Relationship of Biological Family Characteristics to The Pattern of Growth and Development of Children in Alexandria, Egypt

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Abstract

Background: Children during early years of age go through rapid growth and development that is greatly influenced by various factors of which biological family characteristics are of prime importance. **Objective:** This study aimed to portray the current profile of biological family characteristics in relation to the pattern of growth and development of children at two years of age in Alexandria, 2017 and to compare the results with previous comparable study. **Method**: The study included 128 children; 16 children from each district. Data were collected by interview questionnaire and anthropometric measurements and Denver II Developmental Screening test. **Results:** Significant negative correlation was found between weight of studied children and both family size and birth order. Large family size, older or younger maternal age, short or prolonged inter-birth intervals and high birth order were significantly associated with delayed development. **Conclusion**: Large family size, older or younger maternal age, short or prolonged inter-birth intervals and high birth order were significantly associated with delayed development. Marked effort is needed to achieve the desired success waited in the Egyptian Family Planning Program.

Keywords: Child growth and development; biological family characteristics; DENVER II

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Introduction

Childhood is the most crucial and formative period of human life. A healthy childhood is essential for future growth and development. It is greatly influenced by family, society and environment which formulate attitude, behavior, manner and emotions. The first 1000 days of life is a crucial phase of growth and development because exposures during this stage can influence outcomes across the entire course of an individual's life.[1]

Linear growth is the one of the best indicators of children's health that also reflects inequalities in human development. Stunting and wasting are defined as the proportion of children with a height-for-age or weight-for-height that is more than two standard deviations below the WHO (World Health Organization) growth reference population, respectively.[2]

In 2014, according to the Central Agency for Public Mobilization and Statistics (CAPMAS) and United Nations Children's Fund (UNICEF), stunting affected approximately 21.4% of Egyptian under-five children; while wasting was recorded at 8.4 %, and underweight at 5.5 %.[3] A key to success against stunting is focusing attention on pregnancy and the first two years of a child's life. Stunting in a child is not only about being too short for his or her age. It can also mean suffering from stunted development of the brain and cognitive

capacity.[4] Assessment of growth for age based on anthropometric measurements is an important and reliable method in the monitoring of health in an individual child. Developmental assessment is made through evaluation of social, medical, social, family history and physical examination of the child in addition to developmental screening for early detection of problems, by using standardized and formal tools.[5,6]

Denver Developmental Screening Test (DDST) is an example for such tools, first used in 1967. It assesses children from birth to 6 years of age. It was standardized on 1036 children from 2 weeks old to 6 years of age in Denver, Colorado. In 1992, it was revised and re-standardized on 2096 children and was named DDST-II. Test-retest reliability is 90% and it has high sensitivity (83%) to identify children with developmental delays.[7]

Biological family characteristics are important variables that affect the health of mother and child. These include maternal age, inter-birth interval, birth order and number of previous pregnancies.[8] Most growth faltering in developing countries occurs between 6 and 24 months, when infants and young children should receive foods to complement the nutrients in breast milk. This is also the period when mothers who do not use modern methods of family planning will get pregnant again, which may affect breastfeeding practices for current children and lead to malnutrition.[9]

Experts recommended a space of 24 months after a live birth. A recommendation for pregnancy spacing of 24 months would coincide with the optimal duration of breastfeeding, conferring added nutritional benefit in early childhood.[10] It has been speculated that short intervals between births may be associated with poorer mental health because of fetal under nutrition due to depletion of maternal nutritional reserves during the preceding pregnancy, which impacts neuro-development.[11]

Short birth-to-next pregnancy intervals increases the risk of neonatal, child, and maternal mortality; stunting in children; and poor pregnancy outcomes.[11] The size of family, child's position in the family and interpersonal relationships also affect the development of a child, either psychologically or physically.[12,13]

