Morphometric and Allometric Study of the Mouse Exocrine Pancreas Growth During the Postnatal Life

By

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Summary: Postnatal mouse pancreas growth was submitted to allometric analysis by the Wald nonparametric method, modified by Bartlett. The body and gland mass were obtained and the total cell number and the absolute compartmental volumes of acini, ducts and stroma were evaluated by morphometric methods. The allometric coefficients were calculated for the growths between the following parameters: a) pancreatic mass and body mass; b) acinar compartmental volume and body mass; c) ductal compartmental volume and body mass; d) stroma volume and body mass; e) total cell number and body mass; and f) acinar volume and stroma volume. The results of these analysis showed that the pancreatic mass, total cell number and stroma volume exhibited statistically significant allometric growths with a monophasic pattern and allometric coefficients of 1.56, 1.27 and 1.29, respectively, for the periods of 2 to 70, 2 to 28 and 2 to 70 days of age; while the growth of compartmental acinar volume in relation to body mass and compartmental stroma volume was biphasic. In the first case, the 1st phase occurred between 2 to 14 days (K = 1.09) and the 2nd phase between 14 to 70 days (K = 1.44) and in the second case, the 1st and 2nd phases occurred, respectively, between 2 to 28 days (K = 1.31) and 28 to 70 days (K = 0.79) of age. The growth of ductal volume in relation to body mass was also biphasic with a 1st phase between 2 to 14 days (K = 0.88) and a 2nd phase between 14 to 70 days (K = 1.07). These results permitted us to conclude that the growth of the mouse pancreas is allometrically associated with the growth of body mass.

The morphogenetic events responsible for the development of the exocrine pancreas of rodents mainly occur during prenatal life (Koizumi, 1962; Kallman and Grobstein, 1964; Wessells and Cohen, 1967; Parsa, Marsh and Fitzgerald, 1969a,b; Pictet et al. 1972; Spooner, Cohen and Faubion 1977; Hisaoka, Haratake and Hashimoto, 1993; Taga, 1994). Thus, at birth the pancreas already exhibits differentiated acinar cells with the cytoplasm replete of zymogen granules. However, the organ is still very small and its acinar cells are immature. During the first month of postnatal life the pancreatic mass grows conspicuously mainly due to the mitotic activity of acinar cells and also to the increase in the individual volume of these cells (Sesso, 1962; Sesso et al., 1973; Ferraz-de-Carvalho et al., 1978; Kachar et al., 1979; Ermak and Rothman, 1980). Most studies on the postnatal development of the pancreas have been conducted on rats, with emphasis on several basic aspects of development such as differential growth, cell maturation, cell modulation, etc. Few studies are available about the postnatal development of the mouse pancreas. Dore et al. (1981) established a biphasic pattern for the postnatal development of the mouse pancreas. According to these investigators, the 1st phase consists of the period from birth to the 15th day of life and is characterized by the proliferation and growth of endocrine cells, with the Langerhans islets reaching adult morphology at the end of this period. The 2nd phase, from the 15th to the 30th day of life, is characterized by the proliferation and growth of acinar cells which reach the morphological pattern of

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maturity as early as by 20 days of age.

On this basis, we were interested in studying more in depth the postnatal development of the mouse pancreas. Specifically, the objectives of the present study were to evaluate the evolution of pancreatic mass, of the total number of cells and of the absolute volume of the acini (including the centroacinar cells), ducts and stroma. These quantitative parameters were submitted to allometric analysis by the nonparametric method of Wald, as a function of body mass growth. The same method was also used to analyze the growth of the volume of the acinar compartment in relation to the growth of stroma volume.

Material and Methods

General Procedures

The study was conducted on male Swiss albino mice (Mus musculus) reared and maintained at the Central Animal House of the Dental School of Bauru, University of São Paulo, Brazil.

Ninety animals were divided into 9 groups for the postnatal ages of 2, 7, 14, 21, 35, 42, 70, 98 and 140 days. The pups were left with their dams up to the 21st day, when they were weaned. All glands were collected between 10:00 and 12:00 a.m..

The animals were anesthetized with ethyl ether and their body mass was measured on a Mettler P1000 scale. An incision was then made in the abdominal wall, the pancreas was exposed and carefully dissected and removed and its fresh mass was rapidly determined on a Mettler P20 analytical scale.

