centile of WHO-CGS and EgGS as shown in table (18).

The H/A of our population aged 12 to 23 months showed that 2.72 % fell below the 3rd centile of WHO-CGS and none of cases were plotted on EgGS. While none of this group were above the 97th centile of WHO-CGS and EgGS as shown in table (19).

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The H/A of our population aged 24 to 59 months showed that 1.6 % fell below the 3rd centile of WHO-CGS compared to none of the cases when plotted on EgGS. While none of this group were above the 97th centile of WHO-CGS and EgGS as shown in table (20).

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For the assessment of stunting taking in our consideration that our study using normal children not whole population , our findings indicate that children who were on exclusive breastfeeding showed no evidence of stunting. This was confirmed by using EgGS. When we used the WHO-CGS for assessment of stunting, The rate was 0.63% less than the 3rd centile in the age group 6-11 months, in the age group 24-59 months to be1.60% and increased more and more to be 2.72% in the age group of 12-23 months indicating that these children are exposed to chronic malnutrition once they stop breastfeeding. Also if we used the Z-score system, we found stunting 0.6% less than-2SD in the age group

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6-11 months graded to be 3.3% at the age group 24-35 months. This is due to malnutrition caused by recurrent infections that affect these children. Conclude that exclusive breastfeeding for six months protects against chronic malnutrition by building their immunity and preventing their exposure to frequent infections.

The comparative findings between WHO-CGS and EgGS, we noticed that the EgGS of H/A did not detect any cases below the 3rd centile and above 97th rather than the WHO-CGS. The difference may be related to the statistical construction of each curve. Also the WHO-CGS represented a heterogeneous population while the EgGS represented a homogenous population.

Our findings are in agreement with De Onis et al (2006) who showed that the WHO Growth Standard when compared to the NCHS growth reference in a study conducted for a population in Bangladesh; resulted in a high prevalence of stunting for all age groups ***(deOnis et al., 2006)***.

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Discussion

Dewey et al (2001) have characteristically demonstrated higher early growth rates among exclusively breasted and this could explain the higher detection rate of stunting when using the new WHO growth charts ***(Dewey et al., 2001)***. Similarly The KSA study showed that the Saudi children below 5 years of age were shorter than the reference population, using the US growth charts ***(Al-Mazrou et al, 2003)***.

Length for age (L/A) In our study using the Z-score system of the WHO-CGS we found that none fell below the -3 Z-score. While the EDHS (2008) which used the WHO-CGS as their reference showed that for children aged 6-11 months the L/A at -3 Z-score was 10.6% to 11%. Again in our study using WHO-CGS the L/A of children aged 12-23 months none fell below -3 SD, while the L/A in the EDHS (2008) was from 14.2% to 22.9% for this age group at -3SD. This indicates that the population of the EDHS were **severely stunted**. The main differences between our population and the EDHS is in the infant feeding practices, where all of our children were exclusively breastfeeding compared to to only 15% of the EDHS population as at 4-5 months. This means that improving infant feeding practices by encouraging exclusive breastfeeding in the first 6 months can drastically improve the severe malnutrition in our population.

In our study using the Z-score system of the WHO-CGS we found that none fell below the -3 Z-score. While the EDHS(2008) which used the WHO-CGS as their reference showed that for children aged 24-35

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months the L/A at -3 Z-score was 16.8%. In our study using the Z-score system of the WHO-CGS we found that none of the same age group fell below the -3 Z-score, while The EDHS (2008) showed that for children aged 36-47 and 48 to 60 months, the L/A at -3Z-score was 14.9% and 10.5% respectively. ***(EDHS,2008)***.

In our study L/A of children aged 6-11 months showed that 0.6% fell below the -2 Z-score. While the EDHS (2008) showed that for the same age group the L/A at - 2 Z-score was 21.9% 22.0%. Again in our study the L/A of children aged 12-23months, 2.7% fell below - 2 Z-score ,while the L/A in the EDHS (2008) ranged from 28.1% to 40.8%. In our study the L/A of children aged 24-35, 36-47 and 48-60 months was 3.3%, none and 1.2 respectively compared to 34.9%, 31.8% and 24.3% who fell below the -2 Z-score for the L/A in the EDH survey of 2008 ***(EDHS,2008)***.

In the EDHS (2005) which used the NCHS as their reference showed that for children aged 6-11 months the L/A at -3 Z-score was from 5.4%to 6.5%. and for children aged 12-23 months it ranged from 6.9% to 10.3% for children aged 24-35 months it was 8.3% at -3 Z-score. While the L/A in the EDHS (2005) was 6.8% and 3.5% at -3 Z-score for children aged 36-47 months and children aged 48-60 months respectively ***(EDHS, 2005)***.

In the EDHS (2005) using the NCHS as their reference showed that for children aged 6-11 months the L/A at -2 Z-score was from 20.3% to 22.0%. Again in the EDHS (2005) using the NCHS the L/A of children aged 12-23 months was from 21.3% to 24.4% at -2 Z-score, while the L/A in the EDHS(2005) was 18.6% for children aged 24-35

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months and children 36-47 months at -2 Z-score decreased to 13.6% for children aged 48-60 months at -2 Z-score ***(EDHS,2005)***.

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In our study the length for age (L/A) below the 3rd centile, i.e. **stunting,** for the 6-11 months age group was (.%) when plotted against the WHO-CGS compared to none on the Egyptian growth charts, while (3.75%) of our children were 90th to 95th according to the WHO -CGS compared to none on the EgGS. The L/A for the12-23 months showed that .of our children fell below the 3rd centile using the WHO-CGS compared to none on the EgGS. The difference may be related to the statistical construction of each curve. Also the WHO-CGS represented a heterogeneous population while the EgGS represented a homogenous population ***(Schwarz et al., 2006)***.

