

Bio-Impedance Analysis Measures in a Rural Latina Community

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Abstract- Obesity is an ever-growing epidemic that is accompanied by numerous comorbidities and exorbitant health care expenditures. The rural community in which this minority population was studied has the 7th fattest population in the United States and is approximately 40% Hispanic¹. In order to focus on interventions, bio-impedance analysis (BIA) was completed on a segment of the population as part of a community health assessment used in the Public Health Nursing Model. Forty-nine Latina women ages 20-80, attending a Latina Red Dress Event that targeted Heart Health of Latina women, were consented and measured for body composition on a bio-impedance analyzer. The items measured were BMI, body fat percentage, weight, height, body fat mass, fat free mass, visceral fat rating, body water percentage, body water mass, muscle mass, bone mass, basal metabolic rate, and metabolic age. Correlations and frequencies were analyzed for the variable data. State statistics indicate that approximately 60% of the population in this area is overweight or obese. The study findings show the rate is much higher in this segment of the population.

Keywords- *Bio-Impedance; Rural; Latina; Water*

I. INTRODUCTION

Obesity is an ever-growing epidemic that is accompanied by numerous comorbidities and exorbitant health care expenditures. Rural areas in this country have higher rates of obesity than those of urban areas. Mexican Americans are at a higher risk for overweight and obesity and its comorbidities such as hypertension, diabetes, cardiovascular disease, joint disorders, psychological disorders, hyperlipidemia, cancers and asthma [1]. This study was conducted in a rural mid-western area that has approximately 40% Mexican-American [2]. The rural community where the study took place has the 7th highest occurrence of obesity in the United States [3]. In order to focus on obesity prevention interventions for this Hispanic population, bio-impedance analysis (BIA) was completed on a cohort of Hispanic mothers and abuelas (respected grandmothers) who attended a community health event. Hispanic mothers and abuelas were selected for this community health assessment. Significant relationships have been found between obese mothers and the risk for obesity in their children. The mothers and abuelas are also the primary caregivers who determine child feeding behaviors. The Public Health Nursing Model was used to guide the study design. Data from this study will be used to determine the need and direction for a future Hispanic abuela/mother intervention that will encourage healthy child feeding behaviors including limiting low nutrient carbohydrate intake and increasing body water. The overall objective is to help mothers eat, and drink healthier and feed their children in a similar manner to help prevent obesity in themselves and their children.

II. BACKGROUND

Nationwide, approximately 78% of Hispanic women are overweight or obese as compared to 60% for white women [4]. Hispanic women and families, across the country, tend to be of low socioeconomic status (22% live below the poverty line) which contributes to obesity. In this particular rural area, nearly 50% of Hispanic women aging 18-75 live in poverty [4]. Not having enough money to buy nutritious foods can lead to buying cheaper, less healthy foods that have higher fat and calorie content. Drinking more water in place of simple carbohydrate beverages is not only less expensive but can increase body water levels. Lower nutrient, high calorie foods, often simple carbohydrates, contribute to the development of obesity. Educating and motivating mothers and abuelas may help them to choose healthier foods and drinks for themselves and their children and will hopefully decrease the current obesity epidemic. According to one study, the diets of Mexican-American families are known to be high in sugar (simple carbohydrates) from such foods as soda, refined snacks, fruit juices and drinks and processed foods [5]. Many simple carbohydrates have no food value and are often referred to as empty calories. These empty calories may negatively affect a person's body weight and put them at a greater risk of being obese [6].

Along with obesity, comes a host of comorbidities including, but not limited to, cardiovascular disease, hypertension, diabetes, joint disorders and osteoarthritis, hyperlipidemia, psychological trauma, gynecological problems (abnormal menses, infertility), asthma, sleep apnea, stroke, cancers and liver and gall bladder disease [7]. The effects of these comorbidities and treatment required for these comorbidities, only exacerbate these women's already poverty stricken state [7].

Greater consumption of beverages high in low nutrient carbohydrates (e.g. sugar-sweetened drinks) is associated with higher energy intake and weight gain in children [8, 9] and adults [10]. There is particular concern about the nutritional implications of these beverage choices for children [8, 9, 11]. In addition, high consumption of sugar-sweetened beverages is associated with greater risk of coronary heart disease [12] and type 2 diabetes [13]. As this research focus moves toward

helping Hispanic grandmother and mothers feed their children healthy, this is especially important to note.

