

BodyComp™ Analysis

FLUID ANALYSIS

Total Body Water (TBW)

All the water within a person's body, including both intracellular and extracellular fluid. Expressed as volume (liters or pints) and percentage of total weight (%).

Why TBW is important: TBW is impacted by weight gain or loss, as well as disease conditions such as chronic kidney disease. Low TBW does not necessarily mean a person is dehydrated, but can be an indicator. Obese patients will have a lower TBW% as fat contains less water than muscle. It is important to observe any changes over time.

Extracellular Fluid (ECF)

All fluid that is not contained within the cells. Expressed as volume (liters or pints) and percentage of TBW (%).

Why ECF is important: Excess ECF is associated edema or swelling and an increases in ECF as a percentage of TBW can reveal this. Excess ECF can be indicative of disease, nutritional imbalance, heart failure, etc.

Intracellular Fluid (ICF)

All fluid contained within the cells. Expressed as volume (liters or pints) and percentage of TBW (%).

Why ICF is important: ICF is the majority of water in healthy adults. Muscle is ~75% water and makes up 50% of lean body mass. Fat is ~10% water. Decreases are associated with reductions in muscle mass, especially in the elderly and obese.

Hy-Dex® Hydration Analysis

Represents fluid status compared to a healthy population dataset. Impedance outputs are matched to data using age, gender, height and weight. A positive number indicates that a person is more hydrated and a negative number indicates that a person is less hydrated.

Why Hy-Dex is important: Hy-Dex provides an indication of hydration status (but does not diagnose hydration or dehydration).

TISSUE ANALYSIS

Skeletal Muscle Mass (SMM)

Includes all muscle that mechanically pulls on bones to create movement. Does not include cardiac or smooth muscle. Expressed in kgs or lbs and percentage of total weight (%).

Why SMM is important: Optimal levels of muscle are associated with reduced risk of health decline. SMM decreases with age (sarcopenia), with poor nutrition (sarcopenia), and can be exacerbated by disease (cachexia) such as cancer, CHF, COPD. Low SMM increases frailty and may lead to osteoporosis, decreased independence, low quality of life. Once SMM is lost in an older patient, it is very difficult to get back. It is important to assess changes in SMM over time.

Fat Mass (FM)

The amount of mass a person has that is made up of fat. Expressed in kgs or lbs and percentage of total weight (%).

Why FM is important: Excess fat is linked to sedentary lifestyle and nutritional choices. High FM increases the risk of diseases such as diabetes, hypertension, heart disease, some cancers, kidney disease, etc. In contrast, low FM can be associated with malnutrition in some patients; it should be considered in context.

Fat Free Mass (FFM)

The amount of mass a person has that contains no fat (lean body mass). Includes muscle, connective tissue, organs, body water and bone. Expressed in kgs or lbs and percentage of total weight (%).

Why FFM is important: FFM could go up due to increased muscle or water retention; it is important to assess FFM along with fluid. If FFM changes over time, take a deeper look at the individual components of FFM.

Protein & Minerals

Dry Lean Mass, including muscle, organs and bone. Protein & Minerals can be thought of as Fat Free Mass minus Total Body Water. Expressed in kgs or lbs and percentage of total weight (%).

Why Protein & Minerals is important: The human body uses proteins and minerals as “building blocks”. Muscle is primarily protein and bone is primarily minerals so a change in this metric could indicate a change in either of these. Important to observe changes over time. If Protein and Minerals is increasing, this is positive. If decreasing, this is concerning and additional metrics such as Skeletal Muscle Mass should be investigated in more detail.

Active Tissue Mass (ATM)

All metabolically active tissues in the body, including ICF, muscle, organs, and nervous tissue. ATM (which is inside the cells) + ECM (which is outside the cells) = FFM. Expressed as kgs or lbs and percentage of total weight (%).

Why ATM is important: Loss of ATM may be an early indicator of malnutrition. Looking at ATM can be particularly helpful in a situation where malnutrition may be masked, such as when TBW and weight remain constant because a loss of ATM is combined with an increase in ECF.

Extracellular Mass (ECM)

All metabolically inactive tissues in the body, including ECF and all fat free extracellular solids such as bone. ATM (which is inside the cells) + ECM (which is outside the cells) = FFM. Expressed as kgs or lbs and percentage of total weight (%).