Histological procedures

The pancreas of 6 animals per group was fixed in Bouin's fluid for 3 hours at room temperature and kept in 70% ethanol overnight. On the subsequent day, the organs were dehydrated in 80%, 90%, 95%, and 100% ethanol, cleared in xylene and embedded in Paraplast (paraffin + plastic resin). Semiserial 6-1.1μm thick sections were then obtained at 60-μm intervals from each block using a Jung-Leica 2045 Multicut microtome with a disposable knife. The sections were then stained by the Masson trichrome method modified by Goldner (Martoja and Martoja-Pierson, 1970).

Evaluation of processed pancreatic volume

The pancreatic volume of each animal was calculated on the basis of fresh organ mass, organ density (mg/mm²) and retraction provoked by histological processing. Pancreas density was assessed in a group of 12 animals aged 70 days by the method of Scherle, as modified by Pardini and Taga (1986) and the mean value obtained was d = 1.13 mg/mm². Retraction provoked by histological processing was assessed in 2 groups of 12 animals each, respectively, aged 42 and 70 days, by the method of Taga and Sesso (1978) and of Kachar et al. (1979). Linear measurements are obtained of the fresh organ and after all the steps of histological processing. When these measurements were raised to the 3rd power and the relation between the values obtained was calculated, the volumetric retraction provoked by processing was obtained. Mean retraction was 46.66% and the retraction factor was Fr = 0.5334.

After obtaining fresh mass (m), mean density (d) and retraction factor (Fr), processed pancreatic volume (Vp) was calculated by the following formula: Vp = m/d.Fr.

Morphometric evaluation of volume density (Vvi) and total volume (Vti) of each gland component

The volume density (Vvi) of each pancreatic structure (acini including centroacinar cells, intercalated and excretory ducts, and stroma) was evaluated by the morphometric point volumetry method (Weibel, 1969). The points coinciding with each structure (Pi) and with the whole gland (P) were counted in 50 histological fields per animal selected by systematic sampling, using a kpl8x ocular micrometer with a II Zeiss integration grid and a 100x objective (Weibel, 1969).

After obtaining volume density (Vvi) and processed pancreatic volume (Vp), the total volume of the morphologic compartment (Vti) was calculated by the following formula: Vti = Vvi. Vp.

Morphometric evaluation of total cell number (N)

The number of nuclear images (n) of all cell types and the numbers of crosses (c) of the nuclei with the grid lines were counted in 50 randomized histological fields per animal using a kpl8x ocular micrometer containing a II Zeiss integration grid and an immersion objective. After calculating the total area examined (A), the distance between the grid lines (d), the thickness of the section (t) and the processed pancreatic volume (Vp), the total number of cells was calculated by method II of Aherne (1967) according to the following formula: N = 2n. Vp/A(c/nd + 2t).

Allometric analysis

The parameters studied, i.e., pancreatic mass, volume of each morphologic compartment and total number of cells, were submitted to allometric analysis as a function of body mass growth. The volume of the acinar compartment was also analyzed as a
function of stroma volume.

The allometry relationship between weight or volumetric growth of the parts of a whole and of the whole (e.g., pancreatic mass and body mass) is represented by the K coefficient of the equation \( y = b \cdot x^K \) (Huxley, 1924), which represents a constant relation in the growth of the two variables. In this type of analysis, three growth situations may occur: a) when \( K = 1 \), the growth of the two variables is isometric and this means that the unit growth of \( y \) is equal to the unit growth of \( x \); b) when \( K > 1 \), allometric growth is positive and this means that the daily increases in \( y \) are higher than those of \( x \); c) when \( K < 1 \), allometric growth is negative and this means that the daily increases of \( y \) are smaller than the daily increases of \( x \).

In the present study, the K allometry coefficient was calculated by the nonparametric method of Wald modified by Bartlett (1949) using a software developed in our laboratory for an IBM-PC microcomputer. In this method, the decimal or natural logarithms of the data are divided into three successive groups with approximately the same number of values. The division is based on the variable of least variation. The K coefficient of the equation is calculated by the following formula: \( K = \frac{y_3 - y_1}{x_3 - x_1} \), where \( y_1 \) and \( x_1 \) are the means for the extreme groups. The limits of the confidence interval for \( K \) and the t value for linearity were also estimated using the microcomputer software. With respect to the compartmental volumes of acini, ducts and stroma, all the values were multiplied by 10 or 100 before logarithmic transformation in order to avoid negative logarithms.

