OMRON FAT LOSS MONITOR HBF-306C, AN ALTERNATIVE METHOD FOR BODY MASS INDEX MEASUREMENT: COMPARISON STUDY OF COMPUTED BMI FROM OMRON BASED ON SELF-REPORTED DATA WITH BMI DERIVED FROM MEASURED WEIGHT AND HEIGHT

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Family and Consumer Sciences

by

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December 2012
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DEDICATION

This thesis is dedicated to my late mother, who has always been a great source of motivation and inspiration, as well as to my father and family members who supported me all the way since the beginning of my studies. Without your care and encouragement, this would not be possible.
ACKNOWLEDGEMENT

I would like to express my deepest and most sincere appreciation to my chair, Dr. Joyce A. Gilbert. She provided invaluable guidance and encouragement during this undertaking, helping me understand the methodologies of the dissertation and effectively complete the project. I am also thankful for my committee member, Dr. Lydia Chow for her generous support throughout this thesis. Avery hearty thanks to Dr. Konstantinos Vrongistinos and Dr. Yi Cai for their guidance and essential assistance in statistical analysis. Last but not least, I acknowledge the assistance provided by Katherine; my fellow graduate students of California State University, Northridge; and those from Mission Community Hospital San Fernando City who facilitated my successful completion of this study.
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ABSTRACT

OMRON FAT LOSS MONITOR HBF-306C, AN ALTERNATIVE METHOD FOR BODY MASS INDEX MEASUREMENT: COMPARISON STUDY OF COMPUTED BMI FROM OMRON BASED ON SELF-REPORTED DATA WITH BMI DERIVED FROM MEASURED WEIGHT AND HEIGHT

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The recent development of multiple pieces of technology eases life in many areas—and not the least of these is the health arena. The purpose of this study was to examine the validity of the Omron HBF-306C Fat Loss Monitor for BMI against BMI calculation using weight (kg) and height (m²); this study endeavored to discover any significant difference between the two methods. The study design was exploratory and formative, and appropriate instruments were selected and designed for the study to pose minimal risks. Both qualitative and quantitative data were collected from the subjects (n=22) who voluntarily attended a six-week self-management intervention program specific to diabetes and obesity prevention at Mission Community Hospital San Fernando (MCH-SF) and were subjected to the use of the Omron HBF-306C Fat Loss Monitor for BMI. The study revealed no significant difference ($t = .814, p = .425$) in BMI using Omron and typical BMI calculation (kg/m²), suggesting the use of Omron HBF-306C in ambulatory care settings as an alternative method for BMI and recommended standardization and careful control of the variables required for calculation.
CHAPTER I

INTRODUCTION

Healthy body weight ensures good health and the minimization of adverse health outcomes. A weight-height index is widely used as a general indicator of health, nutrition status, obesity, and associated disease assessment (Balluz, Okoro, & Mokdad, 2008; Haffner, 2006; Malnutrition Advisory Group, 2003). Accurate and reliable body mass index (BMI) measurements are fundamental to assess obesity and associated chronic conditions. Moreover, it is essential to explore a clinically comprehensible alternative method of BMI and evaluate its accuracy over the standard BMI measured as body weight (kg) in relation to height (m²).

Statement of the Problem

At present, a variety of consumer-grade bioelectrical impedance analysis (BIA) devices are available (Pribyl, Smith, & Grimes, 2011) to monitor weight status, body composition, and progressing weight loss and body fat. Although the popularity of these devices has spiked in both home and health care due to their claimed precision and straightforward use, limited scientific data exist on the accuracy of these devices (Bosy-Westphal et al., 2008).

Omron (HBF-306C) is a relatively inexpensive, portable, user-friendly, and handheld Fat Loss Monitor to estimate the percentage of body fat (%BF) and BMI. It typically is used to calculate %BF by the bioelectrical impedance (BI) method (Peterson, Repovich, & Parascand, 2011). However, clinical use of Omron for BMI has not previously been reported. This trial thus may help determine the validity of using Omron in future health care settings as an alternative BMI screening tool by comparing it with
the standard BMI method using weight (kg) and height (m²).

Purpose

The primary purpose of the study is to analyze the validity of the single-frequency BIA consumer device Omron HBF-306C for BMI calculation. The secondary purpose is to provide a clinically comprehensible, inexpensive, and quick alternative BMI screening tool to track the BMI in individuals in ambulatory care settings.

