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Contribution to constructing centile charts for prenatal and neonatal period of a human

Przyczynek do konstruowania siatek centylowych dla okresu prenatalnego i neonatalnego człowieka

Monitoring fetus development and early detection of developmental disorders is a very important task of developmental age medicine. According to Cieślik [2], centile charts are the best graphic presentation of one-trait developmental standards. The centile charts enable to determine the progression level of development of an individual and their position in the population. The analysis of the position of a particular point in the centile chart of a given trait enables to interpret precisely which of the examined traits has the biggest effect on their ontogenesis. At the same time the analysis allows to place an individual in appropriate "developmental channel". The childhood period is relatively well drawn up [3].

The purpose of the work is to present the centile charts for fetal and neonatal period of a human. The charts, prepared for routinely examined traits of fetuses in ultrasonography examinations and in direct measurements of infants, handed to the obstetricians and neonatologists enable proper diagnosis and monitoring of the child's development.

MATERIALS AND METHODS

The material used in the research is fetuses from miscarriage obtained from 1964 to 2003, collected in the Department of Anatomy, Wroclaw Medical University - 2472 fetuses (1278 male and 1194 female) and 2800 infants were analysed (1500 male and 1300 female).

The age of the fetuses oscillated from 84th day to 256th day, and infants from 245th day to 336th day. There were taken measurements for each individual: 1. total Body Length (BL); 2. Body Mass (BM); 3. Head Circumference (HC); 4. Thorax Circumference (ThC) and 5. Rohrer Index - Body Mass / $(B-v)^3$ x 100 (Body Mass in grams, Height in centimeters). The material was divided into 14-day age classes. In all age classes the numbers are representative. All the average values of the traits and their standard deviations were calculated to the value of the middle of age class [1]. In order to construct the centile charts by means of programmes Statistica and Statgraphics, there were marked values for each analysed feature in two week intervals 3, 10, 25, 50, 75, 90 and 95 centile.

RESULTS

Making the observation of for the joined material of male and female individuals is justified in the light of earlier works on fetuses [1] because of small dimorphic differences of the analysed traits (tab. 1-5). There are also works [4] which justify taking into account dimorphic differences in prenatal and neonatal researches. Dimorphic differences of the analysed features in case of our research were statistically unimportant and were of vague and indeterminate nature. In the context of the executed aim of the research the dimorphic differences did not influence the obtained results of the research.

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Joining fetal material from miscarriage with the material of infants born alive is also justified [2] because of the adopted procedure of both fetal and neonatal material selection.

All the analysed traits are characterized by a huge range of variability in particular age intervals. In case of younger individuals the range of the changeability is bigger.

Representative character of the analyzed material is supported by the fact that the metric traits which we analyzed increase not only in particular age intervals in accordance with the centile value gradient but they also increase with age in particular centiles. In case of Roher index one can observe decrease of its value in the first half of the examined development. Due to the indeterminate and very vague nature of its changeability, Roher index may be the least useful form the analyzed traits while evaluating the advancement of fetus and infant development.

CONCLUSIONS

1. During the fetal and neonatal period, body mass and body length, (Rohrer index) head circumference and thorax circumference are characterised by a very big changeability.
2. There were not stated any statistically important dimorphic differences in the range of analyzed features. No developmental differences between miscarried fetuses and infants born alive were stated.
3. The obtained outcome from the examination of metric features allows to use the obtained results while evaluating the advance level of fetus development and infants in the form of constructing centile charts.

Tab. 1. The value of centile charts of total body length (BL) for fetuses and infants

centyl/days	92	106	120	134	148	162	176	190	204
3%	74	111	140	165	213	220	250	284	302
10%	86	120	155	190	225	242	284	310	321
25%	91	129	168,5	205	235	260	290	319	331
50%	103	142	184	220	252	272	300	334,5	347
75%	116	152	200,5	232	265	286	310	348	362
90%	130	163	217	245	275	303	319	361	374
97%	150	178	247	270	282	315	331	370	387
centyl/days	218	232	246	260	274	288	302	316	330
3%	319	348	389	481	492	497	501	502	503
10%	326	361	416,5	491,5	501	510	511	512	513
25%	351	374	446	500	517	527	529	534	535
50%	381	390	476	516,5	532	537	544	547	548
75%	405	420	498	536	554	564	572	561	551
90%	425	471	524,5	554,5	568	583	585	586	586
97%	492	512	551	572	586	601	609	612	615

Tab. 2. The value of centile charts of body mass (BM) for fetuses and infants

centyl/days	92	106	120	134	148	162	176	190	204
3%	19	40	55	80	200	250	340	470	590
10%	22	44	80	139	240	320	461	585	672
25%	27	50	111	190	285	386	520	681	732
50%	36	64	144	245	350	450	573,5	786	835
75%	47	80	184	278	406	513	640	899	898
90%	70	105	230	330	462	590	701	1003	1097
97%	99	120	365	435	508	670	768	1091	1108
centyl/days	218	232	246	260	274	288	302	316	330
3%	750	1045	1427	2113	2600	2700	2820	2170	3120
10%	869	1134	1639	2411,5	2850	2995	3100	3005	3120
25%	945	1321	1999,5	2650	3100	3250	3350	3240	3150
50%	1078	1532	2267	2990	3350	3550	3650	3550	3250
75%	1211	1900	2432	3320	3640	3840	4000	3800	3350
90%	1327	2165	3090	3625	3850	4105	4350	3890	4590
97%	2530	2850	3520	3980	4200	4400	4650	4300	4590