Why ECM is important: As we know, a loss of ATM may indicate malnutrition. ECM should be examined relative to ATM in order to understand any changes more comprehensively.

CELLULAR ANALYSIS

Phase Angle

Indicator of cell health. Phase Angle is the arctangent of reactance/resistance at 50 kHz (i.e., the angle between the measured impedance and the measured pure resistance). Expressed in degrees. The higher the degree, the healthier your cells.

Why Phase Angle is important: More research needs to be done, but this is thought to be an indication of cell membrane integrity and overall cellular health and function.

BODY ANALYSIS

Body Mass Index (BMI)

A relationship between weight and height that is associated with body fat and health risks. $BMI = \text{weight} / \text{height}^2$.

Why BMI is important: BMI is provided for your reference, but this metric is flawed because it only takes weight and height into account – not body composition. Examining other metrics such as Fat Mass and Skeletal Muscle Mass will provide better insight into a person's health.

Basal Metabolic Rate (BMR)

Daily amount of energy a person's body burns when at complete rest. Expressed in calories.

Why BMR is important: Useful for understanding caloric needs to create nutrition interventions.

Standard Deviation (SD) Tables	Mean
	The average for the healthy population.
	-1SD to 1SD
	The range for 68% of the healthy population. The majority of healthy patients fall within this range.
-2SD to 2SD	
The range for 95% of the healthy population.	
-3SD to 3SD	
The range for 99.7% of the healthy population.	

Reference Range Sources

1. Tests performed by and data on file at ImpediMed.
2. Janssen, I et al. Skeletal muscle mass and distribution in 468 men and women aged 18–88 yr. *J Appl Physiol*. July 2000; 89(1):81–8. doi: 10.1152/jappl.2000.89.1.81.
3. Adapted from American College of Sports Medicine (ACSM) Health-Related Physical Fitness Assessment Manual, 5th Edition, 2018.
4. CDC: https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html
5. Bosy-Westphal, A et al. Phase angle from bioelectrical impedance analysis: Population reference values by age, sex, and body mass index. *J Parenter Enteral Nutr*. Jul-Aug 2006; 30(4):309–16. doi: 10.1177/0148607106030004309.
6. Bosy-Westphal, A et al. Patterns of bioelectrical impedance vector distribution by body mass index and age: implications for body-composition analysis. *Am J Clin Nutr*. 2005; 82:60–8.
7. Picoli, A et al. Impedance vector distribution by sex, race, body mass index and age in the United States: standard reference intervals as bivariate Z scores. *Nutrition* 2002; 18:153–167.

FEMALE REFERENCE RANGES

Total Body Water % of Weight¹

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-29	39.4	43.5	47.6	51.7	55.8	59.9	64.0
30-49	34.0	39.6	45.2	50.8	56.4	62.0	67.6
50+	30.9	36.8	42.7	48.6	54.5	60.4	66.3

Extracellular Fluid % of Total Body Water¹

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-29	38.9	40.3	41.7	43.1	44.5	45.9	47.3
30-49	39.4	40.8	42.2	43.6	45.0	46.4	47.8
50+	39.8	41.5	43.2	44.9	46.6	48.3	50.0

Intracellular Fluid % of Total Body Water¹

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-29	52.7	54.1	55.5	56.9	58.3	59.7	61.1
30-49	52.2	53.6	55.0	56.4	57.8	59.2	60.6
50+	50.0	51.7	53.4	55.1	56.8	58.5	60.2

Skeletal Muscle Mass % of Total Weight²

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-29	17.0	22.7	28.4	34.1	39.8	45.5	51.2
30-39	13.8	19.4	25.0	30.6	36.2	41.8	47.4
40-49	14.2	19.2	24.2	29.2	34.2	39.2	44.2
50-59	15.9	20.3	24.7	29.1	33.5	37.9	42.3
60+	15.0	19.7	24.4	29.1	33.8	38.5	43.2

