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# DAP in Dental Panoramic and Cephalometric Examinations in Iceland

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## Introduction

The aim of this study was to collect information about the number of procedures performed in 2010 and also to measure DAP (Dose Area Product) values in all panoramic (panoramic and cephalometric) equipment that are in use in Iceland.

From these results the effective dose can be estimated and the contribution to the collective effective dose for these modalities.

Although the number of measurements and equipment in this survey are few, a Dose Reference Levels (DRL's) is proposed.



**Picture 1**  
A translucent transmission ionization chamber is connected to a DAP meter (Diamentor E2, PTW-Freiburg, Germany)



**Picture 2**  
The ionization chamber was attached directly in front of the exit slit of the x-ray tube

## Materials and methods

In Iceland there are 17 panoramic dental units in use (5 digital) 10 of these units are also used for cephalometric examinations. These units are located in 13 dental clinics and 2 hospitals. Each location was visited during regular inspections and DAP measurements performed on all equipment. Available technical information such as the model, manufacturer, date of manufacture and type of the panoramic X-ray machines were recorded.

For each panoramic unit, 4 different programme were selected, characterized by; Large adult, normal adult, small adult and child.

Evaluation of the number of procedures performed in one year was done by a questionnaire. Here the results for 14 units are presented.

## Results

Tables 1 and 2 show the result of the mean exposure parameters, the DAP values, for both panoramic and cephalometric, along with DAP range, 3<sup>rd</sup> quartile value and mean effective dose.

Graphs 1 and 2 show the distribution of DAP values for all measured equipment for both modalities and for different program settings.

Information about performed examinations in 2010 indicate that about 12.400 panoramic examination and cephalometric examinations were performed. It was not possible to divide this information into these two categories or between different patient ages or sizes.

## Conclusions

The results of this study on patient doses compare favorably with published data (J.-S. Lee et al. 2010, B. Pobble et al. 2006).

In most cases there is an appropriate difference in dose between programme settings for both modalities (see graphs), but there is a great variation between these 14 units.

It was not possible to divide information on frequency of examination into different programme settings or patient size. Estimation of the contribution to the collective effective dose (CED) was found by calculating a mean effective dose for all programme settings and for each modality (0,0089 mSv) and multiply that with the total number of examinations. This gives 0,011 manSv, which is 0,02% of the total CED for medical diagnostic x-rays in Iceland (Report GR 11:02, 2011)

Few DRL's for panoramic and cephalometric examinations have been published, but the results of this study is that the 3<sup>rd</sup> quartile values in tables 1 are a good indication for appropriate DRL's.

Panoramic mean exposure parameters of the DAP values for each type of programme settings, along with DAP range, 3rd quartile and mean effective dose							
Patient programme	Mean tube voltage (kV)	Mean tube current (mA)	Mean exposure time (t)	Mean DAP (mGy cm <sup>2</sup> )	Range (mGy cm <sup>2</sup> )	3rd quartile DAP (mGy cm <sup>2</sup> )	Mean Effective Dose (μSv)*
Large adult	78,7	9,4	16,4	119,3	(72,8 - 153,2)	132,2	10,3
Normal adult	74,9	9,8	15,6	100,6	(49,0 - 172,4)	124,2	7,8
Small adult	70,0	9,4	15,5	75,8	(40,6 - 127,3)	95,2	5,4
Child	64,8	8,8	15,6	54,1	(32,4 - 81,14)	62,6	3,6

