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Review Article

Growth: Postnatal Growth Rate

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Abstract

Growth and development are the most important biological sensors to detect the state of health in the individual and in the population. The strategy for implementing continuous monitoring in the evolution of these two parameters must be carefully evaluated. The interaction between growth, development and education is responsible for the socio-cultural formation of the individual and his integration into society. Any measure of measuring the variable can be used, but some are more advantageous such as the rate of growth per unit in preterm and low birth weight.

Keywords: Postnatal; Growth Rate; Birth Weight; MGVU

Introduction

At the Latin American Center for Perinatology, the median growth velocity per unit (MGVU) [1] was used to have better information on the growth of the different parameters and to better manage their nutritional needs.

Median growth velocity (MGV) and median growth velocity per unit (MGVU) of body size are defined. The authors stress that: (a) growth velocity is related to body mass, (b) a useful evaluation of growth is made by using two consecutive measures with a certain time interval independently of birthweight and gestational age, and (c) expressing growth per day per unit relates well to daily nutritional and other requirements.

The growth rate expresses the gain or increase of a parameter in a variable time. It is what a clinician does in the repeated control of a child has a profile of how the growth is going and according to that result takes the measures he deems appropriate. The problem you may have is that the parameters can be very different for the same age and this can only be helped with the child's history and their own experience. In preterm and or low weight for age newborn it can be used to evaluate the grams it grows per day.

Another way to study growth velocity is (MGVU). It expresses the daily gain per unit; that is, the increase in grams per day and per kilogram of body weight; increase in centimeters per day, for each centimeter of size, and increase in centimeters per day, for each centimeter of the cranial perimeter.

Material and Methods

The (MGVU) is determined based on the previous value. With this methodology in the CLAP [1,2] three growth parameters (weight, height and cranial perimeter) were studied for a period of 24 months for 112 children that was formed by three groups of newborns: 48 born of term and weight adequate for gestational age (NTPA), 40 of preterm with adequate weight (NPPA) and 24 born with low weight for age (NTBP). There is a statistically significant inverse correlation between weight and (MGVU). Smaller is the larger size is the growth which allows the catch-up to occur. Figure 1. Shows an example of the growth of (growth rate per unit (grams per kilo per day) at two months of age for different birth weight. Table 1 shows the speed of different weight interval values and the percentile distribution for each of them.

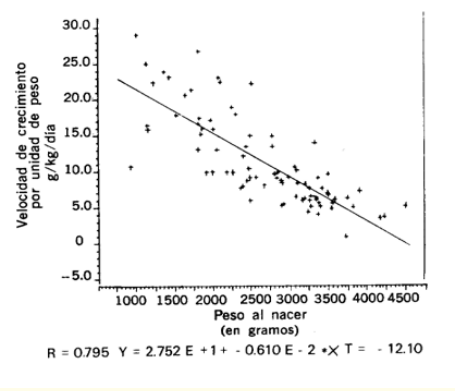

Figure 1: An inverse correlation between VCU and birth weight is observed at 2 months.

For this study, the interval of the independent variable (abscissa variable) was divided into class intervals, and in each one a linear regression was performed with the values of the mean growth rate per unit (VMC/U) of that interval. For each of the observations, this procedure allowed to calculate a theoretical value of the average velocity per unit, corresponding to the average value (of the independent variable) within its interval (theoretical values of the ordinate corresponding to the abscissa of the barycenter in this case was 9.54 kilos). This procedure is based on the method used by Wingerd [3]. Figure 2 shows as an example the procedure applied to the weight variable. Individuals of the same interval were then considered as having the same value as the abscissa, which allowed to estimate percentiles (10,50 and 90). Table 1 and Figure 3 show an example for weight. For the size and cranial perimeter, the same procedure was used (19).

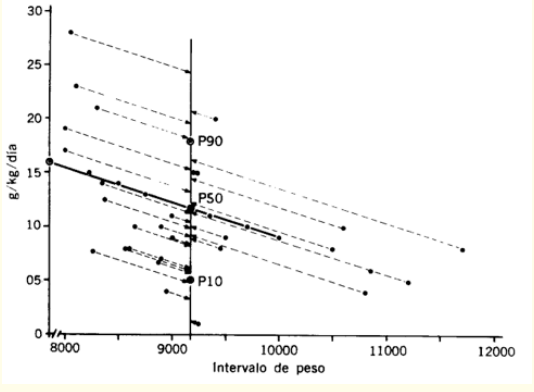

Figure 2: Procedure to calculate the 10th, 50th and 90th percentiles of the VCU for the average weight range between 8 and 12 kilos.

