Cardiology in the Young (2009), **19**, 657–658
doi:10.1017/S1047951109991399

Reply to the 'Letter to the Editor'

First published online: 13 August 2009

Sir,

We thank Professor Mocellin for his letter concerning our article entitled "A practical and transferable new protocol for treadmill testing of children and adults".[1] In this letter, he questions whether the population we chose when making our comparison meets the demands to be expected for normal controls. He wonders whether the part of the study relating to the children is representative.

We had recognised the problems existing in choosing an adequate control population. Our 849 healthy volunteers younger then 18 years of age had already been examined. The distribution of their ages is now shown in Tables 1 and 2 below. We exclude anyone expressing apprehension of the test, which proved the case for some of those attending kindergarten. Despite these exclusions, 68 children younger than 7 years of age, with the youngest being 35 months of age, successfully performed lung function testing, exercise tests and at least 3 gas checks, including measurements of lactate. It is hardly surprising that some young children attending kindergarten refused to participate, were not able to attend, or else found difficulty in understand the instructions offered by the nurses and physicians. We also excluded trained athletes. Those participating in sports at school or in their leisure time, including adults, nonetheless, were included in the study. We recognize, therefore, that there were limitations with our chosen sample. It remains the case, nonetheless, that any study providing standard values requires volunteers. In our opinion, the pre-existing standard values were unsuitable for making comparisons with either children or the elderly. Those existing standards are impractical, unreproducible, and based on very small samples. Before starting our study, therefore, we made a maximum likelihood estimate, calculating percentiles by means of the LMS-Method[2]. Bodily features, such as weight and height, had already been compared to available nomograms.[3–5]

Table 1. Uptake of oxygen at ventilatory threshold related to the square of the measured height.

	Male		Female	
Age [years]	n	Oxygen uptake at ventilatory threshold/height^2 [l min^{-1} m^{-2}]	n	Oxygen uptake at ventilatory threshold/height^2 [l min^{-1} m^{-2}]
3–4	12	0.487 ± 0.110	3	0.392 ± 0.116
5	15	0.501 ± 0.136	9	0.449 ± 0.107
6	13	0.517 ± 0.142	16	0.472 ± 0.132
7	29	0.546 ± 0.154	21	0.520 ± 0.137
8	30	0.539 ± 0.154	21	0.511 ± 0.155
9	40	0.573 ± 0.163	26	0.542 ± 0.151
10	39	0.580 ± 0.156	34	0.535 ± 0.139
11	65	0.612 ± 0.158	45	0.543 ± 0.128
12	71	0.626 ± 0.173	46	0.551 ± 0.133
13	38	0.658 ± 0.189	29	0.577 ± 0.157
14	26	0.733 ± 0.233	21	0.610 ± 0.151
15	28	0.761 ± 0.238	34	0.601 ± 0.157
16	23	0.807 ± 0.240	18	0.590 ± 0.136
17	24	0.796 ± 0.233	8	0.586 ± 0.147
18	10	0.838 ± 0.227	19	0.626 ± 0.138
19–21	16	0.811 ± 0.230	20	0.618 ± 0.146
22–25	9	0.793 ± 0.201	24	0.631 ± 0.157
26–30	14	0.792 ± 0.172	16	0.630 ± 0.151
31–40	52	0.797 ± 0.170	63	0.627 ± 0.155
41–50	55	0.797 ± 0.174	38	0.622 ± 0.145
51–60	17	0.771 ± 0.182	15	0.599 ± 0.143
>61	21	0.745 ± 0.191	22	0.593 ± 0.119

Table 2. Peak uptake of oxygen related to the square of the measured height.