**Statistical analysis**

All the quantitative data obtained for each group were compared pairwise by the Student t-test (Lison, 1985). For volume density, the tests were applied after arcsin transformation of the original data. Data concerning pancreatic mass, total number of cells and total acinar compartment volume were submitted to exponential regression analysis. On the basis of the equation obtained, we calculated the duplication time for each of the parameters under study.

### Results

#### Weight and morphometric results

The results of the postnatal evolution of body mass, gland mass, volume density and absolute volume of the acinar compartment, ducts and stroma are presented in Table 1.

Analysis of the data in this table showed that:

- During the period of 2 to 70 days of age, body mass grew linearly by 2201% (\( P < 0.01 \)) from 1.58 to 36.36 g.
- During the period of 2 to 70 days of age, pancreatic mass was significantly increased by 10246% (\( P < 0.01 \)) from 3.17 mg to 327.96 mg, corresponding to a mean growth of 4.78 mg/day. Graphic analysis suggested an exponential growth of this parameter.
- Volume density of the acinar morphologic compartment exhibited a statistically significant growth only from 7 to 21 days of age (\( P < 0.05 \)), with stabilization during the remaining periods. On the other hand, stroma volume density showed a significant fall from 2 to 21 days (\( P < 0.01 \)). Graphic analysis (Figure 1) showed the existence of an inverse relationship during the first three weeks of development between acinar and stroma volume density, a fact suggesting that acinar growth inside the pancreas during this period occurred in such a manner.

#### Statistical analysis

All the quantitative data obtained for each group were compared pairwise by the Student t-test (Lison, 1985). For volume density, the tests were applied after arcsin transformation of the original data. Data concerning pancreatic mass, total number of cells and total acinar compartment volume were submitted to exponential regression analysis. On the basis of the equation obtained, we calculated the duplication time for each of the parameters under study.

### Table 1. Evolution of body mass (in g), pancreatic mass (in mg), compartmental volume density (in %), compartmental total volume (in mm³), and total cell number (x10⁵), during the first 140 days of postnatal life