Fat Mass % of Total Weight³

Age	Very Lean	Lean	Good	Fair	High	Very High
20-29	<15.1	≥15.1 to <17.6	≥17.6 to <20.6	≥20.6 to <24.2	≥24.2 to <30.5	≥30.5
30-39	<15.5	≥15.5 to <18.3	≥18.3 to <22.0	≥22.0 to <25.8	≥25.8 to <31.5	≥31.5
40-49	<16.8	≥16.8 to <20.6	≥20.6 to <24.6	≥24.6 to <28.4	≥28.4 to <33.4	≥33.4
50-59	<19.1	≥19.1 to <23.6	≥23.6 to <27.6	≥27.6 to <30.8	≥30.4 to <35.0	≥35.0
60-69	<20.2	≥20.2 to <24.6	≥24.6 to <28.3	≥28.3 to <31.5	≥31.5 to <35.6	≥35.6
70-79	<18.3	≥18.3 to <23.7	≥23.7 to <27.6	≥27.6 to <31.0	≥31.0 to <35.3	≥35.3

Fat Free Mass % of Total Weight³

Age	Very Lean	Lean	Good	Fair	High	Very High
20-29	>84.9	>82.4 to ≤84.9	>79.4 to ≤82.4	>75.8 to ≤79.4	>69.5 to ≤75.8	≤69.5
30-39	>84.5	>81.7 to ≤84.5	>78.0 to ≤81.7	>74.2 to ≤78.0	>68.5 to ≤74.2	≤68.5
40-49	>83.2	>79.4 to ≤83.2	>75.4 to ≤79.4	>71.6 to ≤75.4	>66.6 to ≤71.6	≤66.6
50-59	>80.9	>76.4 to ≤80.9	>72.4 to ≤76.4	>69.2 to ≤72.4	>65.0 to ≤69.2	≤65.0
60-69	>79.8	>75.4 to ≤79.8	>71.7 to ≤75.4	>68.5 to ≤71.7	>64.4 to ≤68.5	≤64.4
70-79	>81.7	>76.3 to ≤81.7	>72.4 to ≤76.3	>69.0 to ≤72.4	>64.7 to ≤69.0	≤64.7

Body Mass Index⁴

Age	Underweight	Healthy	Overweight	Obese
20+	<18.5	≥18.5 to <25.0	≥25.0 to <30.0	≥30.0

Phase Angle⁵

Age	BMI	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-19	18.5-25	3.86	4.55	5.24	5.93	6.62	7.31	8.00
	>25-30	4.01	4.70	5.39	6.08	6.77	7.46	8.15
	>30-35	4.15	4.80	5.45	6.10	6.75	7.40	8.05
	>35-40	3.82	4.59	5.36	6.13	6.90	7.67	8.44
20-29	>40-50	4.14	4.78	5.42	6.06	6.70	7.34	7.98
	18.5-25	3.94	4.62	5.30	5.98	6.66	7.34	8.02
	>25-30	4.06	4.74	5.42	6.10	6.78	7.46	8.14
	>30-35	4.14	4.82	5.50	6.18	6.86	7.54	8.22
30-39	>35-40	4.17	4.85	5.53	6.21	6.89	7.57	8.25
	>40-50	4.17	4.83	5.49	6.15	6.81	7.47	8.13
	18.5-25	4.02	4.69	5.36	6.03	6.70	7.37	8.04
	>25-30	4.16	4.83	5.50	6.17	6.84	7.51	8.18
40-49	>30-35	4.24	4.91	5.58	6.25	6.92	7.59	8.26
	>35-40	4.26	4.92	5.58	6.24	6.90	7.56	8.22
	>40-50	4.06	4.77	5.48	6.19	6.90	7.61	8.32
	18.5-25	3.92	4.60	5.28	5.96	6.64	7.32	8.00
50-59	>25-30	4.08	4.75	5.42	6.09	6.76	7.43	8.10
	>30-35	4.10	4.79	5.48	6.17	6.86	7.55	8.24
	>35-40	4.06	4.76	5.46	6.16	6.86	7.56	8.26
	>40-50	3.92	4.64	5.36	6.08	6.80	7.52	8.24
60-69	18.5-25	3.69	4.37	5.05	5.73	6.41	7.09	7.77
	>25-30	3.77	4.47	5.17	5.87	6.57	7.27	7.97
	>30-35	3.80	4.50	5.20	5.90	6.60	7.30	8.00
	>35-40	3.73	4.45	5.17	5.89	6.61	7.33	8.05
≥70	>40-50	3.71	4.41	5.11	5.81	6.51	7.21	7.91
	18.5-25	3.17	3.95	4.73	5.51	6.29	7.07	7.85
	>25-30	3.43	4.15	4.87	5.59	6.31	7.03	7.75
	>30-35	3.43	4.16	4.89	5.62	6.35	7.08	7.81
≥70	>35-40	3.31	4.06	4.81	5.56	6.31	7.06	7.81
	>40-50	3.18	3.95	4.72	5.49	6.26	7.03	7.80
	18.5-25	2.60	3.44	4.28	5.12	5.96	6.80	7.64
	>25-30	2.92	3.70	4.48	5.26	6.04	6.82	7.60
≥70	>30-35	3.02	3.77	4.52	5.27	6.02	6.77	7.52
	>35-40	2.74	3.58	4.42	5.26	6.10	6.94	7.78
≥70	>40-50	2.91	3.63	4.35	5.07	5.79	6.51	7.23

