

# Growth Patterns of Jordanian Children: A National Study

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تفحص هذه الدراسة أنماط نمو الأطفال الأردنيين تحت سن الثالثة بالمقارنة مع (NCHS) كمرجع سكاني. وقد تم تحليل البيانات الخاصة بالطول والوزن لـ 1224 صبياً و 1120 فتاة بعد أخذ هذه البيانات من ملفات دراسة وطنية شاملة للاطفال قبل سن المدرسة اجريت عام 1984م. أوضحت هذه الدراسة ان نمو الأطفال من الجنسين كان قريباً وموازياً (NCHS) خلال الربع الأول من السنة الأولى ولكن بعد ذلك، كان انحراف واضح عن معدلات الـ (NCHS) بالنسبة للطول والوزن. وبعد ذلك زاد الانحراف بالنسبة للطول. وتبين من دراسة هذه الاختلافات بين معدلات النمو الوطنية و الـ (NCHS) ضرورة اعتماد هذه الاخيرة كهدف يجب العمل على تحقيقه عند التخطيط أو تقييم أو تعديل البرامج على المستوى الوطني. وكذلك وضع المعايير الوطنية الخاصة بنا كي يتمكن من متابعة الحالات الفردية. الكلمات المرجعية: النمو، التغذية، الاردن، الرضاعة الطبيعية.

*This study examined the growth patterns of Jordanian children below three years of age in comparison with the NCHS reference population. Weight and length measurements of 1224 boys, and 1120 girls were obtained from a national multipurpose study of Jordanian preschool children carried out in 1984. The study results showed that children of both sexes grew at centiles that were close and parallel to the NCHS in the first quarter of the first year. However, both weight and length centiles departed from the NCHS counterparts later on with length showing marked differences from the reference. The differences observed between the local and the NCHS reference population suggest that the NCHS should be used as a target for planning and evaluation of intervention programs at a national level while the need for the local standards to assess individual cases remains a necessity.*

**Key Words:** Growth, feeding practices, Jordan, NCHS, breast feeding

## INTRODUCTION

The measurement of growth of the individual child or of groups of children is one of the most sensitive and commonly used indicators of child health<sup>1</sup>. The value of growth monitoring in significantly improving preventive health care has been widely reported<sup>2</sup>.

The Most commonly used reference data for the assessment of child growth are those recommended by the US National Academy of

Sciences, known as the National Center for Health Statistic/Center for Disease Control (NCHS/CDC) reference population, suggested as the most suitable for use as an international reference<sup>1-3</sup>. However the appropriateness of using the NCHS data as a reference in different ethnic groups has been continuously debated<sup>4-6</sup>.

In Jordan, the assessment of child growth in public Maternal and Child Health facilities is carried out using the NCHS reference

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population. However, to date, no study has investigated the degree to which the growth of Jordanian children agree with that of the NCHS reference population. Moreover, the nutritional status of Jordanian children received heightened attention in the wake of the Gulf war. The influx of Jordanian returnees from neighboring countries with high rates of unemployment and poverty prompted many relief agencies including the United Nations Children Fund and others to design programs to improve the nutritional status of Jordanian children. At the time there was no baseline data. As part of the multitude of issues studied in the "Preschool children multipurpose study carried out in 1984"<sup>7</sup>, anthropometric measurements of children were the most recently available nutritional data on children at that time. The multipurpose study which had its first preliminary report released in 1989, was the most suitable available source of anthropometric data from which one could estimate the concurrent nutritional indicators of Jordanian children in 1992, just following the Gulf war crisis.

In this study, anthropometric data on weight and length from the national multipurpose study were examined and compared with the international reference NCHS in order to study the growth patterns of Jordanian children and to investigate the appropriateness of using the NCHS for the assessment of child growth in Jordan.

## **METHODS**

### **1. Sampling procedures**

The data used in this study is part of a national multipurpose study of preschool children carried out in 1984.