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This indicates that the WHO child growth standard detects stunted children under 2 year of age. The L/A of the 24-60 months age group of our study showed that .% fell below the 3rd centile according to the WHO-CGS compared to none on the EgGS. Hence according to the WHO-CGS more of our population were stunted at (6-11) months, (12-23) months and (24-60) months and this was not detected by the EgGS. It is clear that there is a problem of stunting. **This stunting** appears earlier by the WHO growth references and was not detected by the Egyptian local growth charts. This may be explained by the poor socioeconomic, low or unbalanced food intake and health status of the population under the study.

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~~In the Kingdom of Saudi Arabia (KSA) a similar study was conducted and they showed that most of their population tended to be shorter when plotted on growth charts used for children in the United States of America (USA). Hence the variations in the preschool age group can be related to socioeconomic and dietary factors as well as ethnic and racial factors; ***Frayh et al., 1993***.~~

~~De Onis compared the WHO growth chart with the USA growth chart and showed that the most of population of the USA were taller compared to the WHO.~~

Weight-for-Height charts (W/H):

When using the Z-score system of WHO-CGS, the weight-for-height (W/H) of our population aged 6 to 11 months in the study showed that none of our cases were below -3SD and -2SD but there were 7.8% above +2SD as shown in table (4). When compared with the more recent EDHS of 2008 that used the WHO-CGS as a reference showed in this age group wasting to be 5.8 to 6.5% at -2SD and 1.8 to 2.4 % at -3SD. While the EDHS of 2005, which used the NCHS as a reference, showed that wasting was 4.8 to 6.1 % at -2SD and 0.5 to 1.5 % at -3SD.

The W/H of our population aged 12 to 23 months under study showed that none of cases were below -3SD and 2.5 % fell below -2SD and above +2SD as shown in table (4). When compared with the more recent EDHS of 2008 showed in this age group wasting 5.2 to 8.2% at -2SD and 1.3 to 3.6 % at -3SD.While the EDHS of 2005 showed that wasting was 4.5 to 4.9 % at -2SD and 0.7 to 1.1% at -3SD.

The W/H of our population aged 24 to 35 months in the study showed that none of cases were below -3SD and 0.8 % fell below -2SD

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Discussion

but there were 2.4% above +2SD as shown in table (4). When compared with the more recent EDHS of 2008 the rate of wasting was shown to be 7.3% at -2SD and 3.2 % at -3SD for the same age group. While the EDHS of 2005 showed that wasting was 3.9 % at -2SD and 1.2 % at -3SD.

The W/H of our population aged 36 to 47 months under the study showed that none of cases were below -3SD and -2SD but 2.9% above +2SD were detected as shown in table (4). When compared with the more recent EDHS of 2008 for the same age group, the rate of wasting was 6.8% at -2SD and 3.3% at -3SD.While the EDHS of 2005 showed that wasting was 2.8 % at -2SD and 0.7% at -3SD for the same age group using the combined WHO-NCHS growth charts.

The W/H of our population aged 48 to 59 months under the study showed that none of cases were below -3SD and 1.2 % fell below -2SD but there were 9.3% above +2SD as shown in table (4) compared with the more recent EDHS of 2008 showed in this age group wasting 6.4% at -2SD and 3% at -3SD. While the EDHS of 2005 showed that wasting was 2.3 % at -2SD and 0.3 % at -3SD.

When using the percentile system of WHO-CGS and EgGS, the W/H of our population aged 6 to 11 showed that none of cases were below 3rd centile of WHO-CGS as well as when plotted on EgGS. While 7.81 % of this group were above the 97th centile of WHO-CGS compared to 10.63 % when plotted on EgGS as shown in table (21).

The W/H of our population aged 12 to 23 showed that 2.45 % fell below the 3rd centile of WHO-CGS and 1.09% when plotted on EgGS.

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While 2.44 % of this group were above the 97th centile of WHO-CGS compared to 4.08% when plotted on EgGS as shown in table (22).

The W/H of our population aged 24 to 59 months showed that 0.63% fell below the 3rd centile of WHO-CGS, as well as when plotted on EgGS. While 1.89 % of this group were above the 97th centile of WHO-CGS, as well as when plotted on EgGS as shown in table (23).

For the assessment of wasting and overweight, our findings indicate that the weight for height and using both the "national" and "international" growth charts show that exclusive breastfeeding for 6 months protect children from wasting which represents an acute state of malnutrition. For example, using the WHO Growth Chart Z-score, we found that no cases in the age group 6-11. On the contrary, we found that there is an increase in the proportion of cases above the +2 SD rates of 7.8% of the cases used for the study. We have noted that among the older age groups there is an increase in the rates of cases that are fall below-2SD and the less children above the +2 SD up to the age group 36-47 months, but more children above the +2 SD for the age group 48-59 months–. This may be due to the erroneous feeding practices of children and increase exposure of children to infection especially chest infections and gastroenteritis in the older age groups. In addition, the income level of family and socioeconomic levels of families affect the quality of family foods offered to the child. This supports evidence that breastfeeding protects children against malnutrition.

When we studied the cases by using WHO-CGS, the rate of overweight (above the 97th centile) was 7.8% for the age group 6-11 month decrease to 2.44% at 12-23 months and 1.89% for the age group of 24-59 months. On the other hand the rate of underweight, below 3rd

Discussion

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centile for the age group of 12-23 months was 2.45%, probably reflecting erroneous practices of weaning.