A study held in Pakistan emphasizes the effects of birth order on intellectual development rather than motor development. This study determines the concept of priority and privileges, in which a child enjoys positive parental position and in turns develops higher IQ level. It also describes the relationship of birth order with the educational achievements. Therefore, the first born child receives full adult intellectual attention and nourishment rather than the third child. The intellectual development of first child is explorative in nature as he receives full parental attention.[14]

High parity is one of the globally implicated risk factors for increased maternal and perinatal morbidity and mortality. Grand multiparity (GM) is defined as parity of five or more. The threshold of risks of any obstetric complication, neonatal morbidity, and perinatal death increase markedly at parity ≥ 5.[15]

Growth and development of children are affected by various factors including biological, social, and environmental factors. Determining which risk factors are important for growth and development of children is essential for early intervention and optimal allocation of limited resources.[(16)]

The relation between biological family characteristics and the pattern of growth and development of children was previously explored in Badawy study, a cross sectional study of 610 two and three years old children in Alexandria, 1983.[17] However, families have drastically changed over the past three

decades in terms of family's perception and behaviors, fertility rates and rates of marriages and divorces. Therefore, a temporal comparative study is needed to measure to what extent the biological family characteristics have been changed, and the growth and development of children, in return.

The present study aimed to study the biological family characteristics in relation to the pattern of growth and development of two-year-old children in Alexandria. It specifically aimed to portray the current profile of biological family characteristics, investigate the relation between these variables and the pattern of growth and development of children at two years of age, and to compare the results of the current research with a previous comparable study (Badawy 1983).[17]

Method

Study design and setting: A cross sectional survey was carried out in randomly selected family health centers in Alexandria districts.

Target population and sampling: Two-year-old children attending family health centers in Alexandria for periodic visits, immunization or receiving treatment for acute minor illness.

Alexandria is geographically divided into eight districts namely; East, West, Middle, Al-Montaza, Amrayah, El-Gomrok, El-Agami and Borg El-Arab. From each district; two family health centers were randomly selected.

The sample size was calculated using EPI INFO 7® program based on level of significance of 5%, confidence level of 95%, design effect of 1 and expected frequency of 9%.[(18)] The sample size was estimated to be 128 children where 16 children from each district were involved in the study (8 children from each center). Table (1) shows the selected family health centers in each of the eight districts of Alexandria.

Table 1. Selected family health centers involved in the study

District	Selected family health center
Al-Montaza	1- Sidi-Bishr 2- El-Amrawy
East	1- El-Soyouf 2- Semouha
Middle	1-El-Hadara 2-Moharem Baek
West	1- El-Wardian 2- El-Metras
El-Gomrok	1- El-Manshia 2- El-Hagari
El-Agami	1- El-Dekhela 2- El-Bitash
Amrayah	1- El-Amrayah Health Care 2- El-Amrayah Health Unit
Borg El-Arab	1- Borg El-Arab 2- Old Borg El-Arab

Data collection: The field work was conducted over a three months period from July to September 2017.

Mothers of studied children were interviewed to obtain the following data:

(a) **Socio-demographic characteristics**: Age, education, occupation of parents, urban or rural origin, child gender, type of family, housing conditions, etc. (b) **Biological family characteristics**: Family size, inter birth interval, birth order of the studied child, and maternal age at first and studied conception.

Examination sheet: Assessment of growth: (Anthropometric measurements) *Measurement of weight:* The child was asked to stand in the middle of a scale, with his feet bare and with minimum clothing on. *Measurement of length:* Child length was measured in two ways; in some units, we used a specially designed wooden scale (Infantometer) that consisted of a vertical graduated wooden scale with transverse perpendicular piece fixed to its lower end to touch both heels firmly when a child was assessed. Another movable piece sliding over the scale was gently pushed to touch the crown according to the length of the child. In other units, length was measured by graduated tape; the child stood with bare feet on the flat floor

against the wall with feet parallel and with heels, buttocks, shoulders, and occiput touching the wall. With the help of plastic ruler, the topmost point of the vertex is identified on the wall.

Assessment of development: Using the Denver –II Developmental Screening test.[19] Inclusion criteria included two-year-old children attending FHC with their mothers were included in the study.

