

SPORTSTAF – 30/09/2009

VO₂metingen

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Historiek VO_2 - meting

- 1923: Hill et al. – introductie begrip VO_2 max
'grens aan vermogen om zuurstof op te nemen'

Hill, A. V. and H. Lupton, Muscular exercise, lactic acid, and the supply and utilization of oxygen. Q. J. Med. 16:135-171, 1923

Christensen:

\neq HF bij = arbeid bij \neq personen \rightarrow

\searrow HF bij = arbeid bij = personen \rightarrow training

Meting

- Open circuit spirometrie
 - omgevingslucht ingeademd
 - uitgeademde lucht geanalyseerd op volume (V), [O₂] en [CO₂], T



Criteria VO_2max

1. Plateau in VO_2 ondanks toename belasting



Criteria VO_2max

2. $\text{RER} = \text{VCO}_2 / \text{VO}_2 > 1.10$

3. $[\text{La}] > 8 \text{ mmol/l}$

4. Meting over min 30 sec (liefst 60 sec).

5. Testprocedure:

8 min (minimaal) – 12 min (optimaal)

stapsgewijze belasting – lineair toenemende
belasting

Andere criteria:

- $V_E > 80 \text{ l/min}$ (vrouwen) – 100 l/min (mannen)

- pp voldoende uitgerust, gezond en niet nuchter (of glycogeedepleteerd) getest wordt

Meetfouten

Table 8.3 The Effect of Likely Variation in Ventilation, Gas Percentages in Dry Expirate, Temperature, Barometric Pressure, and Relative Humidity (RH) Upon Calculated Indirect Calorimetry Values

Likely error	F _E O ₂ (% v/v)	F _E CO ₂ (% v/v)	Ṡ _I AIP (L/min)	Ṡ _I STPD (L/min)	Ṡ _E BTPS (L/min)	Ṡ _E SIPD (L/min)	ṠO ₂ (L/min)	Error in ṠO ₂ versus reference values (%)	ṠCO ₂ (L/min)	R	Temp (°C)	P bar (mm Hg)	RH (%)
Reference values	17.51	3.79	150.00	136.10	166.63	136.70	4.542	0.00	5.146	1.133	22.0	755.0	50.0
+5% Ṡ _I	17.51	3.79	<i>157.50</i>	142.90	174.96	143.53	4.770	+5.00	5.403	1.133	22.0	755.0	50.0
+1% F _E O ₂	<i>17.69</i>	3.79	150.00	136.10	167.00	137.00	4.249	-6.46	5.158	1.214	22.0	755.0	50.0
+1% F _E CO ₂	17.51	<i>3.83</i>	150.00	136.10	166.71	136.76	4.532	-0.23	5.195	1.146	22.0	755.0	50.0
+1% P bar	17.51	3.79	150.00	137.48	166.54	138.08	4.589	+1.01	5.198	1.133	22.0	<i>762.55</i>	50.0
+1% temp	17.51	3.79	150.00	135.99	166.51	136.60	4.539	-0.07	5.142	1.133	<i>22.22</i>	755.0	50.0
+1% RH/pH ₂ O	17.51	3.79	150.00	136.08	166.61	136.68	4.542	-0.02	5.145	1.133	22.0	755.0	<i>50.5</i>
Cumulative error Ṡ _I +5% and F _E O ₂ -1%	<i>17.34</i>	3.79	<i>157.50</i>	142.88	174.55	143.19	5.076	<i>+11.73</i>	5.390	1.062	22.0	755.0	50.0

*Reference values are shown in **bold** and the variable that has been altered in subsequent analyses is shown in **bold italics**.

Variabelen: V_I, V_E, O_{2i}, O_{2e}, CO_{2i}, CO_{2e}, T, P_{bar}, P_{H2O}

→ Calibratie gassen: wekelijks (minstens)

→ Calibratie volumes: dagelijks

Voorbeeld: 5% meetfout in volume + 1% meetfout in [O_{2E}] = +11.7% VO₂ !!

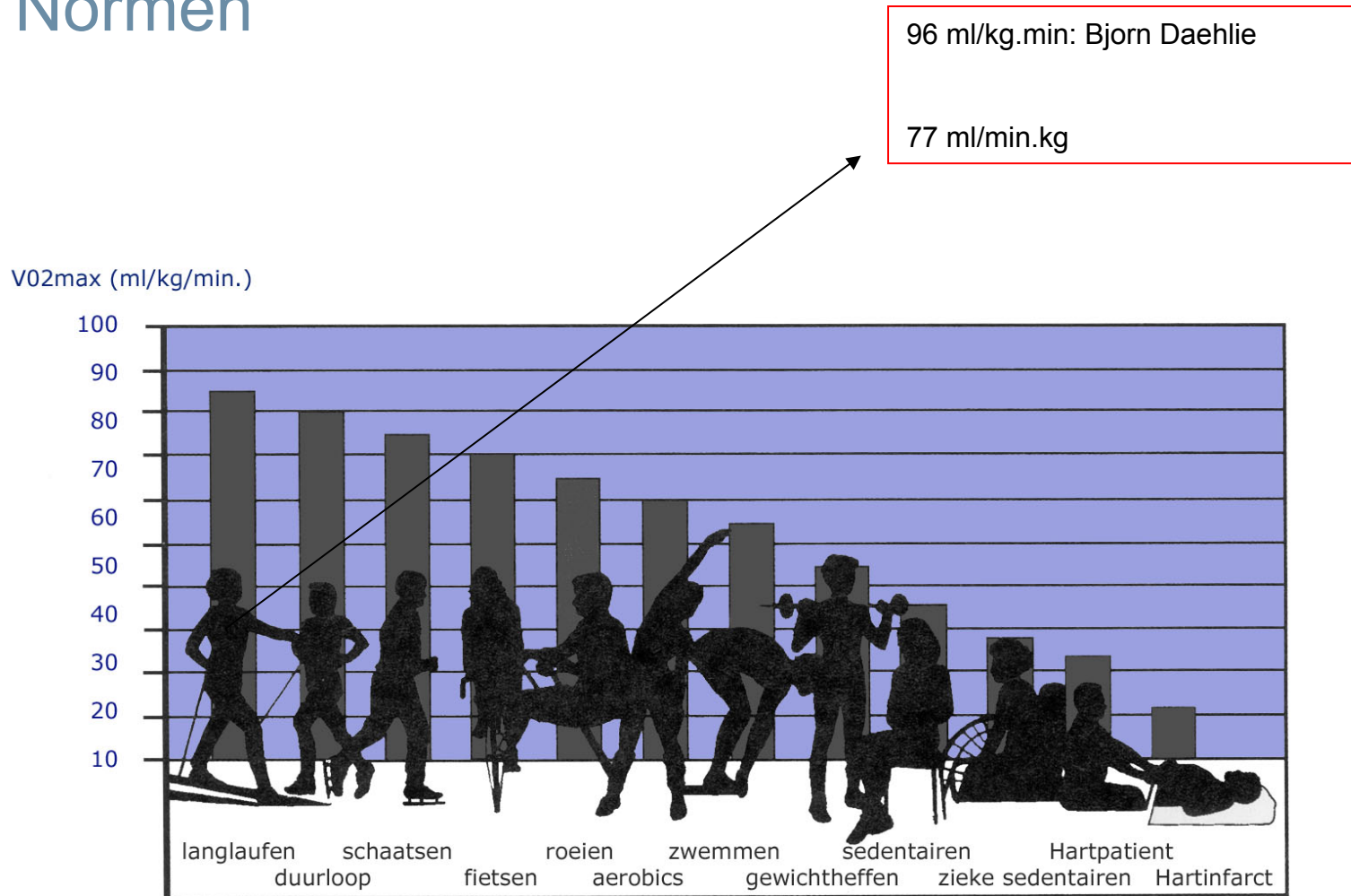
Biologische variabiliteit Technische meetfout

- Interindividuele meetfout:
 - pp moet test 'kennen' → Variabiliteit: $\pm 2 - 3\%$
 - pp moet sportspecifiek getest worden
(hoogste VO_2 → meeste spiermassa)
- Apparatuur: ideaal 2%, vaak 5% !

Conclusie: 5% meetfout is normaal!

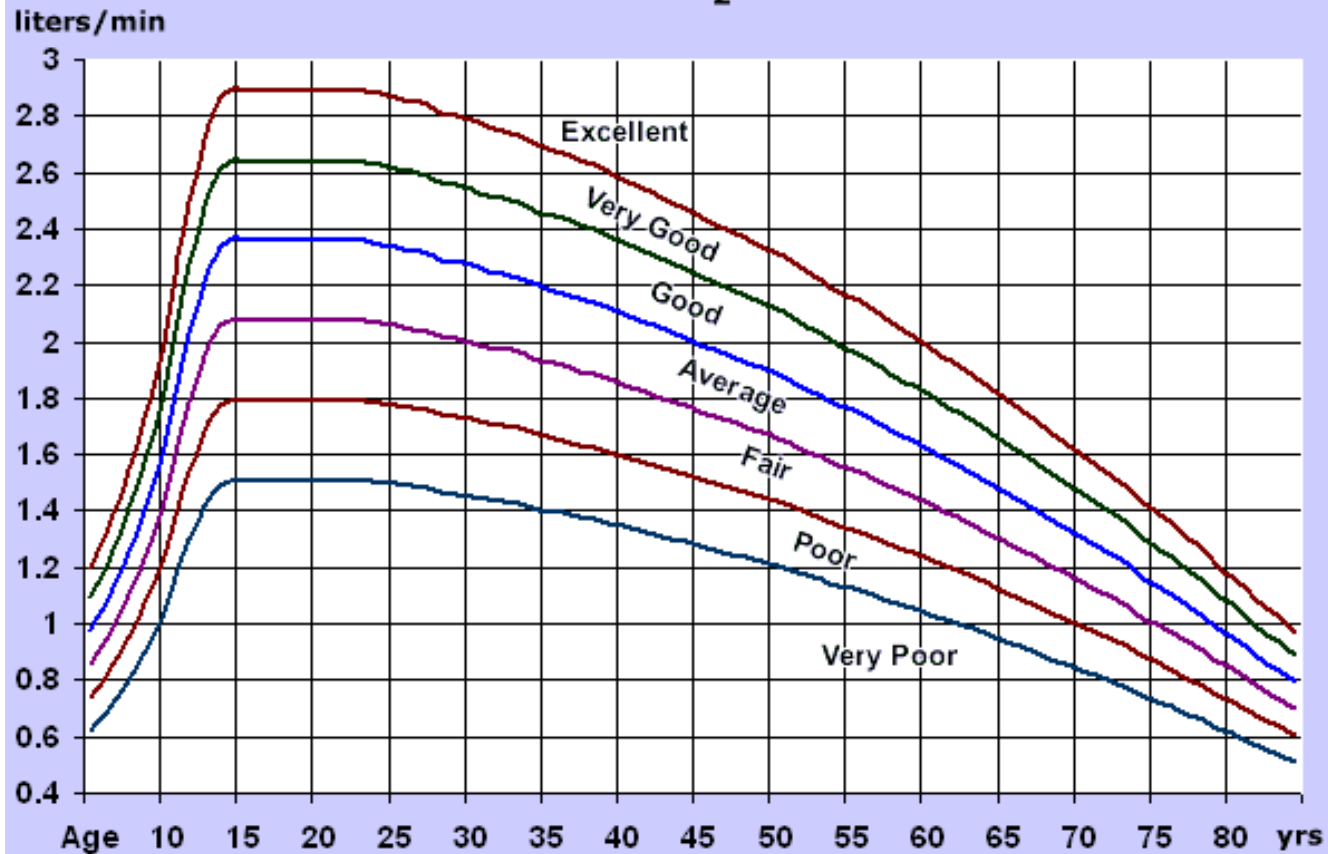
Ref. Physiological tests for elite athletes – ISBN 0-7360-0326-6

Normen



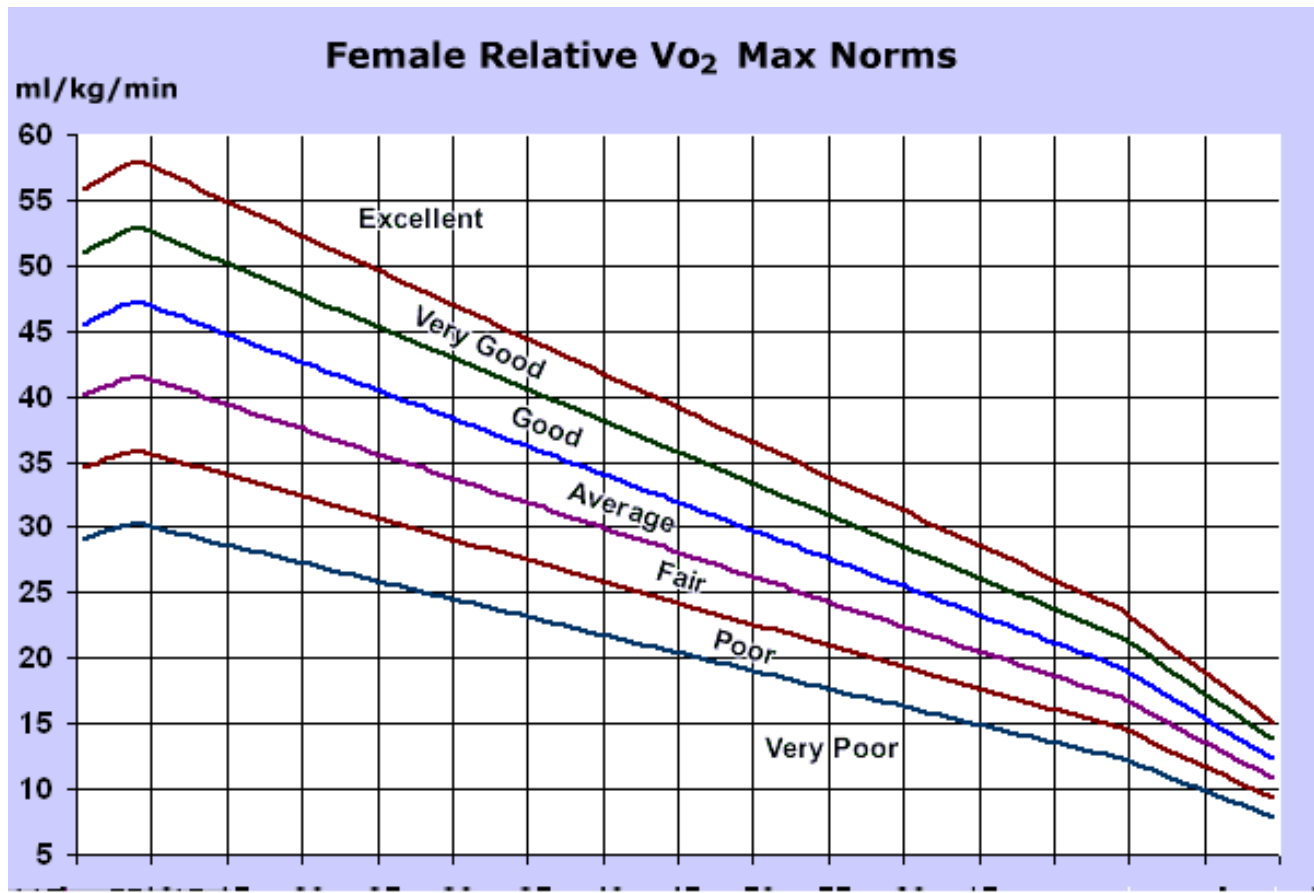
Opm: min. 25 tot 40% VO_2 max is genetisch bepaald (Claude Bouchard, Robert M. Malina, Louis Pérusse, Genetics of fitness and physical performance, Human Kinetics, 1999)