<table>
<thead>
<tr>
<th>Age</th>
<th>2</th>
<th>7</th>
<th>14</th>
<th>21</th>
<th>28</th>
<th>35</th>
<th>42</th>
<th>70</th>
<th>98</th>
<th>140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass</td>
<td>1.58 ± 0.03*</td>
<td>4.22 ± 0.13</td>
<td>8.45 ± 0.10</td>
<td>10.13 ± 0.18</td>
<td>22.38 ± 1.07</td>
<td>24.23 ± 1.22</td>
<td>32.68 ± 1.10</td>
<td>36.37 ± 1.02</td>
<td>35.55 ± 1.19</td>
<td>39.92 ± 1.37</td>
</tr>
<tr>
<td>Gland mass</td>
<td>3.17 ± 0.17</td>
<td>8.13 ± 0.46</td>
<td>22.50 ± 0.90</td>
<td>58.55 ± 2.32</td>
<td>140.88 ± 8.47</td>
<td>200.41 ± 24.56</td>
<td>192.93 ± 10.74</td>
<td>327.97 ± 18.19</td>
<td>283.25 ± 20.21</td>
<td>216.56 ± 4.62</td>
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<tr>
<td>Acini</td>
<td>63.83 ± 1.72</td>
<td>64.16 ± 1.85</td>
<td>72.5 ± 1.94</td>
<td>82.16 ± 1.60</td>
<td>84.5 ± 0.64</td>
<td>81.33 ± 0.98</td>
<td>83.33 ± 0.66</td>
<td>82.83 ± 1.13</td>
<td>82.50 ± 0.42</td>
<td>89.16 ± 0.65</td>
</tr>
<tr>
<td>Ducts</td>
<td>0.49 ± 0.12</td>
<td>0.60 ± 0.11</td>
<td>0.60 ± 0.07</td>
<td>0.48 ± 0.07</td>
<td>0.19 ± 0.04</td>
<td>0.49 ± 0.11</td>
<td>0.23 ± 0.06</td>
<td>0.35 ± 0.11</td>
<td>0.28 ± 0.09</td>
<td>0.50 ± 0.06</td>
</tr>
<tr>
<td>Stroma</td>
<td>31.65 ± 1.72</td>
<td>28.37 ± 1.83</td>
<td>23.85 ± 1.76</td>
<td>15.65 ± 1.32</td>
<td>14.30 ± 0.50</td>
<td>17.53 ± 0.82</td>
<td>15.44 ± 0.79</td>
<td>16.28 ± 1.13</td>
<td>16.22 ± 0.41</td>
<td>9.64 ± 0.66</td>
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</tr>
<tr>
<td>Acini</td>
<td>0.95 ± 0.05</td>
<td>2.46 ± 0.14</td>
<td>7.70 ± 0.38</td>
<td>22.64 ± 0.68</td>
<td>59.32 ± 3.16</td>
<td>77.06 ± 9.76</td>
<td>75.91 ± 4.34</td>
<td>128.10 ± 6.72</td>
<td>110.42 ± 8.23</td>
<td>91.13 ± 1.93</td>
</tr>
<tr>
<td>Ducts</td>
<td>0.007 ± 0.002</td>
<td>0.02 ± 0.005</td>
<td>0.06 ± 0.007</td>
<td>0.13 ± 0.02</td>
<td>0.12 ± 0.02</td>
<td>0.42 ± 0.10</td>
<td>0.21 ± 0.06</td>
<td>0.50 ± 0.16</td>
<td>0.38 ± 0.13</td>
<td>0.51 ± 0.07</td>
</tr>
<tr>
<td>Stroma</td>
<td>0.46 ± 0.03</td>
<td>1.11 ± 0.08</td>
<td>2.52 ± 0.24</td>
<td>4.34 ± 0.55</td>
<td>10.05 ± 0.85</td>
<td>16.37 ± 1.96</td>
<td>12.64 ± 0.64</td>
<td>25.28 ± 2.86</td>
<td>21.41 ± 1.38</td>
<td>9.71 ± 0.73</td>
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</tr>
<tr>
<td>Total cell number</td>
<td>10.28 ± 0.50</td>
<td>39.12 ± 2.43</td>
<td>107.82 ± 7.25</td>
<td>151.40 ± 5.98</td>
<td>277.72 ± 24.59</td>
<td>302.35 ± 36.97</td>
<td>304.13 ± 18.31</td>
<td>313.09 ± 23.84</td>
<td>276.05 ± 26.70</td>
<td>259.82 ± 10.47</td>
</tr>
</tbody>
</table>

*Mean ± standard error of mean
way as to occupy part of the connective spaces. Absolute acinar volume showed a marked 13,384% increase (P < 0.01) from 2 to 70 days of age, including a short period of stabilization between 35 and 42 days when no significant increase was observed (P > 0.05). If the data for this period from 35 to 42 days are not considered, graphic analysis (see Figure 2) suggests a growth pattern tending to be exponential. The absolute volumes of the ductal and stroma compartments also showed significant growth during the same period which tended to be exponential. The absolute volumes of the ductal and stroma compartment also showed significant increases during the same period of 7043% (P < 0.01) and 5396% (P < 0.01), respectively. Total cell number markedly increased by 2622% (P < 0.01) from 2 to 28 days of age, i.e., from 10.2 x 10^5 to 277.7 x 10^5 cells, corresponding to a mean increase of 10.3 x 10^5 cells/day (see Figure 3).

In order to determine growth rate, the data concerning pancreatic mass, acinar compartment volume and total number of cells were submitted to exponential regression analysis as a function of age in days. The equations obtained and the correlation coefficients are shown in Table 2.

**Allometric results**

The results of allometric analysis between the growth of a) pancreatic mass and body mass, b) acinar volume and body mass, c) duct volume and body mass, d) stroma volume and body mass, e) total number of cells and body mass, and f) acinar volume and stroma volume, for the period from 2 to 70 days of age are presented in Table 3 and in Figures 4a,b,c,d,e, and f, respectively for each item.