When we used the EgGS, we found the similar findings. In the age group 6-11 months, the rate was 10.63% above the 97th centile, decreased to be 4.08% in the age group of 12-23 months. Then the rate slightly decreased in the age group of 24-59 months up to 1.89%.

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The comparative findings between WHO-CGS and EgGS, we noticed that The WHO Weight-for-Length curves extend from 45 to 110 cm and Weight-for-Height charts from 65cm to 120 cm to facilitate their use on severely under nourished populations and emergency setting.

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The extension of the WHO Weight-for-Length charts at both ends compared with the Egyptian reference (47 to 91 cm) was intended to facilitate assessment of stunted newborns, tall 2 years-olds and older children who are unable to stand for whatever reason e.g. severe malnutrition and agitation during measurement. ***(deOnis et al, 2006)***.

Comparing the overweight rates detected by the WHO-CGS and EgGS, we find that there is a difference. This difference indicates that the EgGS was based on a population that had higher W/H than the population used for the development of the WHO-CGS. The diversity of racial and ethnic origins in the latter charts may also be other factor that explains such differences. However based on such findings the health care system may be burdened by the over referral of cases of overweight when using the WHO-CGS, may be less so burdened when using the

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local EgGS. Hence based on such findings it may safely assumed that the WHO-CGS would be ideal for assessing the growth in the first 2 years of life, while the local EgGS would be more ideal for assessing the growth of older children from 3 to 5 years of age.

Weight for Length/Height (W/L) In our study population the W/L using the Z-score system of the WHO-CGS for children aged 6 to 11, 12 to 24 and 25 to 35, 36-47 and 48 to 60 months showed that none fell below the -3 Z-score, i.e. there was **no severe wasting** was detected. While the EDH survey of 2008 which used the WHO-CGS as a reference showed that **severe wasting** for the same age groups was 1.8%-2.4%, 1.3%-3.6%, 3.2%, 3.3% and 3.0% respectively EDHS (2008).

In our study, the W/L of children aged 6-11 months using the Z-score system of the WHO-CGS we found that none fell below the -2 Z-score. While the EDHS (2008) which used the WHO-CGS as a reference showed that for the same age group 5.8% -6.5% were below -2 SD. Again in our study using WHO-CGS the W/L of children aged 12-23 months 2.5% fell below -2Z-score, compared to was 5.2%-8.2% in the ***EDHS (2008).***

In our study for children 24-35 and 36 to 47 and 48 to 60 months we found that **wasting** (below the -2 Z-score) was 0.8%, zero and 1.2% respectively. While the EDHS of 2008 it was 7.3% 6.8% and 6.4%.for the same age groups respectively ***(EDHS,2008)***.

In the EDHS (2005) using the NCHS as their reference showed that for children aged 6-11months the W/L at -3Z-score, i.e. for **severe**

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Discussion

wasting, was from 0.5 % to1.5% and of children aged 12-23 months it was from 0.7% to 1.1% and 1.2% for children aged 24-35 months and for children aged 36-47 and 48 to 60 months it was 0.7% and 0.3% respectively. ***(EDHS,2005)***.

The EDHS (2005) using the NCHS as a reference in their study showed that for children aged 6-11 months the W/L at -2 Z-score ranged from 4.8% to 6.1%. While in the EDHS(2005) **wasting** in children aged 12-23 months remained high, ranging from 4.5% to 4.9% at -2 Z-score then for children aged 24-35 and 36 to 47 months it decreased to 3.9% and 2.8% respectively. While the W/L for children aged 48-60 months it decreased even further to 2.3% ***(EDHS, 2005)***.

The WHO Weight-for-Length curves go from 45 to 110 cm and Weight-for-Height charts from 65cm to 120 cm to facilitate there application in severely under nourished populations and emergency setting.

The extension of the WHO Weight-for-Length charts at both ends compared with the Egyptian reference (47 to 91 cm) was intended to facilitate assessment of **stunted** newborns, tall 2 years olds and older children who are unable to stand for whatever reason e.g. severe malnutrition and agitation during measurement.

Weight-for-Length/Height (W/L)

In this study we found that **the underweight** below the 3^{rd} centile for the 6-11 months age group when plotted against the WHO-CGS the EgGS. while 11.56% of our children fell above the 97^{th} on the EgGS compared to 8.75% of our children on the WHO-CGS figure.(29) and

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table (27). There is a clear tendency to **overweight** detected by WHO child growth standard and the Egyptian growth standard. *The W/L* for the 12-23months showed that % of our children fell below the 3^{rd} centile using the WHO-CGS compared to 1.09% of our children on the EgGS. While 4.08% of our children fell above the 97^{th} centile on the EgGS compared to 3.80% of our children on the WHO-CGS figure. (30) and table (28). However the tendency to **overweight** at 6-11 months indicates that we may be overfeeding these children when the main food should be breastfeeding and complementary diet.

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There were no differences between W/L for the 24-60 months age group between the WHO-CGS and the EgGS as **severe wasting** below the 3^{rd} centile was 0.63%. The tendency to **underweight** at this age group may be due to infection or incorrect feeding habits.

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Body Mass Index-for-age charts (BMI):

~~***BMI for age:***~~

The BMI is the relationship between weight in kg divided by height in meters squared. It is used as one of the nutritional indices for overweight and obesity ***(Nelson, 2007)***.