Exclusion criteria: Refusal to participate in the study, children not accompanied by their mothers, children with chronic illness, children with history of low birth weight or congenital anomaly.

Statistical Analysis

Data were analysed using IBM SPSS software package version 20.[20] Data are presented as numbers and percentages for categorical variables and means and standard deviations (SD) for continuous variables.

Mann Whitney test was used for abnormally distributed quantitative variables, to compare between means in two different groups. For qualitative variables, the chi-squared test was used. Correlation coefficient (r) is a statistical measure of strength of linear correlation between two quantitative variables X and Y. All results were interpreted at the 5% level of significance.

Ethical considerations

Official approvals for the study were obtained from Ethical Committee of the Faculty of Medicine, University of Alexandria, and the Alexandria Directorate of health affairs. The objectives of the study and types of information to be obtained were explained to the mothers and their informed consent was taken. Confidentiality of data was assured.

Results

The mean age of mothers of studied children was 29.59± 4.88 years. 74.2% of studied children's families lived in urban areas. The level of education of parents ranged from primary level (27.3% and 21.9% of mothers and fathers respectively) to university education or

Table 2: Distribution of the studied children according to biological family characteristics

Biological family characteristics	Studied subjects (n=128)	
	N	%
Family size		
≤4	77	60.2
≥5	51	39.8
Mean (SD)	4.38 (1.184)	
Min-Max	2-8	
Mother's Age at delivery of 1st child (years)		
<20	17	13.3
20-35	111	86.7
>35	0	0.0
Mean (SD)	23.55 (4.167)	
Min-Max	15-35	
Mother's Age at delivery of studied child (years)		
<20	6	4.7
20-35	115	89.8
>35	7	5.5
Mean (SD)	27.48 (4.97)	
Min-Max	16-41	
Birth order		
1st -2nd	88	68.8
3rd -4th	36	28.1
≥ 5th	4	3.1
Mean (SD)	2.11 (1.12)	
Min-Max	1-6	
Spacing between studied child and previous one (years)		
Mean (SD)	2.44 (2.84)	
Min-Max	0-20	
Average spacing between previous deliveries (years) (n=40)		
Mean (SD)	2.72 ± 1.59	
Min-Max	1-9	

Table 3: Correlation between biological family characteristics and growth measures of studied children

Biological family characteristics	Weight		Height	
	r	P	r	P
Family size	- 0.246	0.005*	- 0.133	0.135
Mother's age at delivery of 1st child	0.157	0.07	0.044	0.619
Mother's age at delivery of studied child	- 0.046	0.604	- 0.036	0.687
Spacing between delivery of studied children and previous delivery	- 0.108	0.226	- 0.039	0.659
Average spacing between previous deliveries	- 0.037	0.822	0.274	0.087
Birth order	- 0.245	0.006*	- 0.081	0.363

**Significant at P ≤0.05*

Table 4: Relation of total Denver II score and biological family characteristics

Biological family characteristics	Total DENVER II score				*Test of significance* (P-value)
	Normal (n=76)		Suspect/Abnormal (n=52)		
	N°	%	N°	%	
Family size					
≤4	62	80.5	15	19.5	X^2 = 35.82
≥5	14	27.5	37	72.5	P =<0.001*
Age at the delivery of 1st child (years)					
20-35	75	67.6	36	32.4	X^2 = 23.25
<20 & >35	1	5.9	16	94.1	P =<0.001*
Age at the delivery of studied child (years)					
20-35	75	65.2	40	34.8	X^2 = 16.02
<20 & >35	1	7.7	12	92.3	P =<0.001*
Spacing between studied child and previous one (years) (n=83)#					
2-5	36	56.3	28	43.7	X^2 = 5.25
<2 & >5	5	26.3	14	73.7	P =0.022*
Average spacing between the previous deliveries (years) (n=40)					
Mean ± SD	2.95 ± 1.85		2.27 ± 1.0		Z = -0.733 P =0.463
Birth order					
1st & 2nd	69	78.4	19	21.6	X^2 = 42.29
>2nd	7	17.5	33	82.5	P =<0.001*

*X^2: Chi square test; Z: Mann Whitney U test; *Significant at P ≤0.05; #: first order births were excluded*

higher (35.1% and 31.2% of mothers and fathers respectively).