Table 3 presents the values of the allometry coefficient (K), as well as the t values and the limits of the confidence interval K. The calculated t value is important to test whether the hypothesis that the logarithms of the two variables are associated by a straight line can be accepted or rejected. Thus, if the calculated t is lower than the critical t this hypothesis cannot be rejected.

Figure 4a,b,c,d, and f illustrates the distribution of the original points equivalent to the logarithms of the two variables, the straight line determined by

<table>
<thead>
<tr>
<th>Parameter</th>
<th>exponential regression equation</th>
<th>r²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gland mass</td>
<td>( y = 8.28 \cdot e^{0.0676 \cdot x} )</td>
<td>0.76</td>
</tr>
<tr>
<td>Acinar volume</td>
<td>( y = 2.19 \cdot e^{0.0704 \cdot x} )</td>
<td>0.74</td>
</tr>
<tr>
<td>Cell number</td>
<td>( y = 36.69 \cdot e^{0.0433 \cdot x} )</td>
<td>0.59</td>
</tr>
</tbody>
</table>
Table 3. Results of allometric analysis of various parameters during the first 70 days of postnatal life

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Periods</th>
<th>K value</th>
<th>Limits of the Confidence Interval</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gland mass × Body mass</td>
<td>2 a 70 days</td>
<td>1.56</td>
<td>S = 1.64</td>
<td>1.76</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 1.49</td>
<td></td>
</tr>
<tr>
<td>Acinar volume × Body mass</td>
<td>2 a 14 days</td>
<td>1.09</td>
<td>S = 1.14</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 1.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 a 70 days</td>
<td>1.44</td>
<td>S = 1.58</td>
<td>1.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 1.29</td>
<td></td>
</tr>
<tr>
<td>Ductal volume × Body mass</td>
<td>2 a 14 days</td>
<td>0.88</td>
<td>S = 1.35</td>
<td>1.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 0.39</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 a 70 days</td>
<td>1.07</td>
<td>S = 1.44</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 0.69</td>
<td></td>
</tr>
<tr>
<td>Stroma volume × Body mass</td>
<td>2 a 70 days</td>
<td>1.29</td>
<td>S = 1.30</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 1.29</td>
<td></td>
</tr>
<tr>
<td>Cell number × Body mass</td>
<td>2 a 28 days</td>
<td>1.27</td>
<td>S = 1.34</td>
<td>1.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 1.20</td>
<td></td>
</tr>
<tr>
<td>Acinar volume × Stroma volume</td>
<td>2 a 28 days</td>
<td>1.31</td>
<td>S = 1.35</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 0.31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28 a 70 days</td>
<td>0.79</td>
<td>S = 0.85</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I = 0.74</td>
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</tr>
</tbody>
</table>

Dedicated time (DT) calculated by the equation

\[
\text{DT} = \ln(2)/K, \quad \text{where } \ln(2) = \text{natural logarithm of 2 and} \ K = \text{the exponent of the equation obtained., was 10.2 days, i.e., the pancreatic mass of the mouse duplicates every 10.2 days during the period from 2 to 70 days of postnatal life.}

Allometric analysis of this increase in pancreatic mass in relation to body mass showed a monophasic pattern of growth, with a K coefficient of 1.56, indicating that growth is of the positive type, i.e., from 2 to 70 days of life the pancreatic mass grows more than body mass, i.e., for each unit growth of body mass the pancreatic mass grows 1.56 times. The pancreatic mass grows because of an increase in acini, ducts and stroma, but mainly in acini. Morphologic analysis suggested that the acini grow both in number and size.

Analysis of the evolution of volume density for the acinar, duct and stroma compartments suggested that during pancreatic growth the acinar compartment grows in such a way as to occupy part of the spaces relative to connective tissue. In absolute terms, the three compartments grew substantially from 2 to 70 days of postnatal life. The volume of the acinar compartment increased 13384%, the volume of the ducts 7043% and the volume of the stroma 3956%.

Since graphic analysis suggested that the growth of the compartmental volume of the acini was also exponential, the data were submitted to analysis by exponential regression and the following equation:

\[ Y = 8.28 e^{0.0076x} \]

the calculated equation and the respective allometry coefficient K.

An analysis of the figures shows that the allometric growth of the pancreatic mass, the total number of cells and the absolute volume of the stroma in relation to body mass occurred in a single phase, whereas the growth of the acinar volume in relation to body mass, the growth of acinar volume in relation to stroma volume and the growth of the ductal volume in relation to body mass were biphasic.

