NUTR 35. 210 LAB 3

OBJECTIVE:
To practice using equations to estimate energy expenditure and macronutrient needs, then to determine whether one is at a healthful weight.

Energy balance consists of the total energy consumed in calories and the total energy burned through metabolism, exercise, and the thermic effect of food. Many people in the US are interested in weight loss; to lose weight one must be in negative energy balance. To achieve negative energy balance a person needs to consume less energy (calories) **and**/or expend more energy (calories) by exercising.

One way to estimate total energy expenditure is to determine how many calories you need to consume daily to **maintain** your current body weight. The least expensive way to do this is to use a prediction equation that uses information about your gender, age, height, weight, and activity level. For this lab you will use four prediction equations to estimate total energy expenditure.

1. The Harris-Benedict equation
2. World Health Organization Equations
3. Mifflin-St. Jeor Equation
4. EER (Estimated Energy Requirement equations) are part of the DRI

You will then calculate your BMI and waist to hip ratio to determine whether you fall into a healthful weight range.

1. The Harris-Benedict Equation

The Harris-Benedict equation is a method used to estimate an individual's basal metabolic rate (BMR) and daily calorie requirements (total energy expenditure). The estimated BMR value is multiplied by a number that corresponds to the individual's activity level. The resulting number is the recommended daily calorie intake to maintain current body weight. The equation assumes a normal body composition, with an average ratio of muscle mass to fat mass, so it may be inaccurate for individuals who are very muscular (the formula underestimates true requirements) or for individuals with obesity (the equation overestimates true requirements).

Men	BMR = 88.362 + (13.397 x weight in kg) + (4.799 x height in cm) - (5.677 x age in years)
Women	BMR = 447.593 + (9.247 x weight in kg) + (3.098 x height in cm) - (4.330 x age in years)

The BMR is then multiplied by a **Physical Activity Factor** to estimate total energy needs (see below).

2. World Health Organization Equations

The World Health Organization (WHO) developed an equation for estimating energy needs in the 1980s. The equation is based on a person's sex, age range and weight. WHO did not feel that height was necessary to include in its equation. The equations are as follows:

Females:
Age 10 to 17 years = 12.2 x (Weight in kg) + 746
Age 18 to 29 years = 14.7 x (Weight in kg) + 496
Age 30 to 60 years = 8.7 x (Weight in kg) + 829
Age over 60 years = 10.5 x (Weight in kg) + 596

Males:
Age 10 to 17 years = 17.5 x (Weight in kg) + 651
Age 18 to 29 years = 15.3 x (Weight in kg) + 679
Age 30 to 60 years = 11.6 x (Weight in kg) + 879
Age over 60 years = 13.5 x (Weight in kg) + 487

Again, these equations are multiplied by the same **Physical Activity Factor** to estimate daily caloric needs.

3. Mifflin-St. Jeor Equation

The Mifflin-St. Jeor equation was developed in 1990 and has been validated by more than 10 studies. The Mifflin-St. Jeor equation is gaining popularity among the nutrition professionals for accurately estimating caloric needs. The equation is as follows:

For females = 10 x (Weight in kg) + 6.25 x (Height in cm) - 5 x age – 161

For males= 10 x (Weight in kg) + 6.25 x (Height in cm) - 5 x age + 5

These equations are also multiplied by the same **Physical Activity Factor** to estimate daily caloric needs

Physical Activity Factors

Little to no exercise	Daily calories needed = BMR x 1.2
Light exercise (1–3 days per week)	Daily calories needed = BMR x 1.375
Moderate exercise (3–5 days per week)	Daily calories needed = BMR x 1.55
Heavy exercise (6–7 days per week)	Daily calories needed = BMR x 1.725
Very heavy exercise (twice per day, extra heavy workouts)	Daily calories needed = BMR x 1.9

EER (Estimated Energy Requirement equations) are part of the DRI's These equations are for adults aged 19 and over.

- Adult Men:
  EER = 662 - (9.53 x age [y]) + PA x { (15.91 x weight [kg]) + (539.6 x height [m]) }

- Adult Women:
  EER = 354 - (6.91 x age [y]) + PA x { (9.36 x weight [kg]) + (726 x height [m]) }

All weights are in kilograms, heights are in meters, and age is in years.
Hints:
1 pound = 2.2kg
1 meter = 39.4 inches

PA is for physical activity coefficient. The activity coefficients are tabulated below:

Activity Level	Adult men	Adult women
Sedentary	1	1
Moderately Active	1.11	1.12
Active	1.25	1.27
Very Active	1.48	1.45

To assess your weight calculate BMI and waist to hip ratio.

Height and weight measurements:
1. Weigh yourself on the scale and record in raw data table.
2. For height:
   a. Take off shoes and anything on your head that would inflate your height (besides hair).