The study sample was specified according to a protocol prepared by the Jordanian Department of Statistics in cooperation with the Institute of Population Studies of North Carolina University. The sample included 3000 families of both urban and rural communities. In this study, the country was divided into 3

replicates, each replicate is independent self-weighted and representative of Jordanians according to the socioeconomic status and residence. Urban areas were divided into 41 locations which were ranked according to the population size in descending order. Within each location, blocks were specified and regarded as the primary sampling units (P.S.U.); families were randomly selected from each of these blocks. In rural areas, the serpentine technique was used in every governorate of the kingdom. In these rural areas where houses are randomly scattered, branching points from the main streets were selected. Along these points, research assistants followed the distribution of houses along that path until they come back to the same point without leaving any house unchecked. The total number of children eligible for the study was 5400, which represented 1% of Jordanian children below the age of 6 years.

Children's age was obtained from birth certificates. Jordanians are very keen on keeping a birth certificate since its possession is a pre-requisite to school entry. Anthropometric measurements including weight and length were guided by WHO standard. Equipment used in the field was checked in the presence of field supervisors in every session. Children's weights were recorded to the nearest 50 gm using the Herbert & Sons Limited (U.K.) balance. Children's length was recorded to the nearest one mm using the Harpenden Infant Measuring Table which is modified by Infastand<sup>10</sup>. Children's length was measured in the supine position. Accuracy of measurements was further assured by inclusion of physicians and nurses among the field research assistants.

In this paper, the sample represents children below 3 years of age accounting for 2344 of whom 1224 were boys, 1120 were girls. Because reported birth measurements by mothers could not be validated, they were excluded from the data analysis. The index age category was selected for the present study because this is the most critical period of growth during which the negative insults of malnutrition leave short and

long term impacts on future physical growth. Furthermore, these are the age groups that are usually cared for in the well baby clinics of the public Maternal and Child Health Centers for growth monitoring and vaccination purposes. Although an under 5 age category seemed more appropriate, yet the under 3 age groups were selected solely for small sample sizes in the 3 to 5 age groups.

## 2. Statistical Analysis

The Statistical Analysis System (SAS) was used to obtain the univariate analysis of the variables studied. The distribution of each variable in each age interval was checked for normality and extreme values were deleted as recommended<sup>8</sup>. Percentiles of weight and height for each age group category were prepared and were later plotted using the Grapher package<sup>9</sup>.

Smoothing of the percentile curves and finding the best fit line was carried out using the power function available in the Grapher package.

## RESULTS

The means of the children's weights and lengths by age and sex are summarized in table 1.

The 5th, 50th and 95th centiles of weight for age of Jordanian children compared with their NCHS respective centiles by sex are demonstrated in fig. 1 and 2. The figures show growth patterns that are parallel to those of the reference population.

A noteworthy observation are the differences between the local and the reference groups at different centiles; for children at the 95th centile, and despite the presence of a minimal

**Table 1**  
**Means of Weight\* and Length\* by Age and Sex, Jordanian Children, 1984.**

Age (Months)	M a l e s				F e m a l e s			
	Weight (Kg's)		Length (Cm's)		Weight (Kg's)		Length (Cm's)	
	n	Mean (SE)	n	Mean (SE)	n	Mean (SE)	n	Mean (SE)
<1	47	3.71 (0.90)	54	53.09 (0.40)	44	3.73 (0.80)	48	52.06 (0.53)
1 - <3	79	5.40 (1.10)	73	58.68 (0.48)	64	4.92 (1.12)	64	56.75 (0.55)
3 - <6	93	7.14 (1.35)	92	65.51 (0.59)	106	6.45 (1.15)	108	63.62 (0.68)
6 - <9	103	8.39 (1.19)	104	70.44 (0.40)	79	7.76 (1.21)	73	69.36 (0.54)
9 - <12	106	9.45 (1.23)	105	74.06 (0.39)	79	8.9 (1.42)	77	72.94 (0.45)
12 - <18	205	10.29 (0.93)	203	78.81 (0.34)	189	9.67 (0.97)	189	76.42 (0.37)
18 - <24	182	11.29 (1.19)	181	83.17 (0.56)	183	10.5 (1.05)	185	80.95 (0.46)
24 - <30	196	12.08 (1.19)	197	86.17 (0.39)	210	11.54 (1.14)	204	84.92 (0.43)
30 - <36	183	13.18 (1.33)	173	91.31 (0.38)	166	12.85 (1.45)	165	90.44 (0.39)

\* Excluding birth measurements

difference between the local and the reference groups, the difference in weight stayed almost constant at all ages. However, for the 5th and 50th centiles, the difference in weight increased exponentially after the third month of age and continued thereafter.

