

2012

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Hollandsworth, Hannah, "The Association between Levels of Physical Activity and Body Mass Index with Under-Reporting of Energy in Middle-Class African American Women: Data Analysis and Results" (2012). *Honors Projects*. 135.
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Hannah Hollandsworth

HNR 499 Senior Thesis

The association between levels of physical activity and body mass index with under-reporting of energy in middle-class African American women: Data Analysis and Results

Introduction

Energy under-reporting is an issue in studies because it can cause inaccurate associations between diet, physical activity and chronic disease. By eliminating under-reporters of energy, conclusions of clinical studies can be altered (Black, 2000). To be able to account for under-reporters of energy, the characteristics of these under-reporters need to be defined. Studies that are focused on under-reporting in African American women are limited (Samuel-Hodge, 2004). The studies that have been conducted were limited to older, obese participants. One study found that body mass index (BMI) was inversely related to energy under-reporting, therefore the women found to be under-reporters have a higher BMI than those who reported accurately (Samuel-Hodge, 2004). Also, women in the study who were found to under-report classified themselves as “trying to lose weight” (Samuel-Hodge, 2004). Defining typical characteristics of underreports could help to eliminate or standardize for under-reporting in studies that include diet recalls. The entire research project focused on many characteristic of under-reporting, including diet quality, socioeconomic status and many other demographic variables. This protocol focuses only on the physical activity and body mass index of the participants in the research project. Low physical activity levels could be a characteristic of under-reporters of energy intake.

There are many individual and social barriers, which inhibit or lower the level of physical activity that African American women participate in. Studies have shown that physical activity in African American women is influenced by their level of education, marital status, health status, independence

and area of residence (Ainsworth, 2003). There are some factors that inhibit physical activity such as their social role in the family, whether the area they live in has sidewalks and other accessible places for exercise and not having a support group who also participates in physical activity (Ainsworth, 2003). Other barriers for physical activity include the perception of the sidewalks and traffic in the area that the women live in and even how their doctor discusses physical activity with them (Wilcox, 2003). Women also worry about the possible consequences of physical activity such as falls, injuries and heart attacks (Wilcox, 2003).

Typically, African American women participate in walking for exercise and are at a level of low physical activity. As educational status increases, more strenuous forms of physical activity are observed (Adams-Campbell, 2000). Women with low physical activity are not always participating in direct forms of exercise; many African American women believe that they get enough physical activity from their workplace and chores around the house such as cooking and cleaning (Eyler, 2012).

The purpose of this study was to examine the relationship between under-reporting with both the BMI and level of physical activity. I hypothesized that there would be greater under-reporting with increasing BMI and lower levels of physical activity.

Methods and Materials

The larger study had 100 women who have completed the study. These women were recruited through Grand Rapids area churches and Grand Valley State University. This project will report the results from the first 53 subjects with complete variables of interested, 24-hour recall, complete actigraph data and BMI. Also for the purposes of this project, a subset of the larger study is presented.

Questionnaires were used to obtain information about general demographics. These questionnaires were administered previous to wearing the Actigraph for seven days. Also, height was measured by trained research assistants using a Seca 214 portable stadiometer (Seca, Hanover, MD).

Weight was measured using a Tanita BWB-800 digital scale (Tanita Corporation of America, Inc., Arlington Heights, IL). Participants removed their shoes and any heavy outer clothing for the anthropometric measurements. The average of two height and weight measurements was used. Height was measured to the nearest millimeter. Weight was measured to the nearest pound. Body mass index (BMI) was calculated as weight (kg)/height (m²). A Gulick 150 centimeter anthropometric tape was used to measure waist circumference. The waist circumference was measured at the level of the superior anterior iliac spine of the pelvis. The measurement was made at the normal expiration and measured to the nearest 0.25 inch. The questionnaires were stored in Dr. Debbie Lown's research office after being completed.

Physical activity levels (PAL) were measured over a 7 day period using an Actigraph accelerometer (ActiGraph, LLC, Pensacola, FL). worn on the right hip. The subjects were asked to wear the Actigraph at all times and record if they took it off while sleeping, swimming, etc. Participants were assigned one of three PAL values from the Institute of Medicine (Institute of Medicine, 2005). The data used from the accelerometers was 4 valid days with 3 valid weekdays and 1 week-end day. The Actigraph had to be worn for at least 10 hours/day with no more than 60 consecutive 0s to be valid. Less than 100 steps was considered sedentary activity, low activity was 100-499 steps, light activity was 500-2019 steps, moderate activity was 2020-5998 steps and vigorous activity was 5999-10,000 steps (10,000 was the upper limit). Twelve of the valid participants met the requirements for moderate intensity.