Definitions

1. BMI is defined as weight in kilograms (kg) divided by the square of height in meters (m²) (Razak et al., 2007).
2. BIA is a widely used method for estimating body composition, compared to other tissues, by its resistance to electricity. It is a simple, quick, and noninvasive technology (National Institute of Health, 1994).
3. Adult (≥ 20 years) obesity was defined in accordance with the National Institutes of Health (NIH) and the World Health Organization (WHO) as a BMI of ≥ 30 (kg/m²) (National Institutes of Health, 1998; and World Health Organization, 2000).
4. Youth obesity was defined using smoothed age and gender-specific as BMI at or above the 95th percentile (Chinn, 2006)

Hypotheses

Null Hypotheses

This thesis was guided by the following null hypothesis: there will be no statistically significant differences in estimated body mass index values between Omron HBF-306C determined from self-reported data and measured BMI (kg/m²).
Research Hypotheses

Based on the review of literature in Chapter 2, the following research hypotheses were developed.

1. What are the differences among BMI values in Omron and kg/m² measurements performed in Hispanic females by those attending a self-management intervention program specific to diabetes and obesity?

2. Is an alternative BMI value obtained from Omron (HBF-306C) more reliable than the currently used BMI (kg/m²) as a criterion?

Assumptions

This research study was created based upon certain assumptions.

- No earlier scientific evidence has been reported on the clinical use of Omron HBF-306C to calculate BMI.

- Omron indicates BMI using a pre-determined metric height (m²) and weight (kg) equation; therefore, after the adjustment of self-reported measurements, relative results will be similar to those measured by BMI regardless of the device used.

- A community-level intervention program specific to prevention and self-management of diabetes and obesity will be effective in reducing body weight, BMI, blood glucose, and cholesterol.

- Participants will participate in the research with personal consent and fill out the pre-post test honestly.
Chapter II

Review of Literature

Anthropometric measures such as height, weight, and body mass index (BMI) are vital in medical practice. These measurements are important for making clinical and therapeutic decisions, such as assessing obesity. The growing prevalence of obesity in the United States (U.S.) has highlighted the importance of accurate assessment of overweight and obese individuals. The most widely used measure is BMI which categorizes individuals as underweight, normal, overweight, obese, or morbidly obese. This section reviewed the published literature and relevant information related to the topic.

2.1 Magnitude of the Problem

Americans are heavier than ever before. More than one-third of adults (35.7%) and almost 17% of youth (2–19 years) are obese (Ogden, Carroll, Kit, & Flegal, 2012). Starting with the first National Health and Nutrition Examination Survey (1976–1980) to a follow-up NHANES assessment (1988–1994), BMI increased by 8% in both genders and for all ethnicities (Sundquist & Winkleby, 2000). The prevalence of obesity defined by BMI (≥ 30 kg/m²) in the U.S. doubled over the last 25 years (Barcenas et al., 2007; Beydon & Wang, 2009). A comparison between NHANES data (1976–1980 and 1999–2000) illustrated that the prevalence of obesity (BMI ≥ 30 kg/m²) increased by 110% (Bowie, Juon, Cho, & Rodriguez, 2007). However, projection models of NHANES 1988–1994 and 1999–2004 data suggested that BMI will continue to rise (Beydon et al., 2009; Ogden, Carroll, Curtin, Dowell, Tabak, & Flegal, 2006).

This growing prevalence appeared greater (BMI ≥30 kg/m² increased 12% to 21%) among Hispanic Americans (HA) from 1991 to 1998 HA surveillance data (Bowie et al.,
2007). In the largest HA subset, Mexican Americans (MA) (73.4%) ranked highest in a combined category of overweight and obese (Ogden et al., 2006). MA women are more likely to be classified as obese, with a BMI $\geq 30$ kg/m$^2$ (Bowie et al., 2007). Fernández et al. (2003) found a higher percentage of body fat (% BF) among HA women than other ethnic women with the same BMI measurements.

The increasing obesity pandemic has reduced the quality of life associated with mortality (Flegal, Graubard, Williamson, & Gail, 2007), increased health care costs, and economic burden (Bhattacharya & Sood, 2004). California’s estimated cost of physical inactivity, being overweight, and obesity was about $21.7 billion in 2000 (Chenoweth, 2005). Well-documented morbidities include type 2 diabetes, hypertension, asthma, arthritis, cancer, stroke, and cardiovascular disease (Burton, Foster, Hirsch & Van Itallie, 1986; Pi-Sunyer, 2002), among other diseases (Malnick & Knobler, 2006). National estimates suggest the annual burden of disease related to being overweight (BMI >25-29 kg/m$^2$) is nearly 300,000 deaths and $117$ billion in healthcare costs (Bowie et al., 2007).

Adult obesity rates are relatively higher in nearly every state among African Americans and Latinos (Levi, Vinter, Laurent, & Segal, 2010). However, the prevalence is highest in middle-aged African Americans and Mexican American women (Flegal, Carroll, Ogden, & Curtin, 2010) and in older Mexican American children and African American girls (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). In California, Hispanics are inexplicably affected by obesity, constituting about 40% of the state’s medically obese adults in 2003 (Public Policy Institute of California, 2006). The factors that contribute to obesity among Hispanics are complex and multifaceted. The causes are not only biological but also involve social and environmental factors (including values, cultures,
resources, and unhealthy foods) that influence eating and physical activity behaviors and choices (Woodward-Lopez & Flores, 2006).