	Male		Female	
Age [years]	n	Peak oxygen uptake/height^2 [l min^{-1} m^{-2}]	n	Peak oxygen uptake/height^2 [l min^{-1} m^{-2}]
3–4	12	0.617 ± 0.131	3	0.561 ± 0.167
5	15	0.651 ± 0.152	9	0.659 ± 0.181
6	13	0.721 ± 0.138	16	0.699 ± 0.165
7	29	0.766 ± 0.141	21	0.738 ± 0.146
8	30	0.786 ± 0.129	21	0.758 ± 0.129
9	40	0.818 ± 0.135	26	0.774 ± 0.117
10	39	0.824 ± 0.123	34	0.773 ± 0.114
11	65	0.858 ± 0.137	45	0.766 ± 0.111
12	71	0.877 ± 0.148	46	0.780 ± 0.130
13	38	0.922 ± 0.157	29	0.804 ± 0.146
14	26	0.996 ± 0.208	21	0.835 ± 0.158
15	28	1.048 ± 0.209	34	0.833 ± 0.141
16	23	1.105 ± 0.219	18	0.810 ± 0.129
17	24	1.125 ± 0.184	8	0.829 ± 0.137
18	10	1.188 ± 0.180	19	0.851 ± 0.143
19–21	16	1.193 ± 0.180	20	0.858 ± 0.143
22–25	9	1.215 ± 0.188	24	0.870 ± 0.147
26–30	14	1.241 ± 0.189	16	0.864 ± 0.149
31–40	52	1.207 ± 0.186	63	0.851 ± 0.152
41–50	55	1.180 ± 0.201	38	0.837 ± 0.142
51–60	17	1.101 ± 0.200	15	0.795 ± 0.135
>61	21	1.014 ± 0.207	22	0.782 ± 0.123

Professor Mocellin suggests that we should have used values for peak consumption of oxygen related to standard values for height. This is a good suggestion, and such values have already been calculated by our working group for peak uptake, and uptake of oxygen at the ventilatory threshold (see supporting files on the website – Figs 1–4). We also agree that the square of the measurement of height is an appropriate reference parameter for standard values of peak uptake of oxygen. This is true for children, but would be wrong when considering the elderly (see Tables 1 and 2). Our data are in keeping with that suggested by Mocellin when considering the paediatric age group[6]. But we investigated exercise performance in a healthy Caucasian population ranging in age from 4 to 75 years. In common practice, consumption of oxygen is related to body mass. Our intention was to create a practical exercise protocol suitable for each age group, thus providing physicians with a helpful tool in the form of percentiles with which they could compare performance during the entire growth and aging of the individual.

Last, but not least, exercise testing, especially ergospirometry, is very difficult to practice and interpret, especially in children or the elderly. In this respect, it remains my own opinion that we have been successful in providing a practical solution to this difficult topic. For those who require them, we also have available many more centile curves relating to ventilatory parameters and gas exchange. I will be more than happy to supply them to interested parties.

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References

1. Dubowy KO, Baden W, Bernitzki S, Peters B. A practical and transferable new protocol for treadmill testing of children and adults. Cardiol Young 2008; 18: 615–623.
2. Cole TJ, Green PJ. Smoothing reference centile curves: The LMS method and penalized likelihood. Statistics in medicine 1992; 11: 1305–1319.
3. Hesse V, Jaeger U, Vogel H. Wachstumsdaten deutscher Kinder von der Geburt bis zu 18 Jahren. Sozialpädiatrie 1997; 20: 20–29.
4. Hesse V, Voigt M, Sälzler A. Alterations in height, weight, and body mass index of newborns, children, and young adults in eastern Germany after German reunification. J Pediatr 2003; 142: 259–262.
5. Komlos J, Kriwy P. Social status and adult heights in the two Germanies. Ann Hum Biol 2002; 29: 641–648.
6. Mocellin R. Exercise testing in pediatric cardiology. In: Torg JS, Welsh RP, Shephard RJ (eds) Current therapy in sports medicine- 2. BC Decker, Philadelphia, 1990, pp 34–39.

https://doi.org/10.1017/S1047951109991399 Published online by Cambridge University Press