Except for a downward shift in the centiles of weight in relation to the NCHS, the female growth patterns were comparable to those of the males.

Figures 3 and 4 illustrate the centiles of length for age of Jordanian children compared with the NCHS reference by sex.

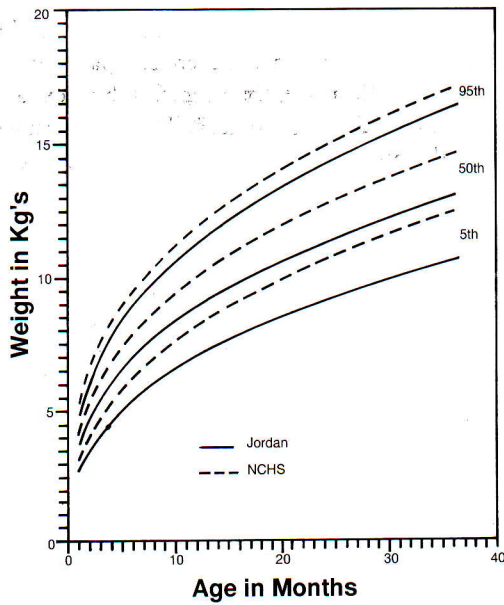


Figure 1 Boys below 36 months: weight for age (excluding birth weight)

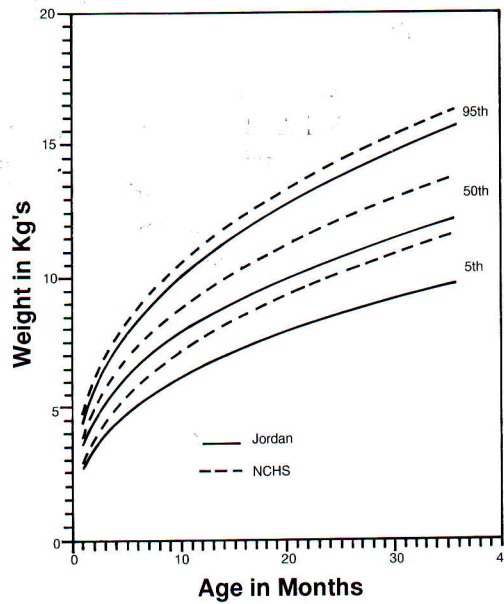


Figure 2 Girls below 36 months: weight for age (excluding birth weight)

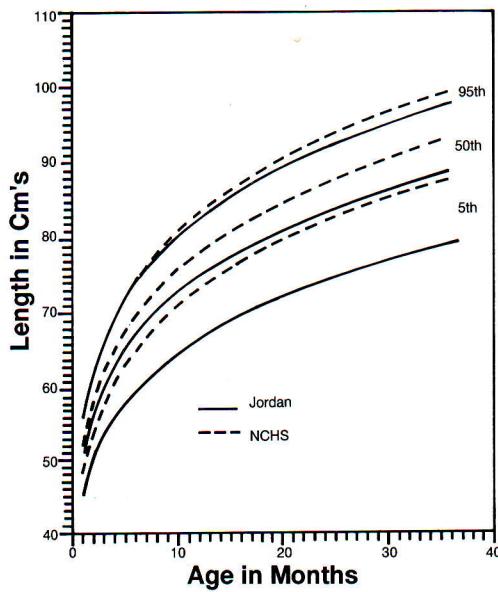


Figure 3 Boys below 36 months: length for age (excluding birth length)