- Calculate your BMI: Weight in kilograms / (Height in meters)^2

Body Mass Index Classifications

Classification	BMI	Health Risk*
Underweight	<19	Low
Ideal BMI	19-24.9	Minimal/Low
Overweight	25-29.9	Increased
Obese	≥30	High

*Health risk mentioned here includes disease risk for type 2 diabetes, hypertension, and cardiovascular disease. The BMI classification and health risk information above are based on Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults published by National Heart, Lung and Blood Institute, NIH, in 1998.Description of waist and hip measurements (have your partner help you):

Waist to Hip Ratio Exercise

WAIST

1. Standing to the side of the subject, locate and mark the lowest point of the last rib and the crest of the ilium (top of the hip bone).
2. Find the midpoint and mark the point.
3. Apple the tension tape over the marked midpoint and ask the subject to wrap it round themselves.
    1. NOTE: Check that the tape is horizontal across the back and front of the subject.
4. Ask the subject to:
    1. Stand with their feet together,
    2. Place their arms at their side with the palms of their hands facing inwards, and
    3. Breathe out gently.
5. Measure waist circumference and read the measurement at the level of the tape to the nearest 0.1 cm.
6. Record the measurement in the raw data table.

HIPS

1. Stand to the side of the subject, and ask them to help place the tape around their hips.
2. Position the measuring tape around the maximum circumference of the buttocks. For women this is usually at groin level. For men it is normally about 2 -4 inches below the navel.
3. Ask the subject to:
    1. Stand with their feet together
    2. Place their arms at their side with palms of their hands facing inwards, and breathe out gently.
4. Check that the tape position is horizontal all around the body.
5. Measure the hip circumference and read the measurement at the level of the tape to nearest 0.1 cm.
6. Record the measurement in the raw data table.

To calculate the waist to hip ratio divide.

Waist to Hip Ratio Chart

Male	Female	Health Risk Based Solely on WHR
0.95 or below	0.80 or below	Low Risk
0.96 to 1.0	0.81 to 0.85	Moderate Risk
1.0+	0.85+	High Risk

Lab report (Please type the final report)

Introduction:
Your introduction should include a short title for this lab.

You also need a discussion of why this lab is important, what you hope to learn from it, and what the information gathered can be used for.

Materials and Procedures:
This section should include a list of any materials or supplies you used to complete this lab.

You also need to include a Step by Step description of what you did during this lab.

Results and Analysis:
You will need to attach your Raw data to this lab, be sure it includes all of your estimates of total energy expenditure.

You will need a table that states your BMI and BMI category and waist to hip ratio and its category.

Conclusions:
You will need to summarize the main findings and analyze what the results are telling you. Make sure to discuss if the results of body weight analysis put you at any health risks. Also discuss if you think the prediction equations are accurate and which one you think is the best and why.

Conclusions Part 2
For this, you must use the data about energy expenditure to estimate fat and carbohydrate needs. SHOW YOUR WORK:

- Calculate recommended total fat intake based on a % of your total calorie needs (from Mifflin equation):
- Calculate how many grams of total fat this is (fat is 9 calories/g):
- Calculate saturated fat needs based on percentage of total calories:
- Determine how many grams of saturated fat this is (fat is 9 calories/g):
- Calculate carbohydrate needs using a percentage of total calories** (45-65% of total calories based on activity level)
- Convert this number to the number of grams of carbohydrate you need (remember carbohydrates supply 4 calories/gram).

RAW DATA TABLES

Total energy expenditure values

Equation	**BMR**	**AF**	**Estimated Energy Expenditure**
The Harris-Benedict Equation			
World Health Organization Equations			
Mifflin-St. Jeor Equation			
EER			

BMI and Weight to Hip calculations

Variables	Value
Height in inches	
Weight in pounds	
Waist circumference in cm	
Hip circumference in cm	

Instructor Signature_____

	Excellent (3 pts)	Good (2 pts)	Adequate (1 pts)	Needs Work (0.5 pt)	Not attempted (0)
Introduction	Includes the question or purpose to be answered by the lab, states the reason why this is important and has a short, relevant title.	One of the "excellent" conditions is not met, two conditions met	Two of the "excellent" conditions is not met, one is met	Introduction present, no exemplary conditions met	
Materials and Procedures	Description or step-by-step process is included, could be repeated by another scientist	Description included, some steps are vague or unclear	The description gives generalities, enough for reader to understand how the lab was conducted	Would be difficult to repeat, reader must guess at how the data was gathered or lab was conducted	
Results and Analysis	Results and data are clearly recorded, organized so it is easy for the reader to see trends. All appropriate labels are included	Results are clear and labeled, trends are not obvious or there are minor errors in organization	Results are unclear, missing labels, trends are not obvious, disorganized, there is enough data to show the experiment was conducted	Results are disorganized or poorly recorded, do not make sense; not enough data was taken	
Conclusions	1. Summarizes data used to draw conclusions 2. Conclusions follow data (not wild guesses or leaps of logic), 3. Discusses applications or real world connections	2 of 3 of the "excellent" conditions is met	1 of 3 of the "excellent" conditions is met	Conclusion section is present but no conditions are met	
Conclusions part 2	Answers all additional questions required correctly.	Answers 2 or 3 additional questions correctly.	Answers 1 of 3 additional questions correctly.	Attempts to answer questions but none are correct.	