WHAT IS THE BMI AND HOW IS IT MEASURED?

In the 1840s the Belgian mathematician and polymath Adolphe Quetelet came up with a way to quickly estimate the fat content in adult bodies. Basing his reasoning on population statistics, he found that a good measure of overweight, normal weight, and underweight for individuals can be determined by looking at the ratio of a person's weight in kilograms to the square of the height in meters. That is-

$$BMI = \frac{[Weight\ in\ kg]}{[Height\ in\ m]^2}$$

Expressed in English customary units, by using the conversions 1kg weight =2.2046 lb and 1meter=3.28084 ft =39.3701 inches, this Body Mass Index also reads-

$$BMI = 4.88247\frac{[Weight\ in\ lbs]}{[Height\ in\ ft]^2} = 703.075\frac{[Weight\ in\ lbs]}{[Height\ in\ inches]^2}$$

Thus a 6 ft tall person weighing 200lb will have a BMI of 27.12. According to modern day statistics for the United States, the BMI classification concerning an individual's adult weight is-

UNDERWEIGHT-	**BMI<20**
NORMAL-	**20<BMI<25**
OVERWEIGHT -	**25< BMI<30**
OBESE-	**30<BMI<40**
MORBIDLY OBESE-	**40<BMI**

These numbers will change with a person's age and their race and ethnicity. The BMI increases with age and is generally lower in countries such as Japan and Singapore than here in the United States. It is estimated that in the United States approximately 34% are overweight and the same number of 34% are obese. An estimate by Johns Hopkins University is that, if the present weight trend continues, a full 75% of the US population will be overweight or obese by 2015.

Recently it has been reported that individuals with a BMI in the slightly overweight range are actually morel healthy than those in the normal range. The reason for this is not clear, although people suffering from certain diseases would tend to have lower BMIs. Also it has been noted recently(Wall Street Journal-May 3, 2011)) that fat bellies in men, regardless of their BMI, tend to increase the frequency of strokes and heart attacks when compared to normal individuals.

Although an individuals BMI can be easily determined by going to your hand calculator or to one of several sites on the internet (i.e.- http://www.nhlbisupport.com/bmi/bminojs.htm) , we consider here an analog approach involving use of a circular slide rule. Although many of the readers will not be familiar with slide rules, they where the instruments of choice for engineers and scientists prior to the advent of electronic computers. The idea behind a BMI slide rule calculator came to me in the late 1980s when I noticed that the BMI formula can be re-written in logarithmic form as –

$$\ln(BMI) = \ln(k) + \ln(W) - 2\ln(H)$$

where k=703.075, W is the weight in lbs, and H the height in inches. Such a log scale allows one to simply subtract the logarithm of W from twice the logarithm of H to find the BMI. We show you here one of these circular slide rule calculators which I have recently constructed in my workshop-

In the photo I have set the device for my weight(W=196lb) and height (H=71.5”) to show a BMI of 27. Earlier in my life my BMI was about 23, indicating I am gaining weight with increasing age. In the construction of the slide rule I started by marking off a logarithmic scale of weight on the periphery of the inner movable disc with W=100lb at θ=0deg and W=300lb at θ=180deg. A red arrow indicating the BMI was placed at θ=270deg. On the outer stationary part of the slide rule I marked off a log based height scale extending from H=4’-4” at θ=0deg to H=7’-7” at θ=180deg. Once this had been done, it was a straight forward procedure to rotate the disc via the knob shown and mark off the BMI values for various combinations of H and W. As one can see, the entire relevant BMI scale from underweight to morbidly obese falls nicely into the portion of the stationary plane between θ=180deg and θ=360deg. It should be possible to manufacture such a circular slide rule using two small flexible coaxial plastic discs (one of slightly larger radius) with the whole device not much larger than a soupcan top. Such a device would cost just a few cents, be carried in ones pocket, and should be helpful for health and fitness enthusiasts. A larger and fancier version of the slide rule could be displayed in health spas for the benefit of its customers.