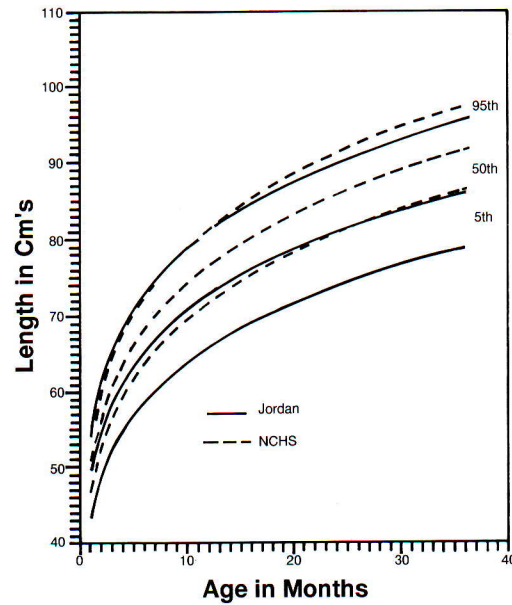


Figure 4 Girls below 36 months: length for age (excluding birth length)

Despite a general agreement in the patterns of growth in length between the local and the reference population, there appears to be high variability in the lengths of Jordanian children. Children's length behaves differently at the different centiles; boys growing at the 95th centile for age were similar in length to the NCHS references from the 1st month of age until the last quarter of their first year when the length curve departed downward and continued at a lower level than the reference until the third year of age.

Although the 50th centile of boys' length started lower but parallel to the NCHS respective centile early in life, it also departed markedly and even became parallel to and slightly higher than the 5th centile of the reference population.

Jordanian boys growing in length at the fifth centile for age were shorter than their NCHS counterparts as early as the first month. The difference in length in this group was larger than that of the group growing at the fiftieth centile.

Girls growing at the 95th centile started their growth with a potential that is as good as that of their NCHS counterparts. However, at about the age of one year, their length centile declined and became lower than that of the reference population. Except for the fact that the drop in the 50th centile of girls' length continued to cross the 5th centile of the NCHS at about the end of the second year, girls' length centiles followed a similar pattern to that of boys in relation to the NCHS. The 5th centile of girls' length behaved as that of boys'; both boys and girls grow at a much lower level than their NCHS counterparts.

## DISCUSSION

Despite a general improvement in the mean weight and length of Jordanian children compared to their respective values in 1974<sup>10</sup>, the study findings indicated that the growth patterns of weight and length of Jordanian children were somewhat comparable to the

reference population only in the first quarter of their first year. Except for the children growing at the 95th centile, the growth patterns for weight and length of both males and females growing at the 50th & 5th centiles departed from their main patterns gradually after the age of 3 months and more so after the first year of life. The available estimate of low birth weight babies in Jordan does not exceed 8%<sup>11</sup>. Therefore, the effect of this group on the general growth patterns of children studied may be minimal. In this study we were unable to examine the growth patterns when low birth weight infants were excluded since the data does not have birth weight measurement. Reliance on reported birth would have been grossly unjustified. The estimate of low birth weight in Jordan of 8%, however, is not very far from other countries in the region.

In 1983, the results of the Jordan Fertility and Family Health Survey<sup>12</sup> showed that the rates of children vaccinated for communicable diseases including Poliomyelitis, Diphtheria, Tetanus, Whooping Cough (DTP) and Measles were 78%, 77% and 68% respectively. In addition, the reported prevalence of diarrheal diseases two weeks before the survey was 8%. Although the possibility of malnutrition due to infectious diseases still exists, this study's results which represent the closest period to the index study, suggests that communicable diseases and diarrhea, may not be the major contributors to the observed drop in growth of children in this study. Malnutrition due to inappropriate feeding practices is another variable to be incriminated in the explanation of the findings. In this respect, as a cultural practice, the majority of Jordanian mothers breast feed their children. The report of the multipurpose study noted that 99.7% of women initiated breast feeding by the end of the first week<sup>7</sup>. However, the continuity of breast feeding was usually interrupted by the early introduction of supplementary feedings. The study reported that, weaning started early in life. Of these children, 15%, 14%, 11%, and 13% were

