

Bowling Fitness - Technical Information

Technical Information

Bowling Calculations

1 Nm	= 0.24 Calories	- calorific energy
1g	= 9.807m/s ²	- gravitational constant
v	= (2*g*h) ^{0.5}	- drop velocity
mb	= 1.5kg	- mass of size 3H bowl
r	= 0.7m	- effective arm length from pivot to bowl centre
F	= mb*v ² /r + mb*g	- axial pull force on arm at delivery point including gravity
E	= 0.5*mb*v ²	- bowl kinetic energy

Assume normal delivery:-

v	= 3.13m/s	- delivery speed for 0.5m drop
F	= 21N + 15N = 36N	- axial pull on arm - normal delivery
E	= 7.35Nm	- bowl energy - normal delivery

Assume firing speed = 2*v:-

v	= 6.26m/s	- delivery speed for firing
F	= 84N + 15N = 99N	- axial pull on arm - firing
E	= 29.4Nm	- bowl energy - firing

Body Mass Index (BMI)

The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m².

Basal Metabolic Rate (BMR) Estimation Formulas

BMR is the amount of energy that a person needs to keep the body functioning whilst resting.

Calorie intake below BMR will result in weight reduction.

Exercise will require additional calories to maintain body weight.

More information can be found at https://en.wikipedia.org/wiki/Basal_metabolic_rate.

Revised Harris-Benedict BMR Equations:-

m	= mass	- kg	
h	= height	- m	
a	= age	- years	
Pmen	= (13.397*m + 47.99*h - 5.677*a + 88.362)	- kcal/day	- BMR (HB) men
Pwomen	= (9.247*m + 30.98*h - 4.330*a + 447.593)	- kcal/day	- BMR (HB) women

The Mifflin St Jeor Equations:-

m	= mass	- kg	
h	= height	- m	
a	= age	- years	
Pmen	= (10.0*m + 62.5*h - 5.0*a + 5)	- kcal/day	- BMR (MStJ) men
Pwomen	= (10.0*m + 62.5*h - 5.0*a - 161)	- kcal/day	- BMR (MStJ) women

Katch-McCardle BMR Formulas:-

h	= height	- m	
LBM	= lean body mass - kg		
	= BW - BF	- kg	
BW	= Body weight	- kg	
BF	= Body fat	- kg	- usually between 10% and 40%
			- 25 to 31 percent if you're female, or 18 to 24 percent
or			
LBMmen	= (0.32810*BW + 3.3929*h - 29.5336)	- kg	
LBMwomen	= (0.29569*BW + 4.1813*h - 43.2933)	- kg	
P	= 370 + (21.6*LBM)	- kcal/day	- BMR (KM)

Approximate BMR:-

BMR	= BW*25	- kcal/day	- BMR (Estimate)
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Resting Metabolic Rate (RMR)

RMR	= BMR*1.1	- kcal/day	- increase over basal to digest food
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Metabolic Equivalent (MET)

1 MET = 1 kcal/kg/hour

e.g.

4 MET for 1/2hr = 4*0.5
= 2 MET hours
= 2 / 24
= 0.083 MET days

- MET = 4 for bicycling <10mph - leisure

Let

P = 2000 kcal/day
Energy = P*0.083
= 2000*0.083
= 166 kcals

Activity Factors

Sedentary	BMR*1.2
Mild Active Level	BMR*1.3 to 1.375
Moderate Activity Level	BMR*1.5 to 1.55
Heavy Activity Level	BMR*1.7
Extreme Level	BMR*1.9