Biological family profile of studied children is portrayed in table 2. 60.2% of the studied children had family size of four members or less. The age at the delivery of the 1st child of 86.7% of mothers lied between 20 and 35 years. Moreover, 89.8% of mothers were between 20-35 years at the delivery of studied children with the mean of 27.48 ± 4.97 years old.

68.8% of studied children were ordered as 1st or 2nd child. 50% of mothers spaced for a duration ranging from two to five years between studied child and the previous one. Moreover, among mothers who delivered more than two children the average spacing time

Table 5: Relations between biological family characteristics and measures of growth and DENVER II score as revealed from results of current study and Badawy's study

Biological family characteristics	Measures of growth				DENVER II score	
	Weight (Kg)		Height (Cm)			
	Current study	Badawy's study	Current study	Badawy's study	Current study	Badawy's study
Family size	*	*	--------	--------	*	*
Maternal age	--------	*	--------	*	*	*
Spacing between studied child and previous one	--------	--------	--------	*	*	--------
Average spacing between previous deliveries	--------	--------	--------	--------	--------	--------
Birth order	*	*	--------	*	*	*

**: Denotes significant association revealed between the indicated biological family characteristic and growth parameters or DENVER II score in the corresponding study*

between previous deliveries was 2.72 ± 1.59 years.

Table 3 demonstrates the relation between growth measures and biological family characteristics. There was a statistically significant negative correlation between weight of studied children and both family size (r= -0.246, P= 0.005) and birth order (r= -0.245, P=0.006) while there was insignificant correlation between height and all studied biological family characteristics.

Regarding the relation between pattern of development and biological family characteristics, table 4 shows that 80.5% of studied children whose families composed of four members or less recorded normal total Denver score compared to 27.5% among those with more than four members (P <0.001).

The majority of children whose mothers' age was less than 20 or more than 35 years old at delivery of 1st and studied children (94.1% and 92.3%, respectively) had suspect or abnormal total Denver score. This association was statistically significant (P= <0.001).

More than half (56.3%) of the children whose mothers had a spacing period between two to five years before the delivery of studied child and the previous one revealed normal total Denver scores compared to slightly more than one quarter (26.3%) of children whose mothers spaced for less than two or more than five years with statistical significant association, (P= 0.022).

More than three quarters (78.4%) of the studied children whose order was 1st or 2nd had normal Denver score, compared to only 17.5% among those with birth order exceeding the 2nd. The difference was statistically significant, (P= <0.001).

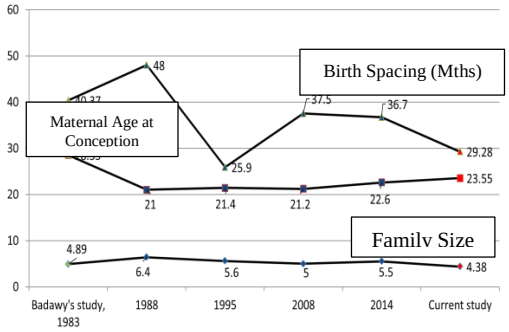

Figure 1: Temporal changes of biological family characteristics

On comparing the current study with Badawy study[17], table 5 shows that both studies revealed statistically significant correlations between family size and birth order in relation to weight. In addition, Badawy study found a statistically significant correlation between weight and maternal age. The current study did not reveal any statistically significant correlation between height with any biological family characteristics, while Badawy's

study showed significant correlations between height and maternal age, spacing between studied child and previous one as well as birth order.

Both studies revealed significant association between Denver score with family size, maternal age and birth order. The current study revealed statistically significant association with another biological family characteristic which was spacing between studied children and previous one.