weaned at age interval 0-3, 4-6, 7-9, and 10-12 months respectively. The weaning was sudden in 24% of these cases. This practice implied supplementation with other foods. Milk supplement accounted for 76%, 33%, 27%, and 37% of the supplementary foods in the respective age intervals mentioned above. The rest of the supplementary foods included home made or commercial foods. Such practices may lead to a decline in the rate of breast feeding and the simultaneous introduction of a nutritionally unbalanced diet both qualitatively and quantitatively. As a consequence, malnutrition increases the risk of infection and when they coexist, they act synergistically.

The minor differences in growth of Jordanian children in the first quarter of the first year compared with NCHS may be attributed to the nutritional and anti infective properties peculiar to breast milk, hence reducing the risks of infections introduced with the supplementary feeding. However, the practices of early introduction of supplementary foods as soon as the first 3 months of life reduces the benefits achievable by exclusive breast feeding. In this study, between birth and three months of life, 237 women introduced supplementary food in addition to breast milk. Of these women, the majority, 85%, used milk with or without other home made or commercial products to supplement their children. The practices of supplementary feeding is further noted in a recent national survey<sup>13</sup>. It was found that 92% of women exclusively breast fed their children between one and four months of age. However, this percentage dropped to 60% by 8 months and to 52% by 12 months. In children over one year of age, the study showed a steep decline in breast feeding practices from 33% in children 13 to 16 months old, to 18% in children 17 to 20 months old and to 12% in children 21 to 24 months old<sup>13</sup>. Given the types of supplementary feeding reported above<sup>7</sup>, these practices may increase the risks of malnutrition and consequently may explain the differences between the local and the reference population becoming more marked as children grew older.

The early discontinuation of breast feeding and the simultaneous introduction of supplementary feeding coupled with relatively early weaning in a developing country like Jordan appear to extend the negative impact on growth to children who are better-off starting their weight and length at the highest centiles compared to the NCHS population. This speculation is supported by the observation of the growth in length in the first 3 months of life, where both Jordanian girls and boys growing at the 50th and 95th centiles grew very closely to their NCHS counterparts. However, the length of Jordanian children dropped dramatically at older ages to levels that made about 50% of them stunted in relation to the reference population. The latter drop in growth in length agrees with the fact that length measures cumulative effects of malnutrition<sup>14</sup>. Therefore, the effects of early malnutrition may have appeared later as stunted growth. Despite the general improvement in the nutritional status apparent in the youngest age groups, the length findings indicate that children suffered and are still suffering from a certain degree of chronic malnutrition.

The use of the NCHS reference population showed that the growth potential of Jordanian children at certain ages was almost similar to that of the American children. This agrees with studies reported elsewhere<sup>6,15-16</sup>. Furthermore, using the NCHS reference, the study results could pinpoint deviations in growth parameters and the ages at which these deviations took place in all children including the well-off children.

The reviewed literature contained enough evidence in support of using the NCHS reference for setting priorities and planning of intervention programs at a national level. Based on the results of the present study, we find that it is appropriate to use the NCHS data as the target for the assessment of child growth at a national level where the minor differences in growth that may be masked by using the local standards, become magnified when the NCHS reference is used. Local standards however, would be needed to decide on the individual

assessment of child growth at the clinic level.

While advocating the use of the NCHS reference as a target for the assessment of the growth of children, and in accordance with the global strategy of the UNICEF/WHO of promoting breast feeding, and improving supplementary feeding practices, one should keep in mind the findings of the recent follow up study<sup>15</sup> of the lower weights of breast fed children in the first 18 months of life compared to formula fed ones. Because the NCHS centiles are based on a mainly formula fed sample, a difference between the local and the targeted NCHS reference should be considered in the first two years of life.

The results of the present study have also shown a sex differential in weight and length among Jordanian children. This observation however warrants further exploration to examine the socio cultural factors implicated in an attempt to prevent them.

#### ACKNOWLEDGMENT

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