

McMaster University  
SCIENCE

## LIFESCI 2N03: Human Nutrition for Life Science

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Week 2

What is a healthy diet?

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### Welcome back!

- TopHat module #2 due Friday Sept 17 at 11:59pm
- Assignment #1 FAQ posted on Avenue
- Q and A after class on Thursday for any questions about Assignment #1



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=> More information about assignment #1 will be discussed next week (Sept. 21st, 2012)

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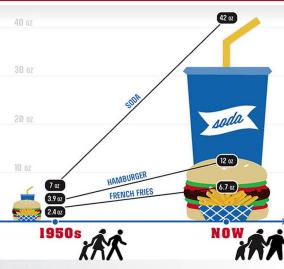


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### Portion Distortion

#### THE NEW (AB)NORMAL

Portion sizes have been growing. So have we. The average restaurant meal today is more than four times larger than in the 1950s. And adults are, on average, 20 pounds heavier. We want to eat healthy things we can actually fit into our bodies. And we can. It's just that we're eating more of them, both at half and take the rest home. We can also ask the managers at our favorite restaurants to offer smaller meals.



Typical portion sizes have increased over the last 70 years, and with it an increase in the consumption of calories.  
<http://www.nhlbi.nih.gov/health/educational/wecan/eat-right/portion-distortion.htm>  
 Centers for Disease Control

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=> CDC = Center for Disease Control

=> Fast food portion sizes have grown a lot; contributing to unhealthy diets

=> Greater portion sizes means more energy

=> Increasing fast food portion sizes may contribute to increasing body sizes; no one has researched this yet

## Portion Distortion



=> These snacks are meant to trick us into thinking that we are making healthy choices

=> These things can be used to justify snacking and unhealthy eating/snacking

=> These snacks are empty carbs and fillers

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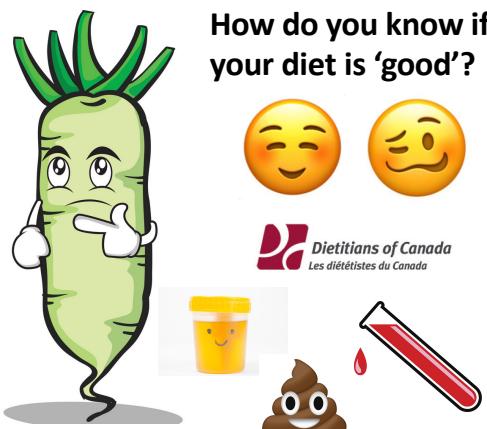
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## Learning objectives

1. Review: describe how the DRIs and EER can be used to plan a diet
  2. Review: practice interpreting nutrition facts tables to make healthy food choices
  3. Compare and contrast methods for dietary assessment
  4. Describe features of the Canada's Food Guide and how it can be used to plan a healthy diet
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## How do you know if your diet is 'good'?




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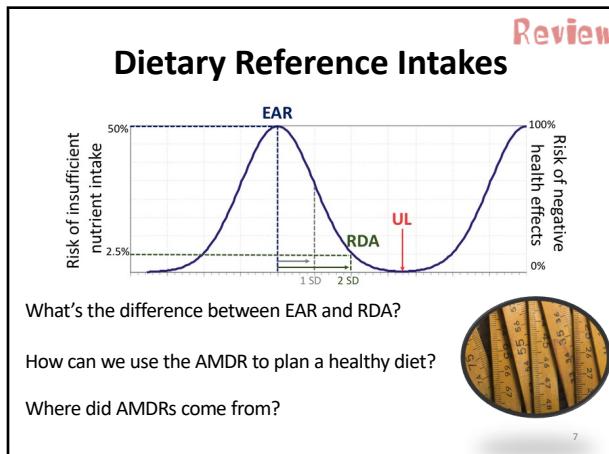


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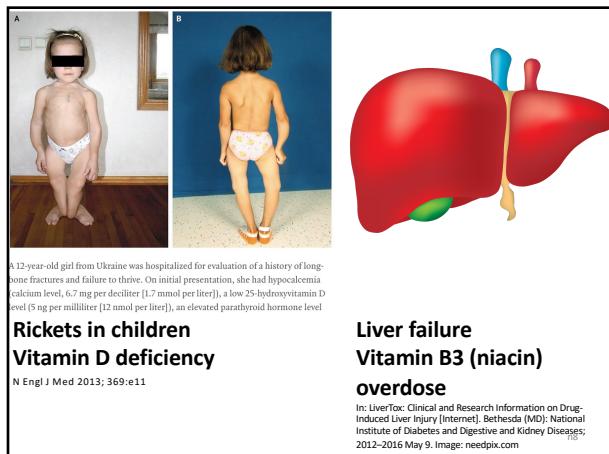