Energy intake was determined by three 24-hour diet recalls which were performed while the subject was wearing the Actigraph for seven days and was finished by an assistant at the University of Illinois-Chicago. This dietary information was entered into Nutrition Data System for Research (NDSR), developed by the University of Minnesota Nutrition Coordinating Center. To prevent the influence on diet recall of the subjects' knowledge that underreporting of calories will be investigated, subjects were

only notified that we were interested in the diet intake and physical activity of African American women rather than under-reporting of energy.

Predicted energy requirements (pER) were derived from the DRI equation from the Institute of Medicine which used demographic information and physical activity levels to determine the pER (Brooks, 2004).

The Goldberg Equation was used to determine under-reporters of energy. The Goldberg equation is widely used in clinical nutrition and elsewhere to determine the validity of the reported energy intake from diet recalls (Black, 2000). Under-reporters were participants with an energy intake \leq 78% of the predicted energy requirements.

Statistical analysis

The statistical analysis of the data was done using SAS (version 9.1; SAS institute, Cary, NC.) Reporting of calories was classified as under-reporters, plausible reporters and over-reporters. For the purposes of this study, the over-reporters (n=1) were excluded from analysis. BMI was classified as normal weight (BMI <25), over weight ($25 \leq \text{BMI} \leq 30$) and obese (BMI >30). Physical activity was categorized into low (steps <5000) and moderate activity (steps=5,000). High physical activity was not included because none of the actigraph measurements showed that any participants had high physical activity.

The demographic categorical variables were assessed with chi-squared tests (level of under-reporting, category of BMI [obese, overweight, non-overweight] and level of PAL). Spearman's were used to assess the correlation between level of under-reporting of energy and BMI.

Results

Table 1 displays the demographic characteristics that were obtained with questionnaires. The only demographic variables that were found to be significant with diet reporting status were BMI ($p < 0.05$) and whether the participant was dieting at the time of the study ($p < 0.0001$).

Table 1: Subject characteristics in total energy under-reporters and plausible reporters (n=52)^a

Variable	Under-reporters of energy (n=39) ^b	Plausible reporters of energy (n=13)	P
Mean age (SD)	51 (14)	44 (15.7)	n.s.
BMI ^c (kg/m ²) (SD)	32.9 (7.2)	28.1 (5.5)	<0.05
Marital status (%)			n.s.
Married	56.4	66.7	n.s.
Single	23.0	25	n.s.
Widowed	15.4	8.3	n.s.
Unknown	5.2	0.0	n.s.
Education (%)			n.s.
High school	10.3	8.3	n.s.
One year of college	43.6	16.7	n.s.
4-years of college	17.9	33.3	n.s.
Post-graduate	28.2	41.7	n.s.
Dieting (%)	87	23	<0.0001

^a Note one subject was an over-reporter and data is not shown

^b Measured over a 7-day period with accelerometers and determined using values from the Institute of Medicine.

^c Body Mass Index

Abbreviation: n.s., not significant ($p > 0.05$)

According to the demographic information obtained, the population of women that were included in the study who were under-reporters tended to have a higher mean BMI than those who were plausible reporters ($p < 0.05$; Table 2). The percentage of under-reporters and plausible reporters that engaged in low or moderate physical activity were not significantly different. (Table 2).

Table 2: Subject BMI and mean reported physical activity levels in total energy under-reporters and plausible reporters (n=52)^a

Variable	Under-reporters of energy (n=39)	Plausible reporters of energy (n=13)	P
BMI ^b (kg/m ²) (SD)	39.2 (7.2)	28.1 (5.5)	<0.05
Physical activity level ^c			
Low (%)	79.5	84.6	n.s.
Moderate (%)	20.5	15.4	n.s.
Vigorous	0.0	0.0	

^a Note one subject was an over-reporter and data is not shown

^b Body Mass Index

^c Measured over a 7-day period with accelerometers and determined using values from the Institute of Medicine.

Abbreviation: n.s., not significant ($p > 0.05$)

In under-reporters, the frequency of women in the BMI categories of normal, overweight or obese did not significantly differ by physical activity level (low and moderate) (data not shown).