Adult (≥ 20 years) obesity was defined in accordance with the National Institutes of Health (NIH) and the World Health Organization (WHO) as a BMI of ≥ 30 (kg/m²) (National Institutes of Health, 1998; and World Health Organization, 2000). Youth obesity was defined using smoothed explain this term age and- gender-specific as BMI at or above the 95th percentile (Chinn, 2006).

2.1.1 Measures of obesity. It is not just fat that causes obesity but also the distribution of fat. Various indicators of adiposity have been developed and are presently in use in clinical practice and research studies (Ellis, 2001; Peterson, Repovich, & Parascand, 2011; Vazquez et al., 2007). Such measurements are underwater weighing (hydrometry), bioelectrical impedance (BI), Dual-Energy X-ray Absorptiometry (DEXA), Magnetic Resonance Imaging (MRI), Computed Tomography (CT), and isotope dilution (WHO, 2000). The state of the art is the BOD POD (Ginde et al., 2005). In general, measuring fat mass is difficult, expensive, and impractical for large-scale studies. In contrast, BMI, Waist circumference (WC), waist-to-hip ratio (WtHR), and skinfold thickness (SF) are more practical and simple anthropometric measures. Although no accurate method is easily available for routine clinical use, BMI and SF are the widely accepted indices for measuring fatness (body fat and subcutaneous fat respectively) and defining obesity (World Health Organization, 1995). Despite the advances made in measuring obesity, there is still no agreement on whether the estimates of body fat, skinfold, and waist circumference are a more accurate measure of obesity than the simple weight-height index (Freedman & Perry, 2000).
2.2 Body Mass Index (BMI)

The standard method to obtain BMI in clinical practice and population surveys is weight in kilograms (kg) divided by the square of height in meters (m²) (Bowie et al., 2007; Flegal et al., 2010; Razak et al., 2007). Universally accepted BMI classifications are underweight < 18.5kg/m², normal weight 18.5-25kg/m², overweight 25-30 kg/m², obese ≥ 30kg/m², and extremely obese ≥ 40 kg/m² (NIH, 1998; WHO, 2000).

2.2.1 The significance of BMI. BMI-defined obesity varies by age, gender, and race and does not distinguish fat from muscle, bone, and other lean body mass (Burkhauser & Cawley, 2008; Gallagher et al., 1996). Romero et al. (2008) considered BMI an imprecise measurement of obesity. Also BMI does not acknowledge loss of muscle mass (Di Monaco, Vallero, Di Monaco & Tappero, 2011). Despite all the shortcomings, BMI is widely used to compare health outcomes by the degree of adiposity in a population. Many studies considered BMI a reasonable measure of adiposity (Deurenberg, Weststrate, & Seidell, 1991; Smalley, Knerr, Kendrick, Colliver, & Owen, 1990; Strain & Zumoff, 1992), inexpensive, safe and practical to acquire in clinical and community settings (Gallagher et al., 1996). Most currently available datasets, such as Behavioral Risk Factor Surveillance System (BRFSS) (Chou, Grossman, & Saffer, 2004), National Health and Nutrition Examination Survey (NHANES) (Rashad, Grossman, & Chou, 2006), Medical Expenditures Panel Survey (MEPS), National Longitudinal Surveys of Youth (NLSY), and Health and Retirement Study (HRS), were the preferred BMI measure or self-report to define obesity (Cawley & Burkhauser, 2006). Moreover BMI widely accepted screening tool for malnutrition as well (Beck, Ovsesn, & Osler, 1999; Malnutrition Advisory Group, 2003).
Studies frequently associate high BMI values (>25 kg/m²) with chronic health conditions such as diabetes, arthritis, hypertension, and hypercholesterolemia (Barcenas et al., 2007; Bays, Chapman, & Grandy, 2007; Balluz, Okoro, & Mokdad, 2008; Bowie, et al., 2007; Joliffe, 2004). Haffner has identified increased BMI as an independent risk factor for coronary heart disease (CHD). His research concluded that weight gain in adulthood is associated with rising rates of multiple cardiometabolic risk factors and an increased risk of chronic diseases (2006). Bays et al. (2007) found the highest prevalence of dyslipidaemia, hypertension, and diabetes mellitus among obese (defined as BMI ≥ 30 kg/m²) and morbidly obese (≥ 40 kg/m²) adults in national surveys (NHANES and SHIELD) data.