Weight range	Median interval	P10	P25	P50	P75	P90
In grams	Weight (in grams)					
600 - 2000	1521		9.84	14.42	18.80	23.90
2001 - 4000	3061	4.82	7.66	9.97	12.81	15.66
4001 - 6000	4986	2.73	3.81	4.90	6.33	7.77
6001 - 8000	6911	5.78	1.64	2.29	3.24	4.20
8001 - 12000	9254	0.32	0.83	1.14	1.55	1.96
12001 - 16000	12460p	0.22	0.38	0.48	0.56	0.64

Table 1: Range of previous weight, median and percentiles of the VCU in g/day/kilo.

Results

Growth charts for preterm and low birth weight up to two years

These tables were constructed for weight, height, and cranial perimeter based on growth rate per unit (22). It was shown that when the (growth rate per unit) VCU is between the 25th and 75th percentile of the VCU of any parameter, the child's growth band remains between the 10th and 90th percentile of the growth curves (curves as a function of age; weight for age, height for age and cranial perimeter for age). If in a single control it is below the 25th percentile and in the following controls it is above, the growth is normal. If it repeatedly grows with a VCU lower than the 25th percentile, the growth trend will be negative with respect to the reference curves. If the rate of growth is above the 75th percentile, repeatedly the growth of the age-based curves will be greater than the 90th percentile. When it grows with the 75th percentile it follows the growth line of the 90th percentile.

Using the P25; P50; and P75 percentiles of the VCU, 2 types of tables were constructed for the 3 parameters (22). They can be built for different intervals: days, weeks or months. The VCU is also calculated with the value in Table 1. These tables are built to facilitate the work of the person who controls the child.

- Monthly increment tables with intervals of 1 month for weight and cranial circumference and 2 months for height,
- longitudinal growth tables for different intervals of weight, height and cranial circumference at birth with intervals of 30 days (1 month).
- Monthly increment tables with intervals of 1 month for weight and cranial circumference and 2 months for height. The following formula was used:

VCU percentile x previous value* x 30= monthly increment (Formula 1)

*Previous value: is the value from which the increment is taken; it can be birth weight or at any age.

VCU percentile

Can be any value. The 25th, 50th and 75th percentiles that are associated with the 10th, 50th and 90th percentiles of the growth curves as a function of age are usually taken (Table 1. For weight).

To better understand this methodology, an example is presented with the weight assessment.

To estimate the 10th percentile of the weight curve as a function of age (distance curve), the P25 percentile of the VCU was used, to estimate the P50 percentile of the weight, the P50 percentile was used and to estimate the P90 percentile the P75 percentile and the V CU was used. Example 1 shows the use of this methodology for a child weighing 1500 g (1.5 kg because the unit is the kilo).

Formula 1 applies

VCU percentile x previous value x 30 = Monthly increment

VCU percentile: The P25, P50 and P75 percentile of the VCU is 9.8, 14.4 and 19.1 g/k/day respectively.

Previous weight

1.5 kg

Calculation of the increase in 30 days for the 25th percentile of VCU, whose value is: 9.8 g/k/day

Monthly increment = 9.8 x 1.5 x 30 = 441g

This value is added to the previous one (1500 + 441) and you have the weight per month, which corresponds to 1941 g. This means that if this child grows for 30 days with a velocity corresponding to the P25 percentile of VCU, it will weigh 1941 g. We proceed in the same way to calculate the P50 percentile and the P90 percentile of the weight per month, using the P50 percentile and the P75 percentile of the VCU (the VCU values are taken from table 1. Table 2 summarizes Example 1.