Those women with a higher BMI were significantly more likely to underreport their calories ($r = -0.33$, $p < 0.05$; Table 3). The level of PAL was not significantly correlated with underreporting or BMI in these women.

Table 3: Spearman partial correlations between the percentage of under-reporting of total energy and BMI and PAL in under-reporters (n=39)

Subject Variables	Under-reporting of total energy intake^a	p
Body mass index	-0.33	P <0.05
Physical activity ^b	0.27	n.s.

^a Energy intake \leq 78% of the predicted energy requirements (found using equation from Institute of Medicine)

^b Measured over a 7-day period with accelerometers and determined using values from the Institute of Medicine

Abbreviation: n.s., not significant ($p > 0.05$)

Conclusions

Under-reporting in African American women ages 18 and over is very prevalent which can be seen in the data because over half of the participants were under-reporters; 39 participants under-reported their total energy intake, 13 participants were plausible reporters and one participant was classified as an over-reported of total energy intake, therefore 75% of participants were classified as under-reporters. Under-reporters had a higher BMI than plausible reporters. Our results agree with previous results reported by Samuel-Hodge in obese African American women with Type 2 diabetes (Samuel-Hodge, 2004).

Surprisingly, physical activity was not correlated with under-reporting and BMI. It is possible that we found no associations as the majority of the women fell into the low physical activity category.

One limitation of this study is that participants volunteered and therefore, may differ from those who did not volunteer.

Now that some characteristic of under-reporters in African American women have been defined, it is crucial to find a way to correct for the under-reporters in studies that involve self-reported dietary recalls. This can help make the results of these studies more viable and lead to more correct correlations between diet and chronic disease that is so prevalent in African American women. Also, further studies should be done to assess other variables that could affect a participant's likelihood to under-report total energy intake.

Bibliography

- ActiGraph. (2012). *GT3X+ Activity Monitor*. Retrieved from ActiGraph:
<http://www.theactigraph.com/products/gt3x-plus/>
- Adams-Campbell PhD, L. L., Rosenberg ScD, L., Washburn PhD, R. A., Rao M.S., R., Kim PhD, K. S., & Palmer ScD, J. (2000). Descriptive Epidemiology of Physical Activity in African-American Women. *Preventive Medicine*, 43-50.
- Ainsworth PhD, MPH, B. E., Wilcox PhD, S., Thompson MSW, W. W., Richter PhD, D. L., & Henderson PhD, K. A. (2003). Personal, social and physical environment correlates of physical activity in African-American women in South Carolina. *American Journal of Preventive Medicine*, 23-29.
- Black PhD,. (2000). Critical Evaluation of Energy intake using the Goldberg cut-off for energy intake: basal metabolic rate. A practical guide to its calculation, use and limits. *International Journal of Obesity*, 1119-1130.
- Brooks, G. A., Butte, N. F., William, R. M., Flatt, J.-P., & Caballero, B. (2004). Chronicle of the Institute of Medicine physical activity recommendation: how a physical activity came to be among dietary recommendations. *The American Journal of Clinical Nutrition*, 921-930.
- Eyler PhD, C. A., Baker PhD, M. E., Cromer MPH, L., King PhD, A. C., Brownson PhD, R. C., & Donatelle PhD, R. J. (2012). *Physical Activity and Minority Women: A Qualitative Study*. Retrieved from Sage Journals Online:
<http://heb.sagepub.com/content/25/5/640.short>
- Institute of Medicine FaNB. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, fatty Acids, Cholesterol, Protein and Amino Acids. Washington DC: National Academy Press, 2005.

- Samuel-Hodge PhD, C. D., Fernandez, MPH, L. M., Henriquez-Roldan, PhD, C. F., Johnston, MPH, L. F., & Keyserling, MD, T. C. (2004). A Comparison of Self-Reported Energy Intake With Total Energy Expenditure Estimated by Accelerometer and Basal Metabolic Rate in African-American Women With Type 2 Diabetes. *Diabetes Care*, 663-669.
- Wilcox PhD, S., Bopp PhD, M., Oberrecht PhD, L., Kammermann PhD, S. K., & McElmurray PhD, C. T. (2003). Psychosocial and Perceived Environmental Correlates of Physical Activity in Rural and Older African American and White Women. *The Journals of Gerontology*, 329-337.