Figure 1 illustrates the changes that occurred in some biological family characteristics in Egypt from the year 1983 to 2017 as derived from Badawy study[17] and some Egyptian DHS surveys.[18,21-23]

Discussion

The age of studied children's mothers ranged from 18 to 43 years with a mean of 29.59± 4.88 years. This figure is close to the mean age of child-bearing in Egypt (27.8 years) as recorded by United Nations in 2011.[24]

In this study, the average family size was 4.38 ± 1.184 that did not change markedly from that of Badawy study[16] which was 4.89± 1.55. This number is lower than other African countries; 9.5 in Nigeria[25] and 7.1-8.9 in Ghana.[26]

The mean maternal age at delivery of 1st child was 23.55 ± 4.167 in the current study compared to that of Badawy study[16] which was 28.55±4.58. This decline in the mean maternal age at conception could be attributed to the association between high level of women's education and age at which they start childbearing. Women who have a university or higher education had their first birth an average of about three years later than women with no education. In the current study, only 35.1% of mothers had university education or higher.

The mean birth order of studied children was 2.11 ± 1.12 compared to that of Badawy study[16] which was 2.87± 1.53. The average spacing time was 29.28 months compared to that of Badawy study[16] that was 40.37 months. Latest Demographic Health surveys showed that Yemen had the shortest intervals, with a median of 25.3 months, and Ukraine had the longest, with a median of 44.1 months. Also, Ali et al[27] reported a mean birth interval of 26 months in Sudan which was lower than the mean birth spacing of the present study.

On exploring the relation of biological family characteristics to growth and development measures, there was a statistically significant negative correlation between family size and weight of studied children ($p=<0.01$, $r=-0.246$). Similarly, Badawy[16] revealed that the mean weight of children born in small families was significantly higher than that of those born in medium or large families. This could be attributed to the low social class, poor diet, frequent infections and inadequate medical care commonly associating large families.

Significantly higher percentage of studied children whose families composed of four members or less recorded normal total Denver score ($P<0.001$). Similarly, Ozkan et al[28] observed that the probability of abnormal Denver II results in the children from families with ≥3 children was approximately 2-fold greater than in those from families with ≤2 children. This may be due to decrease in the quality and quantity of the time allocated for each child in large families.

The current study did not reveal a significant correlation between maternal age at delivery of 1st or studied child and weight of the child. This may point out that the biological effect of maternal age may only appear after a latent period manifesting in later pregnancies. On the contrary, Badawy study[16] revealed significant differences as regards mean weights and lengths of children when maternal age at conception was considered. The inability to find a

significant relation in the present study might be because the majority of mothers were 20-35 years old at delivery of 1st or studied child (86.7%, 89.8%, respectively).

On the other hand, significantly higher percentages of studied children whose mothers' age was less than 20 or more than 35 years at delivery of 1st and studied children had suspect/abnormal total Denver score. Also, Badawy[16] found significant effect of maternal age at conception on the development of children at two years of age. Similarly, Ozkan et al[28] observed that the probability of suspect on Denver II results in the children of mothers aged <20 years at birth was significantly higher than in those whose mother aged 20–40 years. Other studies from high income countries have also shown poorer school attainment, cognitive function, or both in children of teenage mothers, independent of socioeconomic factors.[29,30] Although the effect of maternal age at conception on growth and development is mainly biological, other possibilities such as poorer care and stimulation by younger mothers who are less experienced cannot be ignored.

