Assessing Physical Activity and Dietary Intake in Older Adults

BY

Arunkumar Pennathur, PhD

Rohini Magham

Introduction

Years 1980-2000 *(United Nations' Demographic Indicators)*

❖ 12% increase in people of ages 65 and older

❖ 33% increase in people of ages 80 and older

❖ By 2030 at least 10% of workers will be 60 years or older

Factors Increasing Longevity

❖*Low childhood mortality rates*

❖*Declining fertility rates*

❖*Improved nutrition*

❖*Improved Standards of living*

Changes due to Aging

- ❖ *Decline in cell metabolic rate*
- ❖ *Decrease in lean mass index (muscles, organs, skeletal tissues)*
- ❖ *Decline in physical activity*
- ❖ *Energy expenditure is directly proportional to body size & physical activity*
- ❖ *If food consumption remains the same, calories consumed will not be spent*
- ❖ *Excess energy stored as fat deposits*
- ❖ *Leads to Obesity*
- ❖ *Functional disability*

Physical Activity & Aging

- ❖ *Lack of time*
- ❖ *Smoking*
- ❖ *Obesity*
- ❖ *Intent and awareness of benefits*
- ❖ *Underestimation of need*
- ❖ *Overestimation of risk*
- ❖ *Confidence in ability and enjoyment*
- ❖ *Continuation of low to moderate intensity activities*
- ❖ *Self regulatory skills*
- ❖ *Participation of friends and family*
- ❖ *Lack of environment*
- ❖ *Technology and sedentary behavior*

Physical Activity Assessment Tools

❖ *Mechanical Monitoring Devices, e.g. Caltrac, Doubly labeled water method*

❖ *Most of these methods are burdensome and expensive to administer.*

❖ *Physical activity questionnaire method*

Physical Activity Surveys

❖ *Physical Activity Scale for the Elderly (PASE) (Washburn et al.,1993)*

  Telephone, personal interview or self administration

  Recalls past week physical activity. PASE score for physical activity is computed

  3-7 week re-administration

❖ *Zutphen Physical Activity Questionnaire (Casperson et al.,1991)*

  Self administered

  kcal/kg/day for energy expenditure is computed.

  Recall usual physical activity with no specific time frame

  4-month re-administration

Physical Activity Surveys

❖ *Modified Baecke Questionnaire (Voorrips et al.,1991)*

    Interviewer administered

    Past one year is recall time frame.Questionnaire score is computed.

    20-days re-administration

❖ *Yale Physical Activity Survey (YPAS) (DiPietro et al.,1993)*

    Interviewer administered. kcals/week of physical activity is computed

    Recalls activities performed during a typical week in the previous month. 2-week re-administration

Reliability of Physical Activity Questionnaires

❖ *Reliability*

  ❖ *Recall due to poor memory*

  ❖ *Cognitive information processing*

  ❖ *Variability in physical activity levels over time*

  ❖ *Individual differences*

  ❖ *High reliability in recall of high intensity activities and structured activities*

Validity of Physical Activity Questionnaires

❖ *Content validity*
  - ❖ *Should include low, moderate and vigorous intensity activities*
  - ❖ *Diverse demographic, cultural and ethnicity*
  - ❖ *Context sensitivity*
  - ❖ *New technology and sedentary behavior*

❖ *Criterion related validity*
  - ❖ *Need absolute validity based on self reports*
  - ❖ *Need to include muscle strength, flexibility, weight bearing and sedentary behavior*

Factors affecting Dietary intake & age

❖ *Age, gender, environmental temperature, energy expenditure, pregnancy, hormonal status, dieting behaviors*

❖ *For males and females intake peaked in their 20s and declined thereafter; at all ages males had higher intake*

❖ *Moderate physical activity increases food intake in lean subjects not obese*

❖ *Food intake changes correspond with body weight changes*

Dietary Assessment

❖*Food Records*

   ❖ *Requires to measure and record types and amounts of dietary intake.*
   ❖ *1-Day Record*
   ❖ *3-Day Record*
   ❖ *7-Day Record*

❖*Limitations: Burdensome, time consuming*

❖*Useful for pilot studies (Bingham,1987)*

❖*For overall measures (like Cal), food records are adequate*

Dietary Assessment

❖*Dietary Recalls*

Requires to recall the types and amounts of dietary intake.