~~The BMI is used as one of the nutritional indices for **overweight and obesity**. However when using the WHO Standards more of our population appeared **overweight** i.e. with high BMI that varies by age and nutritional status of the population.~~

When using the Z-score system of WHO-CGS, the Body mass index (BMI) of our population aged 6 to 11 and 12 to 23 months in the study showed that none of cases were below -3SD and 0.6% and 3.6% were below -2SD but there were 5.9% and 8.7% respectively above +2SD as shown in table (5).

The BMI of our population aged 24 to 35 and 36 to 47 and 48 to59 months under the study showed that although none of cases were below -3SD yet 0.8%, 1.9% and 1.2% fell below -2SD while 8.1%, 7.7% and 9.3% fell above +2SD respectively as shown in table (5).

When using the percentile system of WHO-CGS and EgGS, the BMI of our population aged 24 to 59 showed that 1.28 % fell below the 3rd centile of WHO-CGS and 4.81% when plotted on EgGS. While 9.62% of this group were above the 97^{th} centile of WHO-CGS compared

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to none when plotted on EgGS as shown in table (24).

For the assessment of underweight and overweight, our findings indicate that When we used the Z-score system, we found that there was 0.6% under-2SD in the age group 6-11, which is appropriate evidence of the importance of breastfeeding and its impact on the health and nutritional status of children .The Rates of cases under-2SD increased up to 3.6% in the age group 12-23 months. The Rates had been decreased more and more in advanced age group and reached up to 0.8% in the age group 24-35 months. As a result of faulty weaning for the children and increasing the rates of Gastroenteritis and chest infections in this age. In the age group 36-47and 48-59 months, the rates increased again under-2SD to 1.9% and 1.2%, As a result of improving the nutrition in this age groups and the adoption of children on the diet of their families.

The patterns of the rates above the +2 SD drew our attention as we found these rates which reflect the nutritional status of children for the age groups 6-11, 12- 23 and 24- 35 months were climbing from 5.9%, 8.7% and 8.1% respectively. It means that the increase reflects the adoption of most families to poor dietary habits at the stage of weaning with increase in carbohydrates and fats that cause overweight. These rates decreased after that to become 7.7% in the age group 36-47months, but 9.3% for the age group 48-59 months, probably reflecting increased exposure to infection and less attention of the families to overfeed the older child, but these were not detected for the age group 48-59 months. Also as a result of participation of children in these ages of most of the family food. This agreed with studies which conclude that the breastfeeding had a decreasing effect on the mean of BMI through life

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~~Discussion~~

course of infants ***(Owen et al, 2005)***.

The comparative findings between WHO-CGS and EgGS, we noticed in relation to age, the artificial drop in prevalence at 24 months seen with the Egyptian reference was resolved by the design and analytical techniques used to construct the WHO Standards. The Egyptian reference for BMI-for- age begins after 24 months aged children and thus comparative results are not presented for this indicator. In the WHO standards, the BMI-for-age charts were able to produce it from birth to 60 completed months and are recommended for screening overweight through childhood ***(WHO, 2006)***.

Rates of cases under the 3rd centile in the age group 24-59 months was 1.28%, while that above 97th centile was 9.6%, which indicates an increase in the proportion of overweight. On the contrary, with the use of EgGS we note that the percentage of cases under the 3rd centile in the same age group was 4.81%, while that of the above 97th centile was 0%, which indicates shift of the pattern of growth pertaining to BMI of our population to lower centiles compared to the reference population used in these standards. This difference is due to several reasons including the statistical design of each growth chart. Also due to the EgGS has been designed for the children of elite Egyptians who were showing a positive secular trend at that time. While our population had gone through two epidemics of exposure to the avian flu and the N1H1 viruses that caused many children to be deprived of eating chicken and eggs in their diet. The latter are one of the main food components on the Egyptian family table and important source of protein. This caused a shift towards underweight, although early feeding practices on Breast milk were still protective for these children against severe underweight and stunting. While the over exposure to dietary products in the form of milk and cheese, to compensate the low protein in their diet resulted in increased intake of fats and as a result the obesity that was manifest on the WHO growth charts.

Breastfeeding reduces the risk of both under nutrition and overweight later in childhood. In disadvantaged populations, exclusive breastfeeding is associated with less growth faltering during early infancy and continued breastfeeding through the second year of life enhances linear growth ***(Villalpando* and Lopez-Alarcon*, *2000)*.

~~In relation to age, the artificial drop in prevalence at 24 months seen with the Egyptian reference was resolved by the design and analytical techniques used to construct the WHO Standards. The Egyptian reference for BMI-for- age begins after 24 months aged children and thus comparative results are not presented for this indicator. In the WHO standards, the BMI-for-age charts were able to produce it from birth to 60 completed months and are recommended for screening **overweight** through childhood.~~

~~In relation to the age 24 to 60 months, we found that (1.28%) of our population fell below the 3^{rd} centile of WHO to (4.81%) on the . While none of our population where above the 97^{th} centile of compared to (9.62%) on the . This is shown in tables (30) and figure (32). The increase of BMI, which is indicative of **overweight**, was shown by but not shown by the is constructed based on exclusively breastfed children but the construction was based on elite or affluent population.~~

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importantdairyThe WHO-CGS, reflects the growth of exclusively breastfed babies. The variation between the local and international standards are related to the high socioeconomic standard elite population that was used to develop the local EgGS. However almost three quarter of our study population were of moderate and low socioeconomic standard.

Mid upper arm circumference charts (MUAC):

The measurements of MUAC were plotted on WHO-GCS using the Z-score system only because there is no available Egyptian Charts concerned for this measurement. The measurement of MUAC is useful for screening acute malnutrition in the community. Our exclusively breastfed infants showed a normal distribution across the centiles of the WHO-GCS. MUAC/A for the age groups 6-11months, 12-23 months and 24-59 months were 0.9%, 0.81% and 0.3% below the 3rd centile respectively and none were above 97th centile of WHO-GCS except 0.5% of population; aged 12-23; was detected above the 97th centile of WHO-GCS, as shown in table (14).