VCU percentile	VCU g/k/day	Pre-weight (grams)	Time interval (days)	Increase in grams in 30 days	Weight at 30 days *
P 25	9,8	1500	30	441	1941
P50	14,4	1500	30	648	2150
P75	19,1	1500	30	860	2360

Table 2: Example of the estimation of the weight in 30 days estimation of the weight in 30 days.
*This value is obtained by adding the increase to the previous weight that was 1500.

In this way it is estimated that the monthly increase in weight for a child weighing 1500 grams, will be between 440 and 860 g. This is the speed by increment. In general, children do not have a uniform rate of growth, but it is variable; this is why the interval that the child should grow should always be estimated. It has been shown that if a child grows up with a fixed VCU percentile, for example the P25, the child will always be in the P10 percentile of the weight-for-age curves (distance curve). Example 2 (Table 3) shows the values of the P10, P50 and P90 percentiles of the expected monthly increment

Using the same methodology, an expected monthly increment table was constructed with weight intervals of 100 g from 600 g to 12,000 g. Table 4 only describes the expected monthly increase from 600 g. Given the percentage of initial weight loss and the days it takes to regain birth weight, these values are valid from the second month of life. Weight values less than 1400 g usually correspond to children who are in intensive care and often have some type of complication or digestive intolerance and growth should be evaluated day by day.

Pre-weight	Estimated monthly increment (g)		
	P 10	P50	P90
1500g	441	648	860

Table 3: Monthly increment of the example.

The monthly weight gain tables estimate the expected increase in a child whose weight can range from 600 to 12,000 g (see Table 4). For example, if you have a child of 5000 g and in 30 days he increased 600 g, it can be said that his weight gain is a little greater than the 10th percentile of the rate per increment. If you look from another point of view you have that a child of 5000 g is expected to increase in 30 days between 570 and 930 g. No matter the age only the weight matters.

Using the same methodology, increment tables were constructed for the size and cranial perimeter. For the size, the increase was estimated every 2 months from 44. to). for the cranial and the perimeter and height increase was calculated monthly.

Longitudinal growth tables

Using the same methodology, a table of expected monthly increase was constructed with weight intervals of 100 g from 600 to 12,000 g (see table 4). using the VCU data with which Figure 5 was constructed.

Birth weight	600	700	800	900	1000	1100	1200	1300	1400	1500
1-month P90	780	923	1069	1188	1301	1458	1605	1653	1864	1980
P50	718	836	957	1094	1207	1286	1447	1569	1728	1852
P10	659	728	857	939	1954	1120	1274	1382	1587	1701
2-month P90	1201	1421	1646	1809	2003	2235	2623	2671	3103	3200
P50	1054	1227	1404	1605	1772	1887	2124	2303	2429	26 02
P10	910	1005	1183	1298	1455	1668	1759	1908	2051	2348
3 months P90	1849	2188	2664	2889	3131	3397	3809	3844	4255	4400
P50	1547	1801	2017	2278	2498	2637	2791	3131	3271	347 0
P10	1256	1386	1633	1789	1897	2153	2263	2431	2625	2937
4 months P90	2681	3350	3847	4055	4294	4510	4967	5002	5395	5550
P50	2219	2572	2789	3106	3353	3505	3810	4034	4181	4380
P10	1734	1911	2077	2293	2420	2727	2852	3036	3273	3585
5 months P90	3867	4518	5005	5183	5392	5570	5897	5932	6295	6475
P50	3020	3382	3667	4009	4264	4415	4709	4918	5042	5210
P10	2219	2434	2635	2882	3025	3367	3510	3702	3954	4278
6 months P90	5025	5576	5935	6116	6300	6487	6757	6792	7075	7300
P50	3917	4293	4572	4893	5110	5245	5482	5644	5758	5914
P10	2793	3039	3298	3540	3691	4048	4193	4384	4621	4931
7 months P90	5965	6475	6795	6947	7107	7228	7485	7512	7729	7900
P50	4810	5139	5385	5619	5820	5949	6171	6314	6407	6551
P10	3441	3705	3977	4123	4373	4720	4853	5028	5220	5516
8 months P90	6801	7216	7493	7622	7767	7882	8120	8147	8330	8500
P50	5560	5849	6074	6289	6469	6586	6768	6896	6 973	7084
P10	4124	4387	4649	4700	5917	5332	5438	5598	5766	6054
9 months P90	7499	7870	8128	8249	8378	8484	8703	8720	8882	9073
P50	6240	6498	6685	6871	7019	7119	7264	7372	7443	7550