24-hour recalls

3-day recall

7-day recall

❖*Limitations: Failure to recall accurately the intake*

Dietary Assessment

❖*Food Frequency Questionnaire*

Questionnaires contain specific foods relevant to the area of focus which need to be identified.

Time frame may vary from a day to a year.

Easy to administer for large sample sizes.

❖*Limitations:*

Does not yield good results when precision of nutrients is the interest of study (Block et al.,1982)

Factors affecting dietary assessment accuracy

❖ *Sampling errors*
- ❖ *Small samples*
- ❖ *Non response bias*

❖ *Reporting errors*
- ❖ *Participant co-operation, motivation, literacy*
- ❖ *Interviewer training*

❖ *Other errors*
- ❖ *Day to day variation in intake*
- ❖ *Inherent errors in food composition tables*

Age & Dietary Intake Findings

- *Decline in intake from 2700 kcals/day at 30 years to 2100 at 80 years (McGangy et al.,1966)*
  - *200 kcal-lean body mass reduction*
  - *400kcal-decline in physical activity*
- *NHANES II*
  - *Men: 2700 at 23-24 y to 1800 at 65-74 y*
  - *Women: 1600-1300 kcals/day*
- *HHANES*
  - *Mexican American males: 1840 kcal/day 60-74y*
  - *Mexican American women: 1339 kcals/day*
- *San Antonio Heart Study*
  - *Mexican American males: 2414 kcals/day 25-64y*
  - *Mexican American females: 1646 kcals/day*

Health Trends in Mexican American Population

❖ *50% of Hispanic men and 57% women have no leisure time physical activity*

❖ *69.3% of the Mexican American population (20-74 years) was overweight*

❖ *24.8% of men and 36.1% of women were obese.*

❖*Nearly 23% older Mexican American men & 35% older Mexican American women are obese (Hispanic EPESE of 3050 older Mexican Americans from 5 Southwestern States)*

❖*This prevalence is higher in older Mexican American adults than other older adults groups*

Objectives

Hypothesis: Caloric intake in older Mexican American adults is more than energy expenditure (physical activity, basal and digestive)

Primary Objectives

❖ *Estimate energy expenditure in physical activity performance for older Mexican American Adults*

❖ *Estimate Caloric intake for older Mexican American adults*

❖ *Perform a pilot comparison of estimated energy expenditure and caloric intake*

Objectives

Secondary Objectives

❖ *Determine test-retest reliability & criterion-related validity of YPAS for physical activity assessment in older Mexican American adults*

❖ *Determine if YPA dimensions, total time and total energy expenditure are affected by age*

Methodology

❖ *Yale Physical Activity Survey (YPAS) was used to estimate energy expended in physical activities over a typical past week (kcal/week)*

❖ *3-day food record was used to estimate Dietary intake, & proportionally scaled up to 7 day intake (kcal/week)*

Methodology

❖ *The resting energy expenditure for basal activities was estimated using the Harris Benedict equation (Frankenfield et al., 1998).*

❖ *For Males: 66.4730 + (13.7516 * weight in kg) + (5.0033 * height in cm) − (6.8 * age in years) = kcals/day*

❖ *For females: 665.0955 + (9.5634 * weight in kg) + (1.8496 * height in cm) − (4.6756 * age in years) = kcals/day*

Yale Physical Activity Survey

❖ *YPAS used to estimate energy expenditure*

❖ *Consists of 2 sections*

❖ *Calculates 3 summary indices*

Total time in hours/week

Total Energy Expenditure in Kcals/week

Total Activity Summary Index score

Yale Physical Activity Survey

❖ *Section 1 calculates Total Time and Total Energy Expenditure .*

❖ *Section 1 is subdivided into 5 subsections.*

Work Related e.g. Shopping, Food preparation,etc.