Adequate water intake has many health benefits [14] and can help efforts to reduce or maintain weight [15-19]. Adequate hydration helps ward off fatigue that may lead to unnecessary snacking, aids digestion, and contributes to feelings of fullness without adding calories [16]. In addition, exchanging water for sugar-sweetened beverages helps reduce calorie intake and increase weight loss [15-19]. Replacing sugar-sweetened beverages with water can also help lower the risk of type 2 diabetes [20].

III. METHODS

This descriptive study was conducted at an annual Latina heart health event. University of Nebraska Medical Center IRB approval was obtained for this study. Potential participants were consented and measured on a Tanita SC-240 Body Composition Analyzer. The reliability and validity of bio-impedance analysis (BIA) are well established; test-retest correlation is $r=.78-.88$ [21, 22]. Upon voiding, they were asked to remove shoes and socks, and were then assisted onto the analyzer. Participants were asked to stand as still as possible while the BIA was conducted. They were then asked to step back from the analyzer as the results were computed and printed on a sheet which was then given to the participant. Measures computed were body mass index, body fat percentage, weight, height, body fat mass, fat free mass, visceral fat rating, body water percentage, body water mass, muscle mass, bone mass, basal metabolic rate, and metabolic age.

IV. RESULTS

Forty-nine Latina women, ages 20-80, were consented and measured for body composition using a bio-impedance analyzer (BIA). Correlations and frequencies were analyzed for the variable data. The mean age of participants was 44 years, mean height was 62 inches, mean weight was 175 pounds, mean body mass index (BMI) was 32% (normal 18-25), mean body fat percent was 40.5% (normal 22-33%), and mean body water percentage was 42% (normal 46-60%). According to the body composition assessments, only 5 of the 49 women (10%) measured had healthy body fat percentages, and these same women were the only women who had normal body water percentages. While state statistics indicate that approximately 60% of the population in this area is overweight or obese, 90% of this sample population is overweight or obese. Unexpected findings included a highly negative correlation ($-.959$) between water and body fat percentages and a highly positive correlation (.848) between BMI and visceral fat. Expected correlations were that BMI and weight were positively correlated (.865) and fat free mass and muscle mass were positively correlated (.999).

V. CONCLUSION

It is noteworthy that this Latina population had a higher prevalence of overweight or obesity than the state average and such low body water percentages. This was especially so, in light of the heart healthy event they were attending, which would seem to be a health seeking behavior. It is difficult to surmise whether they attended this event out of concern for their precarious health status related to being overweight and having low body water composition, or for the social, cultural aspects of the event. Events such as this, provide an opportunity to educate and motivate participants to implement healthier behaviors such as limiting low nutrient carbohydrates and drinking water. It is interesting to note that Popkin et al. [23] and Goodman et al [17] found that higher water consumption was associated with healthier eating habits and/or behaviors. Though our study did not examine dietary habits, these patterns are consistent with our finding that women with healthy body fat percentages also had normal body water percentages. It also supports our approach of combining limiting low nutrient carbohydrate intake with improving water intake for our future mother/abuela interventions to promote healthy eating, drinking and child feeding behaviors. Additional research is needed to determine the causes of high fat percentage rates and low body water levels in this population, as well as their motivation for attending the community health event.

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REFERENCES

- [1] Ogden CL, Carroll MD, Flegal KM. High body mass index for age among US children and adolescents, 2003-2006. *JAMA*. 2008; 299(20):2401-2405.
- [2] Nebraska Department of Health and Human Services. Needs assessment. <https://perfddata.hrsa.gov/MCHB/TVISReports/Documents/NeedsAssessments/2011/NENeedsAssessment.pdf>. Updated 2007. Accessed January 12, 2011.
- [3] Banner, V. Ten fattest cities in America. Available at <http://www.qualityhealth.com/dieting-articles/10-fattest-cities-america.2008>.
- [4] Centers for Disease Control. Health United States, 2011. Table 74. Available at <http://www.cdc.gov/nchs/data/abus/abus11.pdf>. 2102
- [5] Wilson, D. New perspectives on health disparities and obesity interventions in youth. *Journal of Pediatric Psychology*. 2009; 34:3: 231-244.