Significantly higher percentage of children whose mothers spaced from two to five years between delivery of studied child and the previous one revealed normal total Denver scores. This coincides with Fink et al.[31] who pooled 153 cross-sectional demographic health surveys across 61 countries conducted between 1990 and 2011 and found that birth intervals of less than 12 months and between 12 and 23 months were associated with higher relative risks for stunting compared to a 24–35 month inter-pregnancy interval. The maternal depletion hypothesis suggests that women who become pregnant after a short interval are less able to provide nourishment during the second pregnancy because their bodies have had less time to recover from the previous pregnancy. Sibling competition for parental time and resources is another explanation.[32,33]

Birth order is intimately related to family size.[34] There was a statistically significant negative correlation between weight and birth order (r=-0.245, P<0.01). This coincides with Badawy study.[16] A possible explanation for this association could be that higher order births are more likely to be unwanted which results in less attention and care from parents. Moreover, allocation of food and resources decreases with an increasing number of births in the household. As a result, births of higher order might suffer from various health hazards as well as malnutrition.

78.4% of the studied children whose order was 1st or 2nd, had normal total Denver II score, compared to 17.5% among those with higher birth order (P<0.001). Similarly, Badawy[16] found significant relation between birth order and DDST performance where the highest percentages of delayed children were those of the fifth order or more. Other studies suggest that the average intelligence of children decline with increasing birth order.[35,36]

Considering results of current study in a temporal perspective reveals that both family size and maternal age at conception showed favourable difference compared to previous Demographic Health Surveys results i.e. family size is smaller and maternal age is older.[17,20-22] However, spacing period did not depict much improvement as it was evidently shorter than most of demographic health surveys figures as well as that of Badawy study.[16]

Conclusion

The results of our study show that large family size and high birth order were significantly associated with delayed growth manifested in lower weight gain whereas large family size, advanced or younger maternal age, short or prolonged

inter birth intervals and high birth order were significantly associated with delayed development.

No certain pattern of improvement of biological family characteristics in relation to Badawy study was revealed.

Marked effort is needed to achieve the desired success waited in the Egyptian Family Planning Program. Messages of education and communication efforts in this respect should emphasize the favourable effects of healthy reproductive norms on the welfare of the child in clearly stated growth and development aspects.

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References

1. De Onis M. Child growth and development. In: Nutrition and Health in Developing World 2017. Humana Press, Cham. pp. 119-141.

2. World Health Organization & United Nations Children's Fund. WHO Child Growth Standards and the Identification of Severe Acute Malnutrition in Infants and Children: A Joint Statement. WHO Press, 2009.

3. The Central Agency for Public Mobilization and Statistics (CAPMAS), Egypt United Nations Children's Fund (UNICEF), Egypt. CHILDREN IN EGYPT 2016: a statistical digest, 2017.

4. UNICEF report. Stunting in children can be defeated, 2013.

5. WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. Acta Paediatr Suppl. 2006;450:76–85.

6. Glasco FP. Developmental screening & surveillance. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BM, editors. Nelson Textbook of Pediatrics. 18th ed. Philadelphia: Saunders; 2008. pp. 74–81

7. Frankenburg WF, Dodds J. DENVER II Training Manual 5th ed. Denver, Colorado/ Denver Developmental Material Inc 1992; p. 4.

8. Senanayake P, Nott JH, Faulkner KM. Adolescent sexual and reproductive health: the challenge for society. Human Fertility 2001;4(2):117-22.

9. Shrimpton R, Victora CG, Onis M, Lima R, Blossner M, Clugston G. Worldwide timing of growth faltering: implications for nutritional interventions. Pediatrics. 2001;107(5):e75.

10.Marston C. Report of a WHO technical consultation on birth spacing. Geneva (Switzerland): World Health Organization; 2005.

11.Conde-Agudelo A, Belizan JM, Norton MH, Rosas-Bermudez A. Effect of the inter pregnancy interval on perinatal outcomes in Latin America. Obstetrics and Gynecology 2005;106(2):359–66

12.Kristensen P, Bjerkedal T. Explaining the relation between birth order and intelligence. Science 2007;316:1717

13.Khodarahimi, S, Ogletree SL. Birth Order, Family Size, and Positive Psychological Constructs: What Roles Do They Play for Iranian Adolescents and Young Adults? Journal of Individual Psychology 2011;67(1):41-56.

14.Atta MA, Jamal DA, Baloch J, Ayaz M. Effects of the birth order on educational achievements of children. International Journal Of Academic Research 2011;3(2):977-82.