Yard-Work e.g. Gardening, sweeping, raking,etc.

Care Taking e.g. adult care, child care

Exercise e.g. Brisk walking,cycling, swimming

Recreational e.g. Leisure,Dancing,Golf

Activity Dimensions

Section 2 calculates Total activity Summary Index for:

❖ *Vigorous Activity*

❖ *Leisurely Walking*

❖ *Moving*

❖ *Standing*

❖ *Sitting*

Yale Data Analysis

❖ *Each activity time was multiplied by intensity score (Taylor et al.,1978) to obtain kcal/week value in section 1.*

❖ *The sum of all the kcal/week values in section 1 gives Total energy expenditure.*

❖ *Sum of the reported times provides total time index in hours/week.*

❖ *The duration x frequency x weight summed over all 5 indices provides Summary activity index with no units.*

Test-retest reliability of YPAS

❖ *Reliability of YPAS was determined by test-retest correlation for all Yale activities, summary indices, and activity dimension scores*

  ❖ *Pearson Product Moment Correlation*

  ❖ *Spearman Rank Correlation*

❖ *Paired t-test between first and second administrations*

❖ *Validity of YPAS was obtained by correlating:*

> *Total time*
>
> *Total energy expenditure*
>
> *Activity Summary Index*
>
> *Vigorous Activity index score*
>
> *Leisure walking index score*
>
> *Moving index score*
>
> *Standing index score*
>
> *Sitting index score*

with body weight (self reported) and BMI

Diet Record

❖ *3-day diet records to estimate caloric intake*

    ❖ *2 week days and 1 weekend day*

    ❖ *Breakfast, snack, Lunch, snack, Dinner, snack*

    ❖ *Method of food preparation- homemade, Ready to eat, frozen, Restaurant*

    ❖ *Serving Sizes, or the amount*

❖ *ESHA Nutrition Analysis software*

❖ *This software converts food intake into Kcal.*

  ❖ *3-day food records were entered*

  ❖ *Standard serving sizes were used if not specified*

  ❖ *Same brands were assumed if not specified for consistency.*

    ❖ *e.g. If salad was recorded green salad was given.*

    ❖ *e.g. If cereal was mentioned Quaker cereal was assumed*

❖ *Weekly kcal intake was extrapolated from 3-day kcal value obtained from ESHA*

❖ *Paired t-test between weekly energy expenditure and weekly caloric intake from food records.*

❖ *The confidence level for the comparison was set at 95%.*

Participant Recruitment

- ❖ IRB Approval

- ❖ Senior centers

- ❖ Information sessions

- ❖ Voluntary participation

- ❖ Survey

Participants

Yale and Diet Data

Survey	Age Group	Total	Women	Men
YPAS	60-91	49	42	7
Diet	60-85	23	20	3

Yale Physical Activity Survey

Participant Data

YPAS	Age Group	Total	Women	Men
1st Adm.	60-91	49	42	7
2nd Adm.	61-91	15	12	3

Summary Statistics

YPAS	Height (cm)	Weight (lbs)	BMI kg/m^2
1st Adm. n=49	159.21	155.27	27.882
2nd Adm. n=15	159.08	155.8	27.326
Diet Rec. n=23	159.17	151.17	26.92

Results

❖ *Estimated daily energy expenditure and daily caloric intake*

Variable	Mean(23)	SD
Daily caloric intake (kcal/day)	*1931.69*	*428.06*
Daily energy expenditure on physical activity (from YPAS) (kcal/day)	*941.63*	*412.76*
Daily energy expenditure on basal activities (kcal/day)	*1310.94*	*175.03*
Daily energy expenditure on digestive activities (kcal/day)	*131.09*	*17.50*
Daily total energy expenditure (kcal/day)	*2388.66*	*433.32*

Results

❖ *Paired t-test results comparing daily intake with daily total energy expenditure (including basal activities, digestion and physical activity).*

Variable	Mean(n=23)	SD	P-value	95% CI
Daily Caloric Intake	*1931*	*428.1*	*0.004*	*(-748,-156)*
Daily total energy expenditure	*2383.7*	*433.1*		
Difference	*-452*	*684*		