MUAC

In our study using the WHO-CGS as a reference, we found that 0.9% of our population fell below the 3rd centile. However 0.3% of our population fell from 95th to 97th for our population aged 6-11months and none above the 97th centile. Again in our study we found that 0.81% of our population fell below the 3rd centile, however 0.5% fell above the 97th for our population aged 12-23 months. In our study we found that 0.3% fell below the 3rd centile, however 1.28% from 90th to 95th and

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~~none above the 97th for our population aged 24- 60 months as show table (20) and figure (21 and 22).~~

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Head circumference-for-age charts (HC/A):

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~~Discussion~~

~~*Head circumference-for-age (HC/A):*~~

When using the percentile system of WHO-CGS and EgGS, the HC/A of our population aged 6 to 11 showed that 1.25% of our cases fell below the 3rd centile of WHO-CGS to none were plotted on the EgGS. While 0.31% of our cases where above the 97th centile of EgGS and the WHO Growth standard, as shown in table (25). This agreed with the studies showed that Head circumference for exclusive breastfed infants was higher than for others ***(Michael et al., 2003 and Harit et al., 2007)***. Also from the results, we noted that the WHO-CGS is useful for detecting the extremes.

Also, for the age 12to 23 months, we found that 0.27% of our cases fell below the 3rd centile of WHO-CGS to none were plotted on the EgGS. While 0.82% of our children were above the 97th centile of the EgGS and the WHO-CGS, as shown in table (26). For the age 24 to 60 months, we found that none of our children fell below the 3rd centile of WHO-CGS to 3.03% were plotted on the EgGS. While 1.52% of our children were above the 97th centile of EgGS compared to 1.01% on the WHO-CGS, as shown in table (27).

Our population showed a normal distribution across the centiles of the WHO standard and also the Egyptian reference curves, as shown in tables (25, 26 and 27). These children were distributed evenly allover the WHO standard but majority of these cases are aggregated between 10th and 90th centiles in the Egyptian reference which reflects that they were highly homogenously selected population, representing a similar race and ethnic population. Unlike the WHO Growth Standard which represents multiple races.

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HC/A for the age 6 to 11months, we found that (1.25%) of our population fell below the 3rd centile of WHO standard and none on the Egyptian growth chart. While (0.3%) of our population where above the 97th centile of Egyptian Growth chart compared to (0.3%) on the WHO Growth standard, as shown in table (31) and figure.(33).

Also, for the age 12to 23 months, we found that (0.27%) of our our population fell below the 3rd centile of WHO standard compared to none on the Egyptian growth chart. While (0.82%) of our population where above the 97th centile of Egyptian Growth chart compared to (0.82%) on the WHO Growth standard, as shown in table (32) and figure.(34). For the age 24 to 60 months, we found that none of our population fell below the 3rd centile of WHO standard to none (3.03%) on the Egyptian growth chart. While (1.52%) of our population where above the 97th centile of Egyptian Growth chart compared to (1.01%) on the WHO Growth standard, as shown in table (33) and figure.(35).

The findings of our study show a normal distribution through centiles on the WHO standard and also through the Egyptian reference curves. Our population was distributed evenly across the WHO centile standards but the majority of this population is aggregated between the 10th and 90th centiles in the Egyptian reference which reflects that they were a highly homogenously selected population, of similar race and ethnic origin unlike the WHO Growth Standard which represent multiple races.

Also, the study that was done by de Onis found that there was a high prevalence of overweight when she comparing between NCHS and the WHO growth charts. Hence, these charts should be revised repeatedly updated. Also, the effects of secular trends on the growth of

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children should be taken into consideration when interpreting growth of children using these growth standards ***(de Onis et al, 2004; Schwarz et al. , 2006).***

., .In the Kingdom of Saudi Arabia (KSA) a similar study was conducted. They compared the current 5th, 50th and 95th percentiles for Saudi 0-59 months growth standards with their counterparts of NCHS percentiles revealed that at birth the Saudi children are very close to the NCHS reference standards in weight for age, height for age and weight for height. However, as the Saudi children grow older, they become shorter and thinner than the US children do. This difference starts to be significant as soon as the child is 5-6 months old. In addition, this study showed that the Saudi children below 5 years were shorter and lighter than the reference population ***(WHO, 1983, Frayh et al.,1993, Salah et al.,1995 .***

In conclusion, there is a significant difference between the national growth monitoring data and the NCHS data, so it is important to use the national figures to avoid the drawbacks of NCHS standards, which are used for growth monitoring in KSA . It indicates that there is stunting of growth among KSA children but not as severe as shown by the EDH survey in Egypt. The difference may be attributed to the affluence in KSA compared to poverty and poor nutrition in the EguptianEgyptian population ***(Al-Shoshan,1983; , Salah et al.,1995).***

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Pattern of growth:

The shape of the curve of our population group tended to show

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that the majority of our children overlapped with the WHO ~~–~~growth charts in relation to W/A growth standard~~—~~. however the pattern of growth in relation to L/A growth standard ~~-~~did not overlap, but deviated towards the left indicating considerable stunting in our group. Also the pattern (shape of the curve) for W/L and BMI growth standards ~~-~~tended to overlap in the majority of children with some deviation to the right, indicated tendency to overweight in our population, as shown in figures (1 to 8) and tables (~~8-~~2 to ~~20~~13)~~-and figure(13-to22)~~. This can be explained by dietary habits of our population that were mostly dependent on a high carbohydrate diet with low protein, vegetables and fruits. It can also be explained by the high carbohydrate diet which are more cheap and readily available in homes because as the majority of our study population were of moderate (52.4%) to low (20%) socioeconomic status, and also (59.4%) of our population came from rural areas, as shown in table(1a). Many studies were done to evaluate the effectiveness of growth charts in growth monitoring.