Hy-Dex^{6-7*}

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
All	-75	-50	-25	0	25	50	75

*Hy-Dex is a bi-directional scale that displays a person's fluid status as compared to a dataset from an average population. Height, age, gender and BMI are already taken into account. Results are simply "normalised" to the scale above, with 25 points equivalent to 1 standard deviation.

MALE REFERENCE RANGES

Total Body Water % of Weight¹

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-29	47.3	51.1	54.9	58.7	62.5	66.3	70.1
30-49	45.4	49.3	53.2	57.1	61.0	64.9	68.8
50+	42.1	46.0	49.9	53.8	57.7	61.6	65.5

Extracellular Fluid % of Total Body Water¹

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-29	40.1	41.4	42.7	44.0	45.3	46.6	47.9
30-49	38.9	40.9	42.9	44.9	46.9	48.9	50.9
50+	41.9	43.5	45.1	46.7	48.3	49.9	51.5

Intracellular Fluid % of Total Body Water¹

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-29	52.1	53.4	54.7	56.0	57.3	58.6	59.9
30-49	49.1	51.1	53.1	55.1	57.1	59.1	61.1
50+	48.5	50.1	51.7	53.3	54.9	56.5	58.1

Skeletal Muscle Mass % of Total Weight²

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-29	29.1	33.5	37.9	42.3	46.7	51.1	55.5
30-39	24.1	29.1	34.1	39.1	44.1	49.1	54.1
40-49	25.1	29.1	33.1	37.1	41.1	45.1	49.1
50-59	24.9	28.3	31.7	35.1	38.5	41.9	45.3
60+	18.6	24.0	29.4	34.8	40.2	45.6	51.0

Fat Mass % of Total Weight³

Age	Very Lean	Lean	Good	Fair	High	Very High
20-29	<7.9	≥7.9 to <11.5	≥11.5 to <15.8	≥15.8 to <19.7	≥19.7 to <24.9	≥24.9
30-39	<12.4	≥12.4 to <15.9	≥15.9 to <19.2	≥19.2 to <22.4	≥22.4 to <26.4	≥26.4
40-49	<15.0	≥15.0 to <18.5	≥18.5 to <21.4	≥21.4 to <24.2	≥24.2 to <27.8	≥27.8
50-59	<17.0	≥17.0 to <20.2	≥20.2 to <23.0	≥23.0 to <25.6	≥25.6 to <29.2	≥29.2
60-69	<18.1	≥18.1 to <21.0	≥21.0 to <23.6	≥23.6 to <26.4	≥26.4 to <29.8	≥29.8
70-79	<17.5	≥17.5 to <21.0	≥21.0 to <23.7	≥23.7 to <25.8	≥25.8 to <29.4	≥29.4

Fat Free Mass % of Total Weight³

Age	Very Lean	Lean	Good	Fair	High	Very High
20-29	>92.1	>88.5 to ≤92.1	>84.2 to ≤88.5	>80.3 to ≤84.2	>75.1 to ≤80.3	≤75.1
30-39	>87.6	>84.1 to ≤87.6	>80.8 to ≤84.1	>77.6 to ≤80.8	>73.6 to ≤77.6	≤73.6
40-49	>85.0	>81.5 to ≤85.0	>78.6 to ≤81.5	>75.8 to ≤78.6	>72.2 to ≤75.8	≤72.2
50-59	>83.0	>79.8 to ≤83.0	>77.0 to ≤79.8	>74.4 to ≤77.0	>70.8 to ≤74.4	≤70.8
60-69	>81.9	>79.0 to ≤81.9	>76.4 to ≤79.0	>73.6 to ≤76.4	>70.2 to ≤73.6	≤70.2
70-79	>82.5	>79.0 to ≤82.5	>76.3 to ≤79.0	>74.2 to ≤76.3	>70.6 to ≤74.2	≤70.6