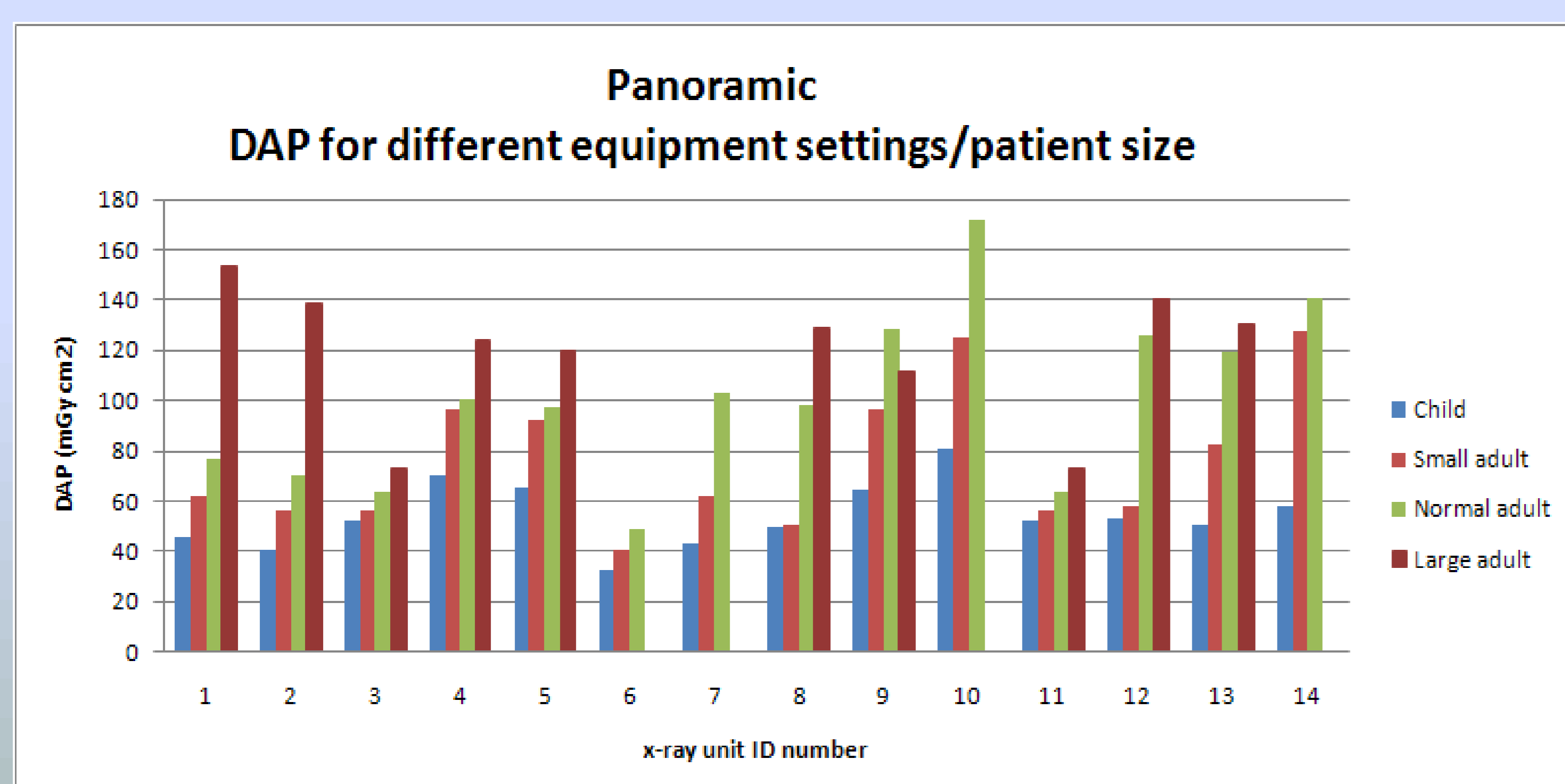
\* using conversion coefficients from Looe H.K. et al (2008)