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These studies were done in multiple countries e.g. KSA and USA. Specific growth patterns were found for each country depending on socioeconomic status, nutritional, environmental, also, may be genetic. For example; in KSA, a study noted that most of their cases tended to be shorter and thinner than the US children do ***(Al-Mazrou et al., 2003)***.

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~~Many studies were done to evaluate the effectiveness of growth charts in growth monitoring. These studies occurred in multiple countries e.g. KSA and USA and growth patterns specific to each country were found depending on socioeconomic status, nutritional, environmental, also, may be genetic.~~

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Discussion

Factors affecting growth:

Gender differenced in growth:

When using the Z-score system of WHO-CGS, the H/A of our males population under the study showed that none fell below -3SD and 2.7 % fell below -2SD as shown in table (7). In contrast with the findings of more recent EDHS of 2008 that used the WHO-CGS as their reference growth curve for nutritional surveillance, they showed that in the same gender group stunting was 30.7% at -2SD and 15.7% at -3SD.While the EDHS of 2005, which used the NCHS as a reference, showed that stunting was 18.8 at -2SD and 6.8 % at -3SD.

The H/A of our females population in the study, we found that 0% fell below -3SD and 0.6 % fell below -2SD as shown in table (11). But when we compared our results with the more recent EDHS of 2008 that used the WHO-CGS as a reference stunting in this age group was 27.1% at -2SD and 12.3 % at -3SD. While the EDHS of 2005, which used the NCHS as a reference, showed that stunting was 16.4 at -2SD and 6 % at -3SD for females.

When using the percentile system of WHO-CGS and EgGS, the H/A of our males population in the study was 2.71 % fell below the 3rd centile of WHO-CGS, i.e. severely stunted and none of cases when plotted on EgGS. While none of this group were above the 97th centile of WHO-CGS and EgGS as shown in table (29).

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The H/A of our females population was 0.6 % fell below the 3rd centile of WHO-CGS and 0 % when plotted on EgGS. While none of this group were above the 97th centile of WHO-CGS and EgGS as shown in table (29).

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For the H/A, we found that there were no differences between both genders, when using any of the growth charts. For example, using the Z-score and WHO-CGS, we found the rates in both sexes that were 0.6% for females and 2.7% for males under-2SD. Also when we used the EgGS, we found the rates were zero under the 3rd centile and above the 97th centile.

When using the Z-score system of WHO-CGS, the W/A of our males population in the study showed that 0% fell below -3SD and 0 % fell below -2SD as shown in table (6). When compared with the more recent EDHS of 2008 that used the WHO-CGS as a reference showed in the same gender group, underweight represented 7.1% at -2SD and 1.5% at -3SD. While the EDHS of 2005, which used the NCHS as a reference for growth and nutrition assessment, showed that underweight was 6.8% at -2SD and 1.1% at -3SD.

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The W/A of our females population in the study showed that none fell below -3SD and 3.1 % fell below -2SD as shown in table (7). When compared with the more recent EDHS of 2008 that used the WHO-CGS as a reference, it showed underweight for the same gender group was 4.9% at -2SD and 1% at -3SD. While the EDHS of 2005, which used the NCHS as a reference, showed that underweight was 5.5 at -2SD and 0.9 % at -3SD.

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When using the percentile system of WHO-CGS and EgGS, the W/A of our males population were none below the 3rd centile of WHO-CGS and 2.17% when plotted on EgGS while 0.98 % of this group was above the 97th centile of WHO-CGS compared to none when plotted on EgGS as shown in table (28).

The W/A of our females population showed that 3.05 % fell below the 3rd centile of WHO-CGS and 1.63 % when plotted on EgGS. While none of this group were above the 97th centile of WHO-CGS compared to 1.02 % when plotted on EgGS as shown in table (28).

As for W/A, we found that all the growth charts used in the study show that there is underweight in males and females ,but underweight for males was not detected on the WHO-CGS. The differences may not be highly significant. It may reflect the tendency to poor feeding practices.

When using the Z-score system of WHO-CGS, the W/H of our males population under the study showed that none fell below -3SD and 0.8% fell below -2SD but there were 6.2% above +2SD as shown in table (10). When compared with the more recent EDHS of 2008 that used the WHO-CGS as a reference wasting for the same gender group was 8% at -2SD and 3.2% at -3SD. While the EDHS of 2005, which used the NCHS as a reference, showed that wasting was 4 at -2SD and 0.7 % at -3SD for males.

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The W/H of our females population in the study showed that none fell below -3SD and 1.4 % fell below -2SD but there were 3.3% above

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+2SD as shown in table (11) compared with the more recent EDHS of 2008 that used the WHO-CGS as a reference showed in the same gender group wasting 6.4% at -2SD and 3.1% at -3SD. While the EDHS of 2005, which used the NCHS as a reference, showed that wasting was 3.8% at -2SD and 1 % at -3SD among the females.

When using the percentile system of WHO-CGS and EgGS, the W/H for males of our population in the study were 0.93 % below the 3rd centile of WHO-CGS and 0.23% when plotted on EgGS while 6.25 % of this group was above the 97th centile of WHO-CGS compared to 7.41% when plotted on EgGS as shown in table (30).