2.3 Alternative Measures of BMI

Studies have challenged the validity of BMI and proposed alternative measures: percent body fat (% BF), WC, WtHR, and SF (Burkhauser & Cawley, 2008; Ellis, 2001; Vazquez, Duval, Jacobs, & Silventoinen, 2007). Yusuf et al. (2005) concluded that by a variety of standards, waist-to-hip ratio (WtHR) and, to a lesser extent, waist circumference, better predict heart attack than does BMI. In meta-analysis, all three measures have similar association with diabetes incidents (Vazquez, et al., 2007). Rothman considered BMI an indirect measure of body fat compared with bioelectrical impedance (BI) (2008). BI has been used to assess % BF as an alternative measure of fatness using prediction equations instead of relying on BMI (Burkhauser et al., 2008). Detailed information on the BIA validity and procedure is presented elsewhere (Ellis, 2001; Kuczmarski, 1996; Kyle et al., 2004; National Center for Health Statistics, 1994).
2.3.1 Bioelectrical impedance fat loss monitor (Omron HBF-306C). The handheld Omron (HBF-306C) is relatively user-friendly and an inexpensive (< $ 50.00) body fat analyzer. It measures two indicators % BF and BMI using data electric current (50 kHz and 500 µA), height, weight, age, gender, and fitness level (athlete or normal). It is generally used for % BF estimation (Peterson, Repovich, & Parascand, 2011). The validity of BMI obtained from Omron HBF-306C has not previously been reported. Hence the present study used Omron (HBF-306C) as an alternative measure of BMI to answer research questions concerning the ability of the Omron to accurately record BMI against BMI (kg/m²) collected from Hispanic females attending a self-management intervention program specific to diabetes and obesity.

2.4 BMI from Self-reported (SR) Weight and Height

Large epidemiological studies often obtained BMI from self reported weight and height (Bays et al., 2007; Gillum & Sempos, 2005; John et al., 2006) because it is a cost effective and practical tool for both study participants and researchers, in assessing weight related health issues in a population. However, the accuracy of BMI obtained from self-reported measures has been questioned due to over-reporting of height and under-reporting of weight. As a result, BMI values calculated from self-reported data frequently under-represent the true degree of adiposity (Kuczmarski, Kuczmarsski, & Najjar, 2001). Studies have demonstrated that accurately self-reported height and weight correlated with measured height and weight (Spencer, Appleby, Davey, & Key, 2002; Avila-Funes, Gutierrez-Robledo, & Rosales, 2004). A few studies suggested that it could be useful in certain populations (Goodman, Hinden, & Khandelwal, 2000; Himes & Story, 1992; Spencer et al., 2002) while others have reported systemic errors (John, Hanke, Grothues,
Gillum et al. (2005) found substantial underestimation of the prevalence of obesity based on self-reported BMI in MAs. Akhtar-Danesh and colleagues found a difference of 7.4% between SR and measured BMI. The estimated prevalence of obesity was 15.6% and 23.0%, respectively. Their analysis confirmed that under-reporting is directly related to weight (in women) and inversely related to height (in men) in Canadian subjects (2008).

Acknowledging the issues with self-reported BMI data, McAdams et al. (2007) suggested that accuracy of self-report BMI is sufficient for epidemiological studies as a primary disease biomarker, though caution is warranted for precise measurements of obesity. Additionally, Ellis (2001) suggested that BMI reasonably approximates body fat, which makes it a good measure for research comparison. In spite of limitations associated with self-reported BMI data, both self-report and direct measure BMI are highly correlated to true measures of percent body fat (Ellis, 2001). Despite limitations of self-reported BMI data, researchers find the benefits are both acceptable and reasonable for estimating adiposity in a research population because BMI highlights the general tendency of that population for health trend comparisons (Joliffe, 2004; Nagaya, Yoshida, Takahashi, Matsuda, & Kawai, 1999).

2.5 Self-management Intervention Programs

Evidence showed that educational programs for self-management in chronic diseases empower individuals and the community to play a primary role in managing their conditions and determine when additional medical attention is necessary. It improved healthcare practices, reduced cost of care, and morbidity (Deakin, McShane, Cade, & Williams, 2005; Guevara, Wolf, Grum, & Clark, 2003; Jovicic, Holroyd-Leduc, & Straus,
2006). Several intervention programs for diabetes prevention and management produced positive results. These programs approached exercise, diet, weight, health education, and community mobilization (Brown, Garcia, Kouzekanani & Hanis, 2002; Stegmayer, Loverien, Smith, Keller, & Gohdes, 1988; Schwab & Simmons, 1989). Community-level disease management programs targeting at-risk populations for diabetes, heart disease, and obesity will be beneficial in improving health outcomes.
CHAPTER III

METHODOLOGY

Procedures

The study design was exploratory and formative in nature. Culturally and linguistically appropriate instruments were selected and designed for the study to pