

## HbA<sub>1c</sub> according to different standards

$$\begin{aligned} \text{DCCT} &= 0.09148 \text{ IFCC} + 2.152, & \text{IFCC} &= 10.93 \text{ DCCT} - 23.5, \\ \text{Mono-S} &= 0.0957 \text{ IFCC} + 1.016, & \text{IFCC} &= 10.45 \text{ Mono-S} - 10.62, \\ \text{JDS} &= 0.09274 \text{ IFCC} + 1.724, & \text{IFCC} &= 10.78 \text{ JDS} - 18.59. \end{aligned}$$

IFCC is an international standard (given in mmol/mol, but which has sometimes been given in percentage, i.e. one tenth of the values here). DCCT is an American standard also called NGSP. Mono-S is a Swedish standard. JDS is a Japanese standard also called JSCC. The formulas come from [1] (see also [2]). However, for Mono-S the newer Swedish recommendations from [3] have been used.

Also estimates for the average blood glucose levels corresponding to a given HbA<sub>1c</sub> are given below. These estimates, which come from [4], are considerable more uncertain, but they are the best available today. (In particular, it has *not* been investigated how correct they are for children.) The formula used here is

$$18 \times \text{Average blood glucose in mmol/l} = \text{Average blood glucose in mg/dl} = 28.7 \text{ DCCT} - 46.7.$$

Glucose levels are measured in mg/dl in America and in mmol/l in Europe.

HbA <sub>1c</sub>				Average blood glucose	
IFCC	Mono-S	DCCT	JDS	mmol/l	mg/dl
20.0	2.93	3.98	3.58	3.76	67.6
21.0	3.03	4.07	3.67	3.90	70.2
22.0	3.12	4.16	3.76	4.05	72.8
23.0	3.22	4.26	3.86	4.19	75.4
24.0	3.31	4.35	3.95	4.34	78.1
25.0	3.41	4.44	4.04	4.48	80.7
26.0	3.50	4.53	4.14	4.63	83.3
27.0	3.60	4.62	4.23	4.78	85.9
28.0	3.70	4.71	4.32	4.92	88.6
29.0	3.79	4.80	4.41	5.07	91.2
30.0	3.89	4.90	4.51	5.21	93.8
31.0	3.98	4.99	4.60	5.36	96.4
32.0	4.08	5.08	4.69	5.51	99.1
33.0	4.17	5.17	4.78	5.65	101.7
34.0	4.27	5.26	4.88	5.80	104.3
35.0	4.37	5.35	4.97	5.94	106.9
36.0	4.46	5.45	5.06	6.09	109.6
37.0	4.56	5.54	5.16	6.24	112.2
38.0	4.65	5.63	5.25	6.38	114.8
39.0	4.75	5.72	5.34	6.53	117.4
40.0	4.84	5.81	5.43	6.67	120.1
41.0	4.94	5.90	5.53	6.82	122.7
42.0	5.04	5.99	5.62	6.96	125.3

HbA <sub>1c</sub>				Average blood glucose	
IFCC	Mono-S	DCCT	JDS	mmol/l	mg/dl
43.0	5.13	6.09	5.71	7.11	127.9
44.0	5.23	6.18	5.80	7.26	130.6
45.0	5.32	6.27	5.90	7.40	133.2
46.0	5.42	6.36	5.99	7.55	135.8
47.0	5.51	6.45	6.08	7.69	138.4
48.0	5.61	6.54	6.18	7.84	141.1
49.0	5.71	6.63	6.27	7.99	143.7
50.0	5.80	6.73	6.36	8.13	146.3
51.0	5.90	6.82	6.45	8.28	148.9
52.0	5.99	6.91	6.55	8.42	151.6
53.0	6.09	7.00	6.64	8.57	154.2
54.0	6.18	7.09	6.73	8.72	156.8
55.0	6.28	7.18	6.82	8.86	159.4
56.0	6.38	7.27	6.92	9.01	162.1
57.0	6.47	7.37	7.01	9.15	164.7
58.0	6.57	7.46	7.10	9.30	167.3
59.0	6.66	7.55	7.20	9.45	169.9
60.0	6.76	7.64	7.29	9.59	172.6
61.0	6.85	7.73	7.38	9.74	175.2
62.0	6.95	7.82	7.47	9.88	177.8
63.0	7.05	7.92	7.57	10.03	180.4
64.0	7.14	8.01	7.66	10.17	183.1
65.0	7.24	8.10	7.75	10.32	185.7
66.0	7.33	8.19	7.84	10.47	188.3
67.0	7.43	8.28	7.94	10.61	190.9
68.0	7.52	8.37	8.03	10.76	193.6
69.0	7.62	8.46	8.12	10.90	196.2
70.0	7.72	8.56	8.22	11.05	198.8
71.0	7.81	8.65	8.31	11.20	201.4
72.0	7.91	8.74	8.40	11.34	204.1
73.0	8.00	8.83	8.49	11.49	206.7
74.0	8.10	8.92	8.59	11.63	209.3
75.0	8.19	9.01	8.68	11.78	211.9
76.0	8.29	9.10	8.77	11.93	214.6
77.0	8.38	9.20	8.86	12.07	217.2
78.0	8.48	9.29	8.96	12.22	219.8
79.0	8.58	9.38	9.05	12.36	222.4
80.0	8.67	9.47	9.14	12.51	225.1
81.0	8.77	9.56	9.24	12.65	227.7
82.0	8.86	9.65	9.33	12.80	230.3
83.0	8.96	9.74	9.42	12.95	232.9
84.0	9.05	9.84	9.51	13.09	235.6
85.0	9.15	9.93	9.61	13.24	238.2

HbA <sub>1c</sub>				Average blood glucose	
IFCC	Mono-S	DCCT	JDS	mmol/l	mg/dl
86.0	9.25	10.02	9.70	13.38	240.8
87.0	9.34	10.11	9.79	13.53	243.4
88.0	9.44	10.20	9.89	13.68	246.1
89.0	9.53	10.29	9.98	13.82	248.7
90.0	9.63	10.39	10.07	13.97	251.3
91.0	9.72	10.48	10.16	14.11	253.9
92.0	9.82	10.57	10.26	14.26	256.6
93.0	9.92	10.66	10.35	14.41	259.2
94.0	10.01	10.75	10.44	14.55	261.8
95.0	10.11	10.84	10.53	14.70	264.4
96.0	10.20	10.93	10.63	14.84	267.1
97.0	10.30	11.03	10.72	14.99	269.7
98.0	10.39	11.12	10.81	15.14	272.3
99.0	10.49	11.21	10.91	15.28	274.9
100.0	10.59	11.30	11.00	15.43	277.6
101.0	10.68	11.39	11.09	15.57	280.2
102.0	10.78	11.48	11.18	15.72	282.8
103.0	10.87	11.57	11.28	15.86	285.4
104.0	10.97	11.67	11.37	16.01	288.1
105.0	11.06	11.76	11.46	16.16	290.7
106.0	11.16	11.85	11.55	16.30	293.3
107.0	11.26	11.94	11.65	16.45	295.9
108.0	11.35	12.03	11.74	16.59	298.6
109.0	11.45	12.12	11.83	16.74	301.2
110.0	11.54	12.21	11.93	16.89	303.8
111.0	11.64	12.31	12.02	17.03	306.4
112.0	11.73	12.40	12.11	17.18	309.1
113.0	11.83	12.49	12.20	17.32	311.7
114.0	11.93	12.58	12.30	17.47	314.3
115.0	12.02	12.67	12.39	17.62	316.9
116.0	12.12	12.76	12.48	17.76	319.6
117.0	12.21	12.86	12.57	17.91	322.2
118.0	12.31	12.95	12.67	18.05	324.8
119.0	12.40	13.04	12.76	18.20	327.4
120.0	12.50	13.13	12.85	18.35	330.1
121.0	12.60	13.22	12.95	18.49	332.7
122.0	12.69	13.31	13.04	18.64	335.3
123.0	12.79	13.40	13.13	18.78	337.9
124.0	12.88	13.50	13.22	18.93	340.6
125.0	12.98	13.59	13.32	19.07	343.2
126.0	13.07	13.68	13.41	19.22	345.8
127.0	13.17	13.77	13.50	19.37	348.4
128.0	13.27	13.86	13.59	19.51	351.1

HbA <sub>1c</sub>				Average blood glucose	
IFCC	Mono-S	DCCT	JDS	mmol/l	mg/dl
129.0	13.36	13.95	13.69	19.66	353.7
130.0	13.46	14.04	13.78	19.80	356.3
131.0	13.55	14.14	13.87	19.95	358.9
132.0	13.65	14.23	13.97	20.10	361.6
133.0	13.74	14.32	14.06	20.24	364.2
134.0	13.84	14.41	14.15	20.39	366.8
135.0	13.94	14.50	14.24	20.53	369.4
136.0	14.03	14.59	14.34	20.68	372.1
137.0	14.13	14.68	14.43	20.83	374.7
138.0	14.22	14.78	14.52	20.97	377.3
139.0	14.32	14.87	14.61	21.12	379.9
140.0	14.41	14.96	14.71	21.26	382.6
141.0	14.51	15.05	14.80	21.41	385.2
142.0	14.61	15.14	14.89	21.55	387.8
143.0	14.70	15.23	14.99	21.70	390.4
144.0	14.80	15.33	15.08	21.85	393.1
145.0	14.89	15.42	15.17	21.99	395.7
146.0	14.99	15.51	15.26	22.14	398.3
147.0	15.08	15.60	15.36	22.28	400.9
148.0	15.18	15.69	15.45	22.43	403.6
149.0	15.28	15.78	15.54	22.58	406.2
150.0	15.37	15.87	15.64	22.72	408.8
151.0	15.47	15.97	15.73	22.87	411.4
152.0	15.56	16.06	15.82	23.01	414.1
153.0	15.66	16.15	15.91	23.16	416.7
154.0	15.75	16.24	16.01	23.31	419.3
155.0	15.85	16.33	16.10	23.45	421.9
156.0	15.95	16.42	16.19	23.60	424.6
157.0	16.04	16.51	16.28	23.74	427.2

## References

- [1] A. GEISTANGER ET AL., Statistical methods for monitoring the relationship between the IFCC reference measurement procedure for hemoglobin A1c and the designated comparison methods in the United States, Japan, and Sweden, *Clinical Chemistry* August 2008;54(8):1379–1385. <http://www.clinchem.org/content/54/8/1379>
- [2] IFCC Standardization of HbA<sub>1c</sub>, <http://www.ngsp.org/ifccngsp.asp>
- [3] P. BJELLERUP ET AL., Genomförande av IFCC-kalibreringen för HbA<sub>1c</sub>-rekommendationer från SFKK och EQUALIS Revision 1 2010-08-26, [http://www.equalis.se/media/19964/rekommendationerhba1c\\_kalibrering2010.pdf](http://www.equalis.se/media/19964/rekommendationerhba1c_kalibrering2010.pdf)
- [4] D. M. NATHAN ET AL., Translating the A1C Assay Into Estimated Average Glucose Values, *Diabetes Care* August 2008;31(8):1473–1478. <http://care.diabetesjournals.org/content/31/8.toc>