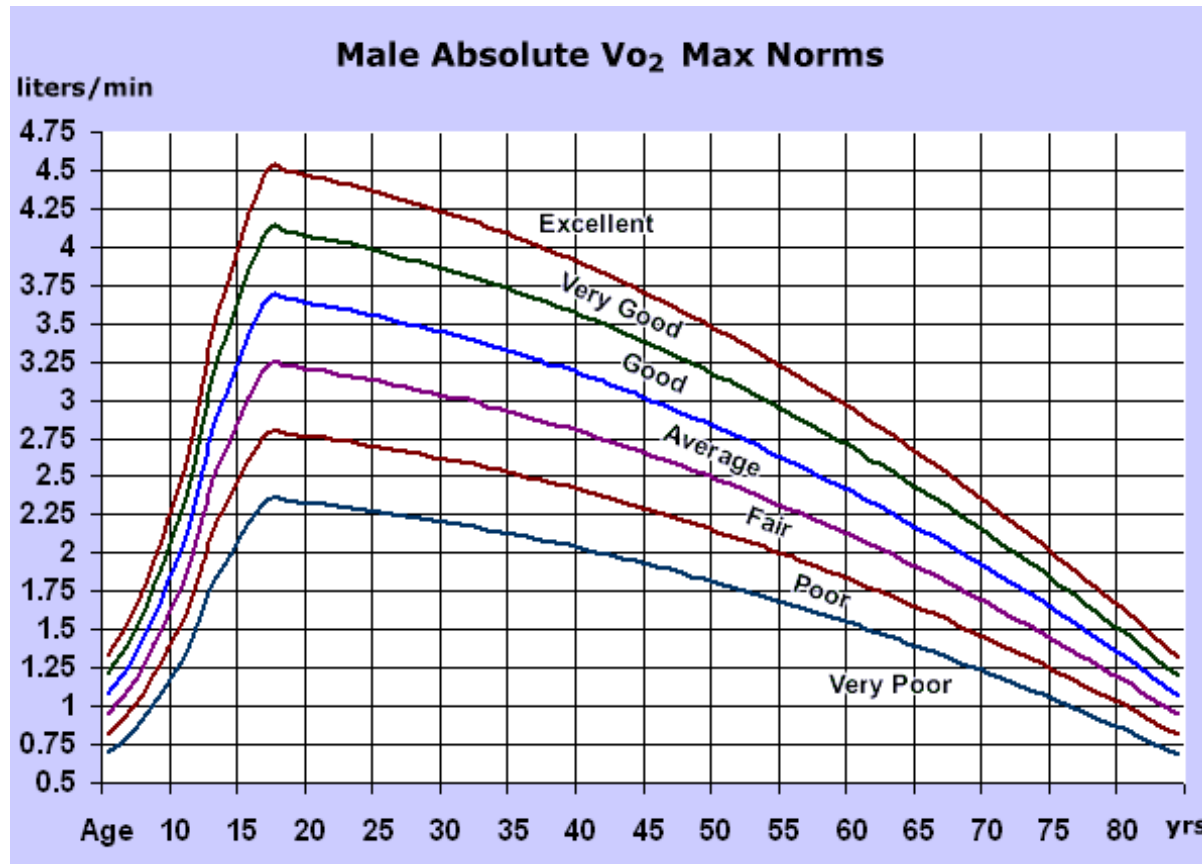
Female Absolute Vo₂ Max Norms

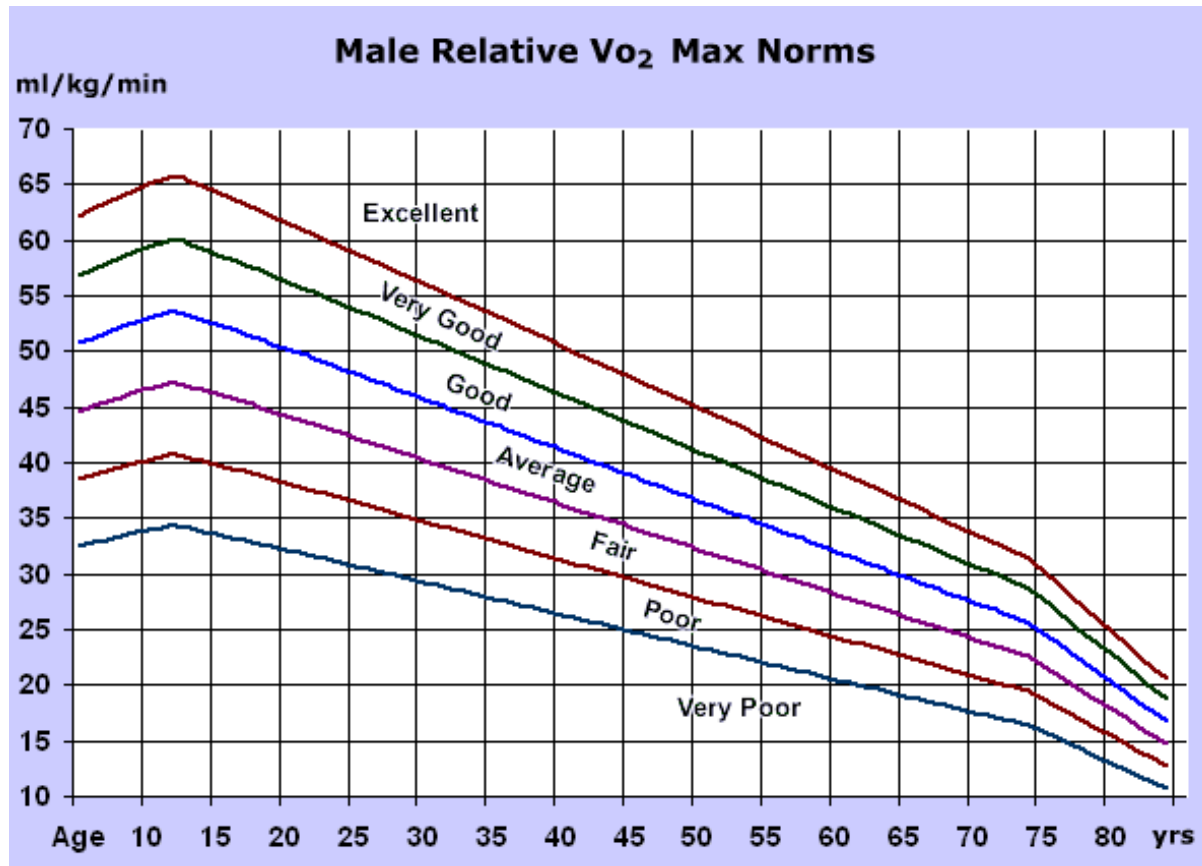


Shvartz E, R.C. Reibold. *Aerobic Fitness Norms For Males And Females Aged 6-75: A review.*

Aviation, Space and Environmental Medicine. 61:3-11,1990





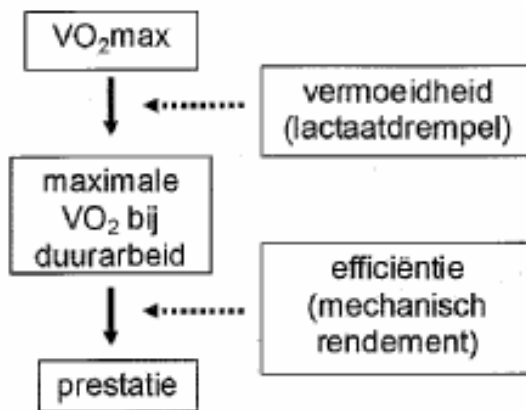


Normen

Referentiewaarden Maximale zuurstofopname (VO ₂ max, in ml.kg ⁻¹ .min ⁻¹)									
			Zwak	Zeer matig	Matig	Gemiddeld	Goed	Z. Goed	Uitstekend
			1	2	3	4	5	6	7
		Leeftijd							
Mannen		20–24	32	32–37	38–43	44–50	51–56	57–62	>62
		25–29	31	32–35	36–42	43–48	49–53	54–59	>59
		30–34	29	29–34	35–40	41–45	46–51	52–56	>56
		35–39	28	28–32	33–38	39–43	44–48	49–54	>54
		40–44	26	26–31	32–35	36–41	42–46	47–51	>51
		45–49	25	25–29	30–34	35–39	40–43	44–48	>48
		50–54	24	24–27	28–32	33–36	37–41	42–46	>46
		55–59	22	22–26	27–30	31–34	35–39	40–43	>43
		60–65	21	21–24	25–28	29–32	33–36	37–40	>40
Vrouwen		20–24	27	27–31	32–36	37–41	42–46	47–51	>51
		25–29	26	26–30	31–35	36–40	41–44	45–49	>49
		30–34	25	25–29	30–33	34–37	38–42	43–46	>46
		35–39	24	24–27	28–31	32–35	36–40	41–44	>44
		40–44	22	22–25	26–29	30–33	34–37	38–41	>41
		45–49	21	21–23	24–27	28–31	32–35	36–38	>38
		50–54	19	19–22	23–25	26–29	30–32	33–36	>36
		55–59	18	18–20	21–23	24–27	28–30	31–33	>33
		60–65	16	16–18	19–21	22–24	25–27	28–30	>30

Besluit

- Nut van de meting
 - situering van de sporter
 - meting mechanische efficiëntie
 - aanvullende informatie op lactaatmeting



Bron: Sportgericht, nr 2, 2009