The W/H for females of our population in the study showed that 1.45% fell below the 3rd centile of WHO-CGS and 0.96 % when plotted on EgGS. While 2.41% of this group were above the 97th centile of WHO-CGS compared to 4.82% when plotted on EgGS as shown in table (30).

When using the Z-score system of WHO-CGS, the BMI of our males population in the study showed that none of cases fell below -3SD and 1.6 % fell below -2SD but there were 9.3 % above +2SD as shown in table (12).

The BMI of our females population in the study showed that 0% fell below -3SD and 2.3 % fell below -2SD but there were 6% above +2SD as shown in table (13).

When using the percentile system of WHO-CGS and EgGS, the BMI for our population of males in the study showed that 0.6 % fell below the 3rd centile of WHO-CGS and 4.29 % when plotted on EgGS.

Discussion

While 12.27% of this group were above the 97th centile of WHO-CGS compared to 0 % when plotted on EgGS as shown in table (31).

The BMI for our population of females in the study showed that 2.01 % fell below the 3rd centile of WHO-CGS and 5.37 % when plotted on EgGS. While 6.71% of this group were above the 97th centile of WHO-CGS compared to none when plotted on EgGS as shown in table (31).

As the results of previously mentioned of BMI, we found a rise in the rates of females below the 3rd centile and below-2SD than males. Also, we found the rates of males above the 97th centile, and above +2 SD of more than females. This was also applied to the W/H although the differences may not be highly significant. It may reflect the tendency to poor feeding practices in this sex, due to over indulgence of mothers to overfeed their males' offspring than females. Also, this can be explained by differences in exposure to infections and parasitic infestations which was more among males than female in our study.

Factors affecting growth,

In relation to gender

We found that for females W/A growth standard using the EgGS 1.% fell below the 3rd centile, however 3.05% fell below the 3rd centile using the WHO-CGS and 1.02% fell above the 97th using the EgGS, and none by using the WHO-CGS . As for males we found that 1.27% fell below the 3rd centile using the EgGS and none fell below the 3rd centile using the WHO-CGS while none, by using the EgGS, fell

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above the 97th centile, but 0.98% fell above the 97th by using the WHO CGS.

As for L/A in females we found that none fell below the 3rd centile using the EgGS, however .% fell below the 3rd centile using the WHO CGS and we found that 1.01% fell from 95th to the 97th centile using the EgGS, while 0.2% fell from 95th to 97th centile using the WHO CGS. As for males L/A we found that none fell below the 3rd centile using the EgGS, while .% fell below the 3rd centile using the WHO CGS and none fell from 95th to 97th using the EgGS and the WHO CGS.

As for W/L in females we found that 1.69% fell below the 3rd centile using the EgGS, however .% using the WHO CGS .Also we found that 4.82% fell above the 97th centile using the EgGS, while 3.37% fell above the 97th using the WHO CGS. As for W/L in males we found that 0.23% fell below the 3rd centile using the EgGS, while 0.93% fell below the 3rd centile using the WHO CGS. Also we found that 8.10% fell above the 97th centile using the EgGS, while 7.18% fell above the 97th centile using the WHO CGS as shown in table (36) and figure .(38a and 38b).

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As for BMI in females we found that 5.37% fell below the 3rd centile using the EgGS, while 2.01 % fell below the 3rd centile using the WHO CGS. Also .% fell above the 97th centile using the WHO CGS, while none using the EgGS. As for males we found that 4.29% fell below the 3rd centile using the EgGS, while .% fell below the 3rd centile using the WHO CGS. Also .% fell above the 97th centile using the WHO CGS, while none fell above the 97th centile using the EgGS as shown in table(37) and figure. (39a and 39b) .

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In our study we found that in females HC/A fell below the 3rd centile in 1.38 % using the EgGS, while 0.92% fell below the 3rd centile using the WHO CGS. Also 0.46% fell above the 97th using both the EgGS and the WHO CGS. As for HC/A in males we found that 0.22% fell below the 3rd centile using the WHO CGS compared to none using the EgGS and 1.11% fell above the 97th using the EgGS, while 0.88% fell above the 97th centile using the WHO CGS as shown in table(38) and figure.(40a and 40b) .

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In relation to place of residence, we found that there was a significant difference between rural and urban areas.

The H/A of urban areas were taller than cases of rural areas as shown in table (34) probably because of environmental, social and economical factors. The W/A tended to demonstrate overweight more in urban areas more than rural areas as shown in table (33). This again reflects environmental, social and economical factors.

The W/H was more increased in urban areas than rural areas, as shown in table (35). Also, the BMI when plotted against the WHO standards detected more overweight in children living in urban areas more than rural areas as in table (36). It also indicates that there is a rising problem of obesity in our urban population which should be investigated. Our dietary assessment of the eating habits of these children showed that their diets were based mainly on carbohydrates and fat and less vegetables, fruits and proteins.