**Table 1**

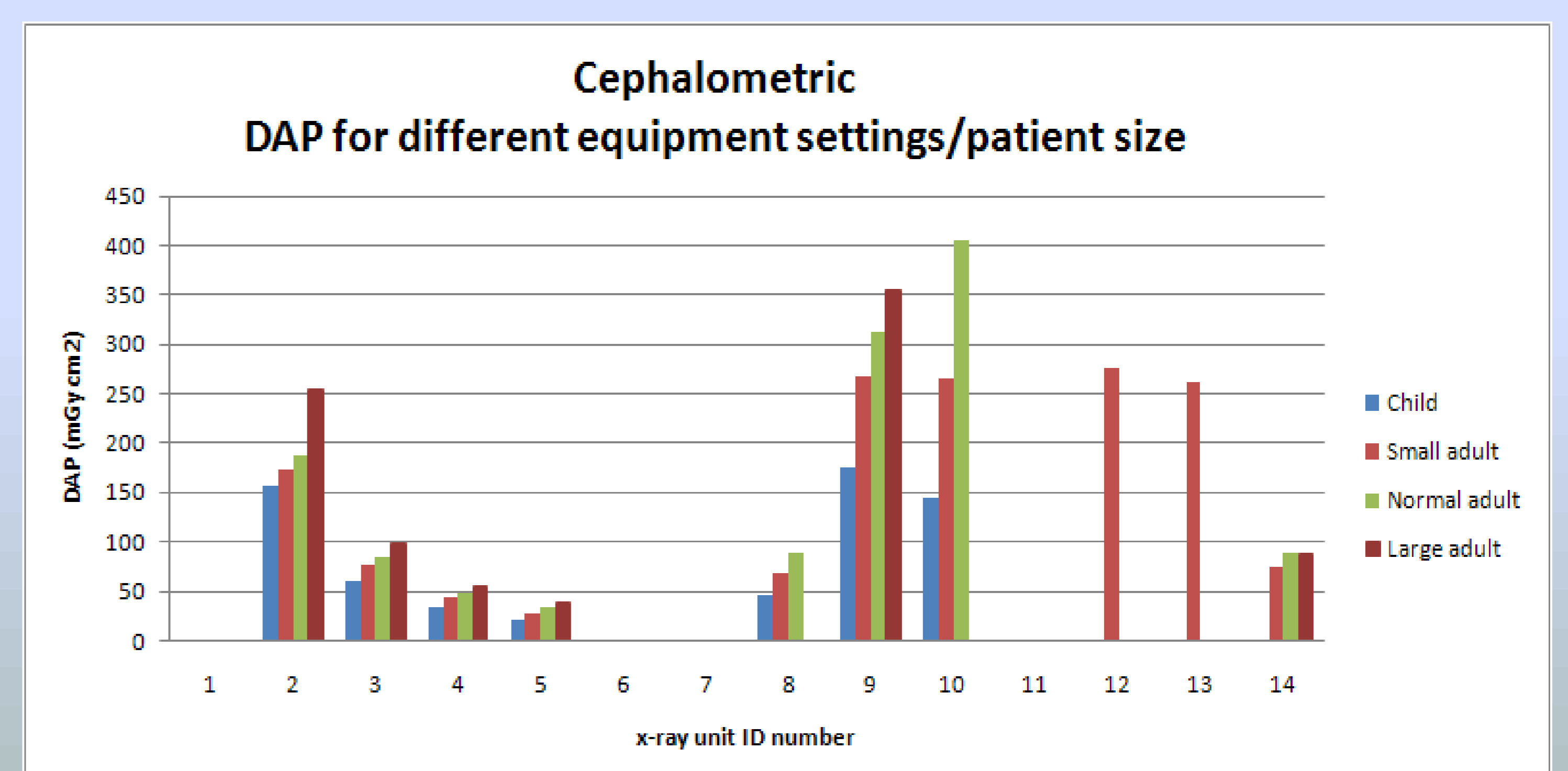
Cephalometric mean exposure parameters of the DAP values for each type of programme settings, along with DAP range, 3rd quartile and mean effective dose							
Patient programme	Mean tube voltage (kV)	Mean tube current (mA)	Mean exposure time (t)	Mean DAP (mGy cm <sup>2</sup> )	Range (mGy cm <sup>2</sup> )	3rd quartile DAP (mGy cm <sup>2</sup> )	Mean Effective Dose (μSv)*
Large adult	83,8	9,5	2,2	148,0	(38,4 - 354,0)	96,3	12,7
Normal adult	79,0	9,7	2,2	156,3	(32,8 - 404,7)	163,4	13,4
Small adult	74,9	10,7	3,9	153,5	(27,6 - 276,8)	264,2	11,9
Child	64,4	9,3	1,4	91,2	(22,3 - 175,4)	150,3	6,0

\* using conversion coefficients from Looe H.K. et al (2008)

**Table 2**



**Graph 1**



**Graph 2**