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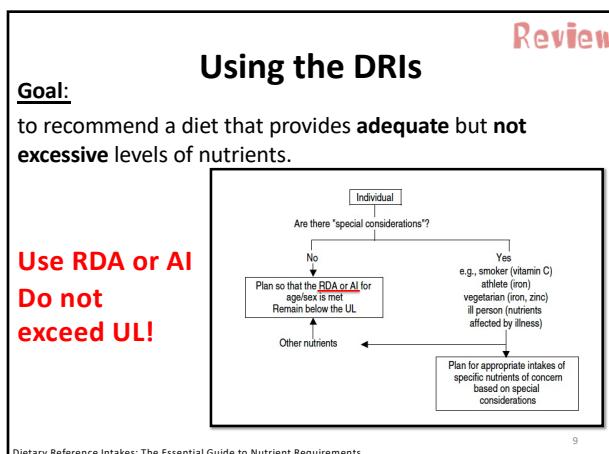
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=> DRIs are the universal method to know if our diet is good or not

=> DRI = Dietary Reference Intake

=> DRI is a way to compare our diet to what the recommendations are

=> EAR = Estimated Average Requirement  
It satisfies the needs of 50% of the population

=> RDA reduces the risk of insufficient nutrients

=> UL = Upper Limit for risk of nutrient toxicity

=> Going past the UL increases the risk of negative health effects (i.e. Taking lots of vitamin B3)

=> AMDR = Average macronutrient distribution range

=> AMDR applies to fat, carbs, and proteins  
It refers to the proportions that should be present in our diet

=> AMDR is a range b/c everyone has a different proportion of fat, carb, and protein in their diet

=> AMDR tells us how much fat, carbs and protein we should be eating

=> Overdosing nutrients typically happen due to supplements, and not food intake

=> For the general population the RDA or AI is sufficient; but the EAR should not be used b/c it only meets 50% of a population's needs

=> RDA/AI might exceed or not meet a person's requirement

=> The body is able to handle large amounts of water soluble vitamins

## Considerations for applying **Review** recommendations

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=> Fatties have different recommendations than normal people

=> Some people need more nutrients than others

=> Genetic testing can show if a person needs more nutrients

=> Excess nutrients intake typically occurs due to supplementation

=> Going a little over or under isn't bad



## Energy requirements

- **Estimated energy requirement (EER)**
  - Average energy intake that will maintain energy balance in a person who has a health body weight and physical activity level

**Look at the EER equations...**

**How accurate do you think they are?**

**What might influence accuracy?**

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=> Stage of life affects EER



**Look at the EER equations...  
How accurate do you think they are?  
What might influence accuracy?**

11

<b>Energy requirements</b>		<b>Review</b>
<b>Children and Adolescents 3–18 years</b>		
Estimated Energy Requirement (kcal/day) = Total Energy Expenditure + Energy Deposition		
<b>Boys</b>		
3–8 years	EER = $88.5 - (61.9 \times \text{age [y]}) + \text{PA}^P \times [(26.7 \times \text{weight [kg]}) + (903 \times \text{height [m]})] + 20$	
9–18 years	EER = $88.5 - (61.9 \times \text{age [y]}) + \text{PA} \times [(26.7 \times \text{weight [kg]}) + (903 \times \text{height [m]})] + 25$	
<b>Girls</b>		
3–8 years	EER = $135.3 - (30.8 \times \text{age [y]}) + \text{PA} \times [(10.0 \times \text{weight [kg]}) + (934 \times \text{height [m]})] + 20$	
9–18 years	EER = $135.3 - (30.8 \times \text{age [y]}) + \text{PA} \times [(10.0 \times \text{weight [kg]}) + (934 \times \text{height [m]})] + 25$	
<b>Adults 19 years and older</b>		
Estimated Energy Requirement (kcal/day) = Total Energy Expenditure		
<b>Men</b>		
	EER = $662 - (9.53 \times \text{age [y]}) + \text{PA} \times [(15.91 \times \text{weight [kg]}) + (539.6 \times \text{height [m]})]$	
<b>Women</b>		
	EER = $354 - (6.91 \times \text{age [y]}) + \text{PA} \times [(9.36 \times \text{weight [kg]}) + (726 \times \text{height [m]})]$	
<b>convert pounds to kilograms (1 lb = 0.45 kg)</b>		
<b>convert height from inches to meters (1 inch = 0.0254 m)</b>		