- [6] Stanford Wellsphere. Strategies for overweight children-stop drinking calories. *Wellsphere*. Available at <http://stanford.wellsphere.com/weight-loss-article/strategies-for-overweight-children>. 2008.
- [7] Centers for Disease Control. Obesity. Available at <http://www.cdc.gov/obesity/adult/causes/index.html> 2012.
- [8] Mrdjenovic, G. and D.A. Levitsky. Nutritional and energetic consequences of sweetened drink consumption in 6-to 13-year-old children. *The Journal of Pediatrics*. 2003. 142:604-610.
- [9] Rampersaud, G.C., L.B. Bailey, and G.P.A. Kauwell. National survey beverage consumption data for children and adolescents indicate the need to encourage a shift toward more nutritive beverages. *Journal of the American Dietetic Association*. 2003. 103:97-100.
- [10] Daniels, M.C. and B.M. Popkin. Impact of water intake on energy intake and weight status: a systematic review. *Nutrition Reviews*. 2010. 68:505-521.
- [11] Petter, L.P.M., J.O. Hourihane, and C.J. Rolles. Is water out of vogue? A survey of the drinking habits of 2-7 year olds. *Archives of Disease in Childhood*. 1995. 72:137-140.
- [12] Fung, T.T., V. Malik, K.M. Rexrode, J.E. Manson, W.C. Willett, and F.B. Hu. Sweetened beverage consumption and risk of coronary heart disease in women. *American Journal of Clinical Nutrition*. 2009. 89:1037-1042.
- [13] Palmer, J.R., D.A. Boggs, S. Krishnan, F.B. Hu, M. Singer, and L. Rosenberg. Sugar-sweetened beverages and incidence of type 2 diabetes mellitus in African American women. *Archives of Internal Medicine*. 2008. 168:1487-1492.
- [14] Institute of Medicine (U.S.). Panel on Dietary Reference Intakes for Electrolytes and Water, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board. Chapter 4. Water. Pages 73-185 in *Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate*. 2004. The National Academies Press, Washington, D.C. Available at <http://www.nap.edu/catalog/10925.html>.
- [15] Akers, J.D., R.A. Cornett, J.S. Savla, K.P. Davy, and B. M. Davy. Daily self-monitoring of body weight, step count, fruit/vegetable intake, and water consumption: a feasible and effective long-term weight loss maintenance approach. *Journal of the Academy of Nutrition and Dietetics*. 2012. 112:685-692.
- [16] D'Arrigo, T. Drink up! The wonder of water. *Diabetes Forecast*. 2007. 60:23.
- [17] Goodman, A.B., H.M. Blanck, B Sherry, S. Park, L. Nebeling, and A.L. Yaroch. Behaviors and attitudes associated with low drinking water intake among US adults, food attitudes and behaviors survey, 2007. *Preventing Chronic Disease*. 2013. 10:120218.DOI: <http://dx.doi.org/10.5888/pcd10.120248>.
- [18] Stookey, J.D., F. Constant, C.D. Gardner, and B.M. Popkin. Replacing sweetened caloric beverages with drinking water is associated with lower energy intake. *Obesity*. 2007. 15:3013-3022.
- [19] Stookey, J.D., F. Constant, C.D. Gardner, and B.M. Popkin. Replacing sweetened caloric beverages with drinking water is associated with lower energy intake. *Obesity*. 2007. 15:3013-3022.
- [20] Pan, A., V.S. Malik, M.B. Schulze, J.E. Manson, W.C. Willett, and F.B. Hu. Plain-water intake and risk of type 2 diabetes in young and middle-aged women. *American Journal of Clinical Nutrition*. 2012. 95:1454-1460.
- [21] Lukaski, Bolonchuk, Hall, & Siders, (1986). Validation of tetrapolar bioelectrical impedance method to assess human body composition. *Journal of Applied Physiology*. 1986; 60:4:1327-1332.
- [22] Segal, Gutin, Presta, Wang, & van Itallie, (1985). Estimation of human body composition by electrical impedance methods: a comparative study. *Journal of Applied Physiology*. 1985; 58:5:1565-1571.
- [23] Popkin, B.M., D.V. Barclay, and S.J. Nielsen. Water and food consumption patterns of U.S. adults from 1999 to 2001. *Obesity Research*. 2005. 2146-2152.