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In relation to place of residence:

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We found that there was a significant difference between rural and urban residence. Length /Age in our population of rural areas

~~were taller than in our population than those residing in urban areas probably because the healthy environment in rural areas. This difference was clearly shown using the EgGS but not prominent on the WHO-CGS. This is because the WHO-CGS was based on a population representing both rural and urban populations and not based on primarily elite populations as recommended by Tanner et al in 1962 when constructing the British charts in the later half of the past century~~ ***~~(Tanner et al., 1962)~~***~~.~~

~~In our study W/A tended to detect~~ **~~overweight~~** ~~more in urban areas. This again reflects educational, socioeconomic and environmental factors. The W/L was more increased in urban areas more than rural areas. Also the BMI when plotted against the WHO-CGS detected more overweight in our population in urban areas as shown in tables (39 to 44) and figures. (41a to 45b). .It probably reflects poor feeding practices and the utilization of micronutrient essential for growth . It also indicates that there is a rising problem of~~ **~~obesity~~** ~~which should be investigated. Our dietary assessment of these children showed that their diet was based on high carbohydrates and fats with less vegetables, fruits and proteins.~~

In relation to education of mothers, we found that there was a significant difference between cases of educated mothers and cases of non educated mothers as the follows:

The L/A of children of educated mothers shifted to higher centiles but children of non educated mothers tended to be shorter. As shown in table (39) and that related to healthy feeding and behavior of educated mothers.

The W/A showed no tendency to underweight in cases of educated mothers rather than non educated mothers, as shown in table (42), due to

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good weaning and the majority of mothers in this study were well educated.

The W/H of our studied population showed a tendency of the children of educated mothers to the higher centiles rather than the children of non educated mothers, as shown in table (40). This also corresponded to the findings reported by the EDHS of 2008.

The BMI-for-age, the WHO standard detected more overweight in the cases of educated mothers more than cases of non educated mothers as in table (41). Again it may reflect affluence in this group of mothers.

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In relation to education of the mothers:

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We found that there was a significant difference between population of educated mothers and population of non educated mothers

The L/A growth standard of the children of educated mothers in our study shifted to higher centiles compared to the population of children of non educated mothers who tended to be shorter. This may be related to healthy feeding behavior of educated mothers.

The W/A growth standard and W/L growth standard showed a tendency to **overweight** in the population of children of educated mothers more than the population of non educated mothers. The majority of our mothers in this group were well educated. Likewise the BMI using the WHO CGS detected more **overweight** in our population of children of educated mothers more than non educated mothers as shown in tables (44 to 48) and figures (46a to 50b).

growth standard

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In relation to feeding habits:

Our dietary assessment of these children showed that their diet was based on high carbohydrates and fats with less vegetables, fruits and proteins. While our population had gone through two epidemics of exposure to the avian flu and the N1H1 viruses that caused many children to be deprived of eating chicken and eggs in their diet. The latter are one of the main food components on the Egyptian family table and important source of protein. This caused a shift towards underweight, although early feeding practices on Breast milk were still protective or these children against severe underweight and stunting. While the over exposure to dairy products in the form of milk and cheese, to compensate for low protein in their diet resulted in increased intake of fats and as a result the obesity that was manifest on the WHO growth charts. Obesity is a serious condition that is responsible for many of the underlying causes for morbidity and mortality in many countries all over the worlds. A considerable risk factor for obesity is related to feeding cow's milk based foods early on life. This was very common in our population and can explain risk of obesity identified in our population group of children.

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We found that Family's diet with high biological values comprised 20% of the study group, while those with family's diet with moderate biological values was 52.4% and family's diet had low biological values was 27.6%. According to intake of diary products, we found that intake of diary products between 6 to 11 months was more in urban areas than rural areas as shown in table (1). The American Academy of Pediatrics recommends that all diary products based on cow's milk should be ~~ptpoed~~stopped to after one year. ~~Obesity is a serious condition that is responsible for many of the underlying causes~~

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~~for morbidity and mortality in many countries all over the worls~~worlds~~.~~ ~~A considerable risk factor for obesity is related to feeding cow's milk based foods early on life. This was very common in our population and can explain risk of obesity identified in our population group of children.~~

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Breastfeeding is an action that can be taken at the individual level, as long as there is adequate support and guidance for initiating and maintaining lactation. Some believe that achieving change in breastfeeding rates is difficult because of entrenched infant feeding behaviors in many populations, but evidence from numerous studies, which agreed with this study, has now shown that substantial increases in the rates of exclusive breastfeeding can occur when appropriate support programs are implemented ***(Bhandari et al.2003 and Quinn 2005)***.

Nonetheless, there are significant barriers to reaching breastfeeding goals, and actions are needed not only at the individual level, but at all levels. Such actions should include creation of health care systems that support exclusive breastfeeding, regulation of the marketing of breast milk substitutes, and support for maternity leave and workplace policies and facilities that allow women employed outside the home to continue breastfeeding. In addition, the increasing prevalence of maternal obesity worldwide may impact breastfeeding rates, as there is growing evidence that maternal overweight is associated with greater difficulty initiating lactation ***(Lovelady 2005)***. Thus, actions to prevent overweight are of importance for multiple reasons.

In summary, we can conclude that factors related to rural residence and education can be additive factors to infant feeding practices in influencing growth patterns. Further studies on the genetics

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basis of overweight and obesity need to be done, as our study obviously indicates that racial factors play a role in the marked tendency to overweight and obesity in our population as compared to international once.

The WHO standards demonstrate that healthy children from around the world who are raised in a healthy environment and follow recommended feeding practices have strongly similar patterns of growth.

The ancestries of the children included in the WHO standards were widely diverse. They included peoples from Europe, Africa, The Middle East, Asia and Latin America.

In this regard, they are similar to growing numbers of populations with increasingly diverse ethnicities. The growth of the children in the various sites was very similar because their environmental conditions were similarly healthy. This indicates that we should expect the same potential for growth in any country. It also implies that deviations from this pattern must be assumed to reflect adverse conditions that require correction e.g. lack of breastfeeding, inadequate nutrient intake, poor or energy-excessive complementary foods, unsanitary environment, deficient health services and /or poverty ***(WHO, 2006)***.