Results

Variable	3-day intake	1-day intake	Weekly intake	Weekly Ener.Exp
n=23	5795	1931.7	13522	6591

❖*Paired t-test comparing weekly caloric intake and energy expenditure on physical activity indicated a significant difference at the 95% significance level (p=0.00 and CI (5026,8768)*

Results for test-retest

Yale Parameters	Pearson Product Moment Correlation	p- value	Spearman Rank Correlation	p-value
Total Energy expenditure (kcals/week)	0.5250	0.044	0.626	0.013
Vigorous(units/week)	0.472	0.076	0.589	0.021
Total Time(hr/week)	0.314	0.255	0.475	0.073

❖ *None of the other activity dimensions were correlated*

Significant test-retest YPAS activities correlations

❖ *Work activities*

  ∗ *Shopping, light housework, heavy housework, food preparation*

❖ *Yardwork*

  ∗ *Lawn mowing, raking*

❖ *Recreational activities*

  ∗ *Leisurely walking, dancing*

Paired t-test for YPAS test-retest

❖ *Only 4 of the 27 activities were significantly different:*

    Dishwashing, light house repair, raking and yoga.

❖ *At 95% level all other YPAS indices except standing index score (C.I. −6.49,-1.51) were not significantly different between the 1st and the 2nd administrations*

Internal Validity

❖ *The degree of association between the YPAS activity dimension scores, total time, and total energy expenditure, and the body weight and BMI were used as measures of internal validity of the YPAS.*

❖ *None of the YPAS indices were significantly correlated with body weight.*

❖ *None of the YPAS indices were significantly correlated with BMI.*

Overall findings

❖ *Some of the physical activities that older Mexican American adults expend most energy are:*

- ❖ *Brisk walking -* ***886 Kcal/week***
- ❖ *Leisure walking -* ***806 Kcal/week***
- ❖ *Light housework -* ***663.6 Kcal/week***
- ❖ *Food preparation -* ***570.2 Kcal/week***
- ❖ *Childcare -* ***552.0 Kcal/week***

❖ *Spend, on the average* ***31.32 hours/week*** *on physical activity*

❖ *Weekly caloric intake is higher than the weekly energy expenditure on physical activity by* ***6897 Kcal/week***;

Conclusions

- ❖ *Overall magnitude of weekly energy expenditure from our study are comparable in magnitude to other studies using YPAS assessment for older adults other than Mexican Americans.*

- ❖ *Older Mexican American adults engage in less intense activities for longer times compared to older adults in other parts.*

- ❖ *Older Mexican American adults spend more energy in walking activities predominantly leisure walking than other older adult groups*

- ❖ *Our pilot study also indicates that older Mexican American adults also spent more time than other their older adult counterparts in food preparation activities.*

- ❖ *Results also indicate that older Mexican American adults do not engage in bowling, golf, and racquet sports (tennis & racket ball) compared to other older adult groups – so content validity of YPAS for older Mexican American adults is questionable*

Study Limitations

- ❖ *The study was based on a convenience sample*
- ❖ *The number of males in the study was very small compared to the number of females*
- ❖ *Anthropometric data was self reported*
- ❖ *YPAS Validity could not be tested using caltrac count or oxygen consumption monitor*
- ❖ *Cognitive abilities were not formally measured.Cognitive and emotional function does effect lower body functioning measures in older Mexican American adults (Raji et al.,2002)*
- ❖ *Exclusion of medical conditions such as hip fracture and stroke may have resulted in an over estimate of physical activity measures.*

Study limitations

❖ *Reliability and validity of 3-day food record was not tested.*

❖ *Assumptions related to serving sizes and standard recipes*

❖ *Coding errors in ESHA*

❖ *Reporting errors*

❖ *Translation errors*

❖ *Lack of clarification due to logistics*

Final Thoughts

☞ *Understanding influence of physical activity in the disablement process (the pathology-impairment-disability pathway) for older Mexican American adults will help slow disability, and provide for graceful and successful aging.*