15.Mgaya AH, Massawe SN, Kidanto HL, Mgaya HN. Grand multiparity: is it still a risk in pregnancy? BMC Pregnancy Childbirth 2013; 13: 241.

16.Da Rocha Neves K, De Souza Morais RL, Teixeira RA, Pinto PA. Growth and development and their environmental and biological determinants. J Pediatr 2016; 92:241-50.

17.Badawy Y. Relationship of family planning variables to the pattern of growth and development of children at their second and third birthdays in Alexandria. Thesis, M.D., Faculty of Medicine, Alexandria University 1983.

18.Ministry of Health and Population [Egypt], El-Zanaty and Associates [Egypt], and ICF International. Egypt Demographic and Health Survey 2014. Cairo, Egypt and Rockville, Maryland, USA.

19.Frankenburg WK, Dodds J, Archer P, Shapiro H, Bresnick B. The DENVER II: A major revision and restandardization of the Denver Developmental Screening Test. Pediatrics 1992; 89:91–7.

20.Kirkpatrick LA, Feeney BC. A simple guide to IBM- SPSS statistics for version 20.0. studented. Bemont, Calif: Wadsworth, Cengage Learning; 2013.
21.Sayed HA, Osman MI, El-Zanaty F, Way AA. Egypt Demographic and Health Survey 1988.
22.Eî-Zanaty F, Hussein EM, Shawky GA, Way AA, Kishor S. Egypt demographic and health survey 1995. Calverton, MD: National Population Council [Egypt] and Macro International. 1996:145-9.
23.Fatma EZ, Way A. Egypt demographic and health survey 2008. Cairo, Egypt: Ministry of Health, El-Zanaty and Associates, and Macro International. 2009.
24.World Population Prospects: The 2010 Revision. New York: United Nations, Department of Economic and Social Affairs, Population Division; 2011
25.Macro IC, National Population Commission. Nigeria demographic and health survey 2013.
26.Gss GH, Macro IC. Ghana demographic and health survey 2008. Accra, Ghana: Ghana Statistical Service, Ghana Health Service, and ICF Macro 2009.
27.Ali AA, Yassin K, Ramadan N. Determinant of Inter-Pregnancy Birth Interval in Kassala, Eastern Sudan. Current Women's Health Reviews 2014; 10(1):5-8.
28.Ozkan M, Senel S, Arslan EA, Karacan CD. The socioeconomic and biological risk factors for developmental delay in early childhood. European journal of pediatrics. 2012;171(12):1815-21.
29.Shaw M, Lawlor D, Najman JM. Teenage children of teenage mothers: psychological, behavioural and health outcomes from an Australian prospective longitudinal study. Soc Sci Med. 2006; 62:2526–39.
30.Morinis J, Carson C, Quigley MA. Effect of teenage motherhood on cognitive outcomes in children: a population-based cohort study. Arch Dis Child 2013; 98:959–64.
31.Fink G, Sudfeld CR, Danaei G, Ezzati M, Fawzi WW. Scaling-up access to family planning may improve linear growth and child development in low and middle income countries. PLoS One 2014; 9(7):e102391.
32.Conde-Agudelo A, Rosas-Bermúdez A, Kafury-Goeta AC. Effects of birth spacing on maternal health: a systematic review. Am J Obstet Gynecol 2007; 196(4):297-308.
33.Smits LJ, Essed GG. Short inter pregnancy intervals and unfavourable pregnancy outcome: role of folate depletion. Lancet 2001; 358:2074–7.
34.Bagger J, Birchenall JA, Mansour H, Urzúa S. Education, birth order, and family size. National Bureau of Economic Research; 2013.
35.Zajonc RB, Mullally PR. Birth order: Reconciling conflicting effects. American Psychologist. 1997; 52(7):685.
36.Downey DB. Number of siblings and intellectual development: The resource dilution explanation. American Psychologist. 2001; 56(6-7):497.