P10	4721	5031	5273	5392	5587	5885	5984	6127	6265	6530
10 months P90	8134	8472	8711	8822	8930	9036	9220	9237	9373	9500
P50	6837	7048	7218	7377	7489	7585	7722	7825	7896	7992
P10	5403	5602	5826	5938	6116	6384	6472	6603	6703	6951
11 months P90	8717	9024	9228	9326	9421	9514	9650	9687	9874	9980
P50	7333	7518	7680	7820	7937	8027	8159	8256	8310	8416
P10	5949	6130	6336	6437	6592	6820	6893	7009	7174	7300
12 months P90	9224	9502	9678	9758	9853	9994	10050	10115	10330	10450
P50	7799	7966	8117	8251	8361	8445	8562	8652	8706	8804
P10	6449	6606	6786	6873	6998	7193	7232	7220	7547	7630
15 months P90	10523	10774	10931	11013	11108	11182	11310	11372	11540	11700
P50	8997	9132	9252	9339	9437	9502	9598	9660	9720	9740
P10	7586	7662	7801	7884	7963	8136	8164	8204	8340	8480
18 months P90	11363	11629	11781	11853	11933	12014	12100	12202	12480	12630
P50	9949	10067	10169	10248	10344	10391	10470	10545	10600	10660
P10	8468	8531	8657	8716	8789	8936	8958	8964	9140	9180
21 months P90	11993	12339	12420	12500	12570	12654	12728	12826	13000	13140
P50	10811	10922	11001	11079	11163	11204	11274	11345	11400	11440
P10	9219	9277	9381	9436	9499	9633	9650	9661	9760	9820
24 months P90	12593	12939	13030	13100	13170	13254	13360	13477	13560	13600
P50	11574	11672	11737	11806	11876	11917	11938	11989	12020	12060
P10	9903	9961	10064	1011	10169	10311	10327	10338	10460	10480

Table 4

Conclusion

The use of this methodology is useful for monitoring preterm and underweight children. It is important to know that if the child follows the growth assessed by this method, he or she reaches the catch up around 2 years of age.

Another aspect to note is that a few years ago, neonatal units competed for who ever reached growth recovery faster, for which it was a matter of accelerating growth with hypercaloric diets at the expense of carbohydrates or medium-chain triglycerides that can reach produce high values of plasma glucose that, on the one hand, is stored as fat that leads to obesity and would even lead to insulin resistance and cardiovascular alterations in the future [4-6]. It is recommended to avoid growth acceleration because it would have negative consequences on health in these children. It is very important to bear in mind that when monitoring the growth of weight, height and head circumference, a panniculus measurement is added to control excess fat. It is also a factor that makes these children require follow-up due to the metabolic or endocrine alterations that they may suffer in early or late childhood (18). For all these reasons it is important to know the rate of growth of this group of children.

Bibliography

1. Martell M., *et al*. "Early postnatal growth evaluation in full term, preterm and small-for-date infants". *Early Human Development* 1 (1978): 313.

2. Martell M., *et al*. "Velocidad de crecimiento en niños nacidos de pretérmino y con bajo peso. En: Crecimiento y desarrollo. Hechos y tendencias. Washington, D.C.: Organización Panamericana de la Salud. Publicación científica Nº 510 (1988):164.

3. Wingerd J., *et al*. "Growth standards in the first two years of life based on measurements of white and black children in a prepaid health care program". *Pediatrics* 47 (1971): 818.

4. Romera G., *et al*. "Energy intake, metabolic balance and growth in preterm infants fed formulas with different nonprotein energy supplements". *Journal of Pediatric Gastroenterology and Nutrition* 38.4 (2004): 407.

5. Jain V and Singhal A. "Catch up growth in low-birth-weight infants: striking a healty balance". *Reviews in Endocrine and Metabolic Disorders* 13 (2012): 141-147.

6. Kerkhof GF., *et al*. "Health profile of young adults born preterm: negative effects of rapid weight gain in early life". *The Journal of Clinical Endocrinology and Metabolism* 97(2012): 4498-506.