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=> Equations account for:

- Base metabolism; secretion of enzymes, maintaining body temperature, etc.,
  - Energy required for digesting food, sitting, etc.
  - Physical activity (i.e. Walking, exercising, etc.)
  - Energy needed to build new tissue
  - Adaptive thermogenesis; dictated by the amount of white and brown fat

Dietary Reference Intakes: The Essential Guide to Nutrient Requirements

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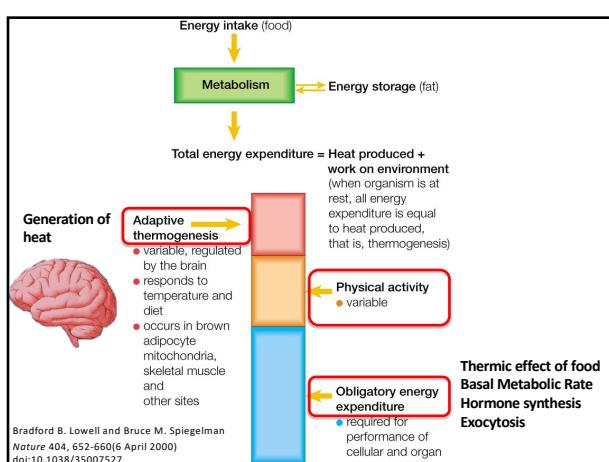
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=> White fat accumulates due to excess energy consumption

=> Brown fat is responsible for using up; energy; it is much more metabolically active

=> The more brown fat a person has the more energy they'll expend in adaptive thermogenesis

=> Brown fat is affected by factors such as: genetics, food, childhood, etc.

## Energy requirements

### Review

**Children and Adolescents 3–18 years**

Estimated Energy Requirement (kcal/day) = Total Energy Expenditure + Energy Deposition

<b>Boys</b>	
3–8 years	EER = 88.5 – (61.9 × age [y]) + PA <sup>b</sup> × [(26.7 × weight [kg]) + (903 × height [m])] + 20
9–18 years	EER = 88.5 – (61.9 × age [y]) + PA × [(26.7 × weight [kg]) + (903 × height [m])] + 25
<b>Girls</b>	
3–8 years	EER = 135.3 – (30.8 × age [y]) + PA × [(10.0 × weight [kg]) + (934 × height [m])] + 20
9–18 years	EER = 135.3 – (30.8 × age [y]) + PA × [(10.0 × weight [kg]) + (934 × height [m])] + 25

**Adults 19 years and older**

Estimated Energy Requirement (kcal/day) = Total Energy Expenditure

<b>Men</b>	EER = 662 – (9.53 × age [y]) + PA × [(15.91 × weight [kg]) + (539.6 × height [m])]
<b>Women</b>	EER = 354 – (6.91 × age [y]) + PA × [(9.36 × weight [kg]) + (726 × height [m])]

**convert pounds to kilograms (1 lb = 0.45 kg)**  
**convert height from inches to meters (1 inch = 0.0254 m)**

Dietary Reference Intakes: The Essential Guide to Nutrient Requirements

=> EER equations are decent in estimating energy needs

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**TABLE 2 Physical Activity Coefficients (PA Values) for Use in EER Equations**

	Sedentary (PAL <sup>a</sup> 1.0–1.39)	Low Active (PAL 1.4–1.59)	Active (PAL 1.6–1.89)	Very Active (PAL 1.9–2.5)
	Typical daily living activities PLUS 30–60 minutes of daily moderate activity (e.g., walking at 5–7 km/h)	Typical daily living activities PLUS at least 60 minutes of daily moderate activity	Typical daily living activities PLUS an additional 60 minutes of vigorous activity or 120 minutes of moderate activity	Typical daily living activities PLUS at least 60 minutes of daily moderate activity
Typical daily living activities (e.g., household tasks, walking to the bus)				
Boys 3–18 y	1.00	1.13	1.26	1.42
Girls 3–18 y	1.00	1.16	1.31	1.56
Men 19 y +	1.00	1.11	1.25	1.48
Women 19 y +	1.00	1.12	1.27	1.45

<sup>a</sup>PAL = Physical Activity Level.