Body Mass Index⁴

Age	Underweight	Healthy	Overweight	Obese
20+	<18.5	≥18.5 to <25.0	≥25.0 to <30.0	≥30.0

Phase Angle⁵

Age	BMI	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
18-19	18.5-25	4.51	5.28	6.05	6.82	7.59	8.36	9.13
	>25-30	4.97	5.67	6.37	7.07	7.77	8.47	9.17
	>30-35	4.25	5.14	6.03	6.92	7.81	8.70	9.59
	>35-40	4.80	5.47	6.14	6.81	7.48	8.15	8.82
20-29	>40-50	4.76	5.36	5.96	6.56	7.16	7.76	8.36
	18.5-25	4.73	5.45	6.17	6.89	7.61	8.33	9.05
	>25-30	4.84	5.56	6.28	7.00	7.72	8.44	9.16
	>30-35	4.89	5.60	6.31	7.02	7.73	8.44	9.15
30-39	>35-40	4.68	5.42	6.16	6.90	7.64	8.38	9.12
	>40-50	4.66	5.35	6.04	6.73	7.42	8.11	8.80
	18.5-25	4.56	5.26	5.96	6.66	7.36	8.06	8.76
	>25-30	4.85	5.54	6.23	6.92	7.61	8.30	8.99
40-49	>30-35	4.78	5.50	6.22	6.94	7.66	8.38	9.10
	>35-40	4.81	5.50	6.19	6.88	7.57	8.26	8.95
	>40-50	4.40	5.16	5.92	6.68	7.44	8.20	8.96
	18.5-25	4.36	5.06	5.76	6.46	7.16	7.86	8.56
50-59	>25-30	4.60	5.30	6.00	6.70	7.40	8.10	8.80
	>30-35	4.71	5.39	6.07	6.75	7.43	8.11	8.79
	>35-40	4.42	5.16	5.90	6.64	7.38	8.12	8.86
	>40-50	4.12	4.89	5.66	6.43	7.20	7.97	8.74
60-69	18.5-25	4.26	4.92	5.58	6.24	6.90	7.56	8.22
	>25-30	4.25	4.97	5.69	6.41	7.13	7.85	8.57
	>30-35	4.33	5.03	5.73	6.43	7.13	7.83	8.53
	>35-40	4.08	4.84	5.60	6.36	7.12	7.88	8.64
≥70	>40-50	3.85	4.62	5.39	6.16	6.93	7.70	8.47
	18.5-25	3.31	4.13	4.95	5.77	6.59	7.41	8.23
	>25-30	3.76	4.51	5.26	6.01	6.76	7.51	8.26
	>30-35	3.75	4.51	5.27	6.03	6.79	7.55	8.31
≥70	>35-40	3.41	4.26	5.11	5.96	6.81	7.66	8.51
	>40-50	3.17	4.03	4.89	5.75	6.61	7.47	8.33
	18.5-25	2.53	3.39	4.25	5.11	5.97	6.83	7.69
	>25-30	3.12	3.89	4.66	5.43	6.20	6.97	7.74
≥70	>30-35	3.22	3.98	4.74	5.50	6.26	7.02	7.78
	>35-40	3.23	3.96	4.69	5.42	6.15	6.88	7.61
	>40-50	2.42	3.29	4.16	5.03	5.90	6.77	7.64

Hy-Dex^{6-7*}

Age	-3SD	-2SD	-1SD	Mean	1SD	2SD	3SD
All	-75	-50	-25	0	25	50	75

*Hy-Dex is a bi-directional scale that displays a person's fluid status as compared to a dataset from an average population. Height, age, gender and BMI are already taken into account. Results are simply "normalised" to the scale above, with 25 points equivalent to 1 standard deviation.