Discussion

At birth, the mouse pancreas, as is also the case for the rat, is already differentiated, with the acini exhibiting the cells replete with zymogen granules, but still with a rudimentary intercalated duct morphology. Thus, inside the abundant stroma of loose connective tissue there are acini, ducts and islets. The acini are present in small numbers and, although their secretory cells are filled with zymogen granules, they are still very small.

The gland grows significantly during postnatal development, with an increase in fresh mass of the order of 10246% between 2 and 70 days of age. Since the original data indicated that the pancreatic mass grew exponentially during this period, we adjusted the data by exponential regression and obtained the following equation: \( Y = 8.28 \ e^{0.0076x} \).
Fig. 4. Allometric analysis for the period from 2 to 70 days of age between the growth of: a) pancreatic mass and body mass; b) acinar compartmental volume and body mass; c) ductal volume and body mass; d) stroma volume and body mass; e) total cell number and body mass; and f) acinar volume and stroma volume. The points in the figures represent the distribution of the original points.
mental acinar volume. that obtained for pancreatic mass and for compartment time was 16.0 days, a much longer time than determination equal to $r^2 = 0.59$. The calculated duplication time, calculated as done for the pancreatic mass, was 9.8 days; a shorter time but close to that obtained for pancreatic mass growth.

Allometric analysis during the growth period from 2 to 70 days of age between absolute acinar volume and body mass showed a biphasic growth, with a first phase between 2 and 14 days ($K = 1.09$) and a second phase between 14 and 70 days ($K = 1.44$). During the first phase, allometric growth tends to be isometric, i.e., there is equivalence in the unit growths of the two variables, whereas during the second phase growth is positive, i.e., the unit growth of the acinar volume is higher than that of body mass. The present results support data reported by Dore et al. (1981) who observed that endocrine cell growth may predominate from birth to the 15th day of postnatal life, whereas acinar cell growth may predominate after this early period.

The volume of the duct compartment exhibited two phases of allometric growth, the first between 2 and 14 days, with $K = 1.07$, and the second between 14 and 70 days, with $K = 0.88$, both showing a growth of the isometric type since the confidence intervals for $K$ include the value of 1. Furthermore, the compartmental volume of stroma in relation to body mass showed a positive allometric growth with a $K$ coefficient of 1.29.

Acinar volume growth, when analyzed allometrically in relation to stroma volume, showed a biphasic pattern. During the first phase (2 to 21 days), allometric growth was positive, with a $K$ value of 1.31, i.e., the unit growth of acinar volume was higher than that of stroma volume. During the second phase (21 to 70 days), growth was negative, with $K = 0.79$, i.e., for each unit growth of stroma volume, acinar volume grew 0.79 times.

In the present study we were also interested in determining the participation of the increase in total cell number in the increase of pancreatic mass. Thus, the total number of pancreatic cells was evaluated by the morphometric method II of Aherne in mice aged 2, 7, 14, 21, 28, 35, 42, 70, 98 and 140 days of age. Analysis of the results showed that the total number of cells increased by 2622% from 2 to 28 days, with no statistically significant increase observed after this period. Despite this occurrence, in order to carry out a uniform mathematical analysis, we performed regression analysis including all the values of the period from 2 to 70 days and obtained the exponential equation $y = 36.69 e^{0.0433x}$, with a very low coefficient of determination equal to $r^2 = 0.59$. The calculated duplication time was 16.0 days, a much longer time than that obtained for pancreatic mass and for compartmental acinar volume.

The data concerning total cell number were submitted to allometric analysis for the period of 2 to 70 days in relation to body mass growth. The growth of the total number of cells exhibited a single phase of allometric growth between 2 and 28 days, with $K = 1.27$, i.e., a positive growth with a greater unit growth of cell number than the unit growth of body mass. After this period there was no allometric growth.

Analysis of these data shows that the proliferative activity, especially of acinar cells, plays a fundamental role in the pancreatic growth of the mouse during the first month of postnatal life; since the pancreatic mass continues to grow up to the 70th day, the data obtained suggest that the increase in individual volume of pancreatic cells plays an important role in this growth.

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