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=> Coefficients are used in EER equations to factor in physical activity

=> For instance: If a 4 year old was very active, the coefficient used is 1.42

=> A burn is a high metabolic disease; the body requires a lot of energy to make new skin cells. It needs lots of protein, nitrogen, etc.

## APPLICATION

## Calculate the EER

- 20 year old female
  - Walks to school at a brisk pace (5km/h) each day (~35 min)
  - Weight = 145 lbs
  - Height = 5'6"

convert pounds to kilograms (1 lb = 0.45 kg)  
convert height from inches to meters (1 inch = 0.0254 m)

=> The EER is 2265 kcal/day

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### Calculate the EER

- 20 year old female
  - Walks to school at a brisk pace (5km/h) each day (~35 min)
  - Weight = 145 lbs → 65.25 kg
  - Height = 5'6" → 66 inches → 1.68 m

$$\text{Women: } \text{EFB} = 354 - (6.91 \times \text{age [y]}) + \text{PA} \times [(9.36 \times \text{weight [kg]}) + (726 \times \text{height [m]})]$$

*Round to 2 sig digs ... remember BDMAS*

$$\begin{aligned} \text{EER} &= 354 - (6.91 \times 20) + 1.12 \times [(9.36 \times 65.25) + (726 \times 1.68)] \\ &= 354 - 138.20 + 1.12 \times [(610.74) + (1219.68)] \\ &= 354 - 138.20 + 1.12 \times 1830.42 \\ &= 354 - 138.20 + 2050.07 \\ &= 2265.87 \text{ kcal per day} \end{aligned}$$

=> Equation is:

$$\text{EER} = 354 - (6.91 \times \text{age [y]}) + \\ \text{PA} \times [(9.36 \times \text{weight [kg]}) + \\ (726 \times \text{height [m]})]$$

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**Calculate your own EER for your assignment!**

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**Dietary Reference Intakes**  
The Essential Guide to Nutrient Requirements

+ update for calcium and vitamin D

online

Resources for your assignment

The definitive summary resource about nutrient reference values: how much of each nutrient healthy people need, why they are important, and how to use nutrient reference values in planning and assessing diets.

INSTITUTE OF MEDICINE  
OF THE NATIONAL ACADEMIES

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=> The DRI guide is posted on Avenue under Assignment #2

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### Learning objectives

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**Review**

## Nutrition Facts Tables (NFTs)

- 13 mandatory nutrients listed
- %DV only mandatory for 10 nutrients



<b>Want a little:</b> • Sodium • Saturated fat • Trans fat	<b>Want a lot:</b> • Fibre • Calcium • Vitamin A • Iron ...
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1. Serving size
2. %DV comparison
3. Nutrient comparison

<https://www.canada.ca/en/health-canada/services/publications/food-nutrition/how-use-serving-size-daily-value.html>

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=> NFTs are on the package of every food that you buy at the grocery store

=> NFTs are NOT on restaurant meals

=> 5% is a little; 15% is a lot

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If you are at the grocery store and you want to pick the cracker that has the least amount of sodium for a standard 28 g serving, which would you pick?



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=> Triscuits

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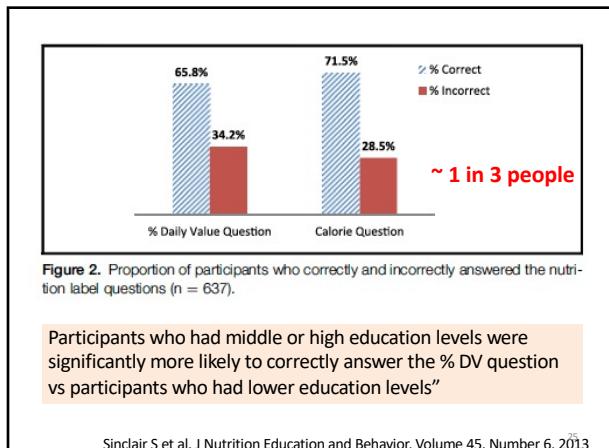
=> PC crackers have 260mg of Sodium in a serving size of 28g

=> Triscuits have 115mg of Sodium in a serving size of 20g

=> Make servings comparable:  
 $28g/20g = 1.4$

=> Use conversion factor for nutrient:  
 $115mg \times 1.4 = 161mg$

=> Triscuits have less salt than PC crackers when standardizing serving size



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=> Only 1 in 3 people are able to correctly interpret nutrition labels

=> Being able to read nutrition labels correlate with level of education; educated people can and un-educated cannot

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=> myfitnesspal is not validated for accuracy

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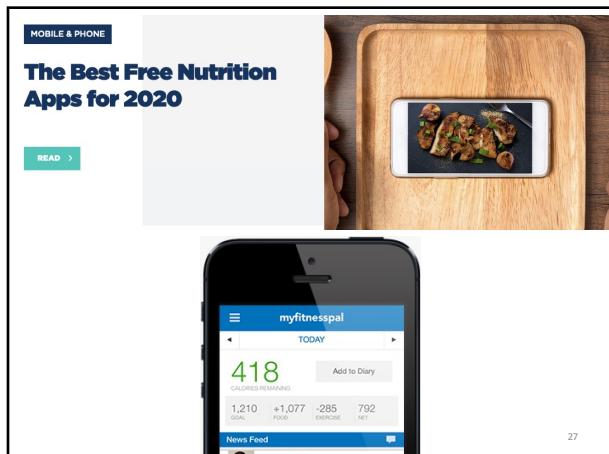
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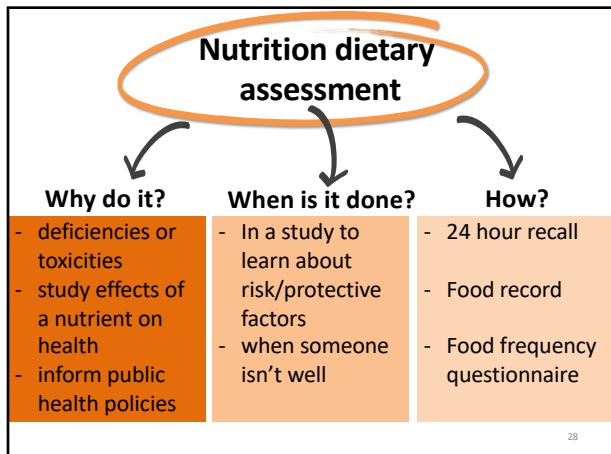
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### 24 hour recall

- Record of foods consumed in the past 24 h
- Captures how food is prepared, brands

**PROS**

- Quick, in the moment assessment
- Validated

NATIONAL CANCER INSTITUTE ASA24  
ASA24 Automated Self-administered 24-hour Recall

Freudenheim JL. J Nutr. 1993;123:401-5.  
Subar et al. J Nutr. 2015; 145(12): 2639–2645.  
National Cancer Institute Dietary Analysis <https://dietassessmentprimer.cancer.gov/profiles/recall/validation.html>

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=> A 24-hour recall is a list of food someone has consumed in 24 hours

=> Usually done with software like ASA24, or verbally with a dietitian who is trained to ask questions

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### Validity

- Tool measures what it is intended to measure
- 2 different methods have been used to capture the same thing
  - If they match, "validated"

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=> i.e. If a questionnaire is looking at the type and quantity of a beverage consumed during the day, then it would be valid if it produces an accurate report of what you actually drank

=> Taking a picture of the food eaten and writing it down are valid; if the 2 things agree well enough within a certain percent overlap, then it is considered validated

=> Validated tools should be used for nutrition research

## Reliability

- Tool produces the same measurement repeatedly, under similar circumstances
  - Quantity
  - Variety
  - Between participants
  - Within participants



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=> Information such as quantity of food, type of food, etc. are important

=> The tool needs to be consistent between participants and within participants

=> We need to make sure that the tool we are using is reliable, so it can give us the right information

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## 24 hour recall



- Record of foods consumed in the past 24 h
  - Captures how food is prepared, brands
- |  |   |
|--|---|
| <b>PROs</b> <ul style="list-style-type: none"> <li>• Quick, in the moment assessment</li> <li>• Validated</li> </ul> | <b>CONS</b> <ul style="list-style-type: none"> <li>• Rely on short-term memory</li> <li>• People have a hard time estimating quantities</li> <li>• Time and labour consuming data analysis (20-60min)</li> <li>• Current, not usual intake</li> </ul> |
|--|---|



Freudentheim JL. J Nutr. 1993;123:401-5.

Subar et al. J Nutr. 2015; 145(12): 2639–2645.

National Cancer Institute Dietary Analysis <https://dietassessmentprimer.cancer.gov/profiles/recall/validation.html>

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=> Children and elderly people cannot remember perfectly what they ate

=> First timers have a hard time estimating quantities

=> Takes a long time to procure

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## Food records



- Record food intake for 3-7 days
  - Details including preparation, quantities, brands
  - Weighing increases validity
  - Best to complete in 'real time', not end of day
- |   |   |
|---|---|
| <b>PROs</b> <ul style="list-style-type: none"> <li>• Gives idea of food intake over range of days, habitual</li> <li>• Validated</li> </ul> | <b>CONS</b> <ul style="list-style-type: none"> <li>• Respondent burden (decrease accuracy with increase in # days)</li> <li>• Time and labour consuming data analysis</li> <li>• Assume literacy</li> <li>• Diet alteration bias</li> </ul> |
|---|---|

Freudentheim JL. J Nutr. 1993;123:401-5.

Subar et al. J Nutr. 2015; 145(12): 2639–2645.

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=> Participants do not need to recall what they ate, because tracking is done in real time

=> Responsibility is placed on the participant

=> Some people aren't able to record due reasons such as: not literate

=> Participants may eat healthier b/c they are being watched

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**Food frequency questionnaire (FFQ)**

- Indicate frequency and amount foods are consumed
- accuracy increases if interviewer-administered

PROs	CONs
<ul style="list-style-type: none"> <li>good for large studies</li> <li>can be self-administered</li> <li>easy coding and data entry</li> <li>Reflective of diet over longer term (2 weeks- 1 yr)</li> <li>Validated</li> </ul>	<ul style="list-style-type: none"> <li>Accuracy depends on list</li> <li>Time consuming</li> <li>Depends on short-term memory</li> <li>Could be affected by seasons</li> <li>Limited detail on food preparation and brand</li> </ul>

Freudentheim JL. J Nutr. 1993;123:401-5  
Subar et al. J Nutr. 2015;145(12): 2639-2645.

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=> There are other ways to capture people's diet, but the 3 main methods are: FFQ, Food Recall, & 24 hour recall

=> Doesn't capture all foods on the questionnaire; so the real diet may not be recorded

=> Participants must remember what they ate a long time ago

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**usual eating habits DURING THE LAST YEAR**

	How often?			Average Serving	Your Serving Size			
	Write in ONE column only				Less Than Average (small)			More Than Average (medium)
	Per Day	Per Week	Per Month		S	M	L	
<b>A. BEVERAGES</b>				1 cup	S	M	L	
1. Milk (Whole, 2%, 1%, skim chocolate, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 packet	S	M	L	
2. Cocoa (from mix)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3/4 cup	S	M	L	
3. Non-calcium fortified juices (orange, apple, grape, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1/2 cup	S	M	L	
4. Calcium-fortified Orange Juice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 cup	S	M	L	
5. Calcium-fortified Cow's Milk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 cup	S	M	L	
6. Calcium-fortified Soy Beverage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 cup	S	M	L	
7. Calcium and Vitamin D Fortified Soy Beverage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 cup	S	M	L	
8. Milk in Tea and Coffee (Cream, 2%, 1%, skim)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 tbsp or 15 ml	S	M	L	
9. Pop (eg. Coca Cola, Pepsi, 7-up)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 can or 355 ml	S	M	L	
10. Milk Shake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 cup	S	M	L	
11. Yogurt Drink	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 cup	S	M	L	

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=> Example of an FFQ

=> Options can explode very quickly

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Q: Which method for dietary assessment tends to have the highest level of participant burden?

A: Food diary

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## Considerations for dietary reporting

- **Measurement error in dietary self-reporting**
  - Calorie intake underreporting
    - 12-13% for middle aged men
    - 6-16% for young and middle aged women
    - 25% for elderly women
  - Less of an issue for nutrient analysis
    - 5% underreporting for protein
    - 3% underreporting for potassium
- **For best assessment of health, use with clinical assessment (body comp, blood, urine etc.)**



Subar et al. J Nutr. 2015; 145(12): 2639–2645.

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=> People forget what they ate/drank

=> Eye-balling or remembering food portions is challenging

=> Best measurement for measuring diet is blood, urine, etc. But conducting something like this is expensive

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