Tab. 3. The value of centile charts of head circumference (HC) for fetuses and infants

centyl/days	92	106	120	134	148	162	176	190	204
3%	43	78	108	128	148	164	179	216	224
10%	47	89	115	137	156	175	197	221	234
25%	62	100	124	148	165	185	209	228	243
50%	75	109	134	155	177	195	214	239	248
75%	89	119	143	165	187	212	227	248	258
90%	100	126	154	174	198	224	243	256	269
97%	109	134	169	182	209	237	261	278	279
centyl/days	218	232	246	260	274	288	302	316	330
3%	254	267	291	300	300	301	302	310	321
10%	258	269	301	306	310	314	318	318	321
25%	267	279	310,5	317	320	321	325	327	330
50%	271	296	327,5	330	330	332	337	335	342
75%	279	313	341	342	343	344	347	346	354
90%	289	323	345	351	355	356	362	370	377
97%	318	338	351	361	364	367	376	392	397

Tab. 4. The value of centile charts of thorax circumference (ThC) for fetuses and infants

centyl/days	92	106	120	134	148	162	176	190	204
3%	43	76	100	125	141	162	178	213	224
10%	46	87	113	135	150	168	192	217	231
25%	60	98	119,5	143	162	177	204	224	237
50%	73	106	128,5	152	172	189	212	235	245,5
75%	85	116	139	162	184	206	224	245	254,5
90%	97	123	154	168	193	220	238	253	268
97%	104	131	164	176	206	234	256	278	279
centyl/days	218	232	246	260	274	288	302	316s	330
3%	247	261	289	289	298	300	304	307	324
10%	256	267	300	302	310	312	314	316	324
25%	261	278	316,5	318	319	321	324	324	324
50%	268	288	324,5	328	328	330	332	340	345
75%	276	312	333	334	340	341	345	346	346
90%	283	326	342	343,5	347	349,5	356	358	359
97%	314	334	345	352	356	362	378	384	387

Tab. 5. The value of centile charts of Rohrer index (RI) for fetuses and infants

centyl/days	92	106	120	134	148	162	176	190	204
3%	1,87	1,44	1,51	1,53	1,65	1,47	1,55	1,59	1,45
10%	2,07	1,76	1,70	1,73	1,82	1,78	1,78	1,80	1,63
25%	2,53	2,03	1,96	1,99	1,99	1,97	1,94	1,97	1,81
50%	3,19	2,36	2,27	2,23	2,16	2,22	2,11	2,13	1,98
75%	4,26	2,70	2,52	2,50	2,40	2,46	2,34	2,26	2,19
90%	5,43	3,25	2,97	2,70	2,62	2,70	2,56	2,39	2,32
97%	7,32	3,62	3,58	3,36	2,86	3,54	2,83	2,52	2,73
centyl/days	218	232	246	260	274	288	302	316	330
3%	1,31	1,69	1,55	1,66	1,71	1,71	1,75	1,68	1,94
10%	145	1,98	1,75	1,84	1,87	1,89	1,86	1,75	1,99
25%	1,69	2,26	1,93	1,96	2,02	2,00	1,98	1,98	2,29
50%	1,84	2,72	2,41	2,12	2,21	2,17	2,12	2,18	2,31
75%	1,98	3,33	2,45	2,28	2,38	2,36	2,31	2,45	2,41
90%	2,13	3,76	2,66	2,41	2,53	2,53	2,51	2,50	2,48
97%	2,33	4,18	3,05	2,67	2,76	2,74	2,72	2,66	2,48

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SUMMARY

Centile charts are the best graphic presentation of evaluating the level of development of an individual and they are determinants of an individual's position in the population. The aim of this study is an attempt to evaluate developmental changes in fetuses and infants in 14-day age intervals in the context of constructing centile charts. The research was conducted on the archival material of 2472 fetuses and on 2800 infants at the age of - from 84 to 336 days. For each individual the following measurements were taken: total body length and mass, head and thorax circumference and Rohrer index. The study showed that during the prenatal and neonatal period the analysed measure features are characterised by a very big changeability. There were not stated any statistically important dimorphic differences in the range of analysed features. There were not stated any developmental differences between miscarried fetuses and infants born alive. Therefore, it was possible to join the material of fetuses and infants regardless of their sex. The obtained outcome from the examination of metric features allows to using the obtained results while evaluating the advance level of fetus development and infants in the form of constructing centile charts.

STRESZCZENIE

Siatki centylowe są najlepszym graficznym obrazem określenia stopnia zaawansowania w rozwoju osobnika oraz wyznacznikiem jego miejsca w populacji. Celem pracy jest próba oceny zmian rozwojowych płodów i noworodków w 14 dniowych interwałach wiekowych w kontekście skonstruowania siatek centylowych. Badania przeprowadzono na materiale archiwalnym 2472 płodów oraz na 2800 noworodków wrocławskich w wieku od 84 do 336 dnia. Dla każdego osobnika wykonane zostały następujące pomiary: całkowita długość i masa ciała, obwód głowy i klatki piersiowej oraz wskaźnik Rohrera. Stwierdzono, że w okresie płodowym i noworodkowym analizowane cechy pomiarowe odznaczają się bardzo dużą zmiennością. Nie zaobserwowano istotnych statystycznie różnic dymorficznych w zakresie analizowanych cech. Nie stwierdzono różnic rozwojowych między poronionymi płodami, a żywo urodzonymi noworodkami. Uzyskane rezultaty badań cech metrycznych upoważniają do wykorzystania uzyskanych wyników przy ocenie zaawansowania rozwoju płodów i noworodków w formie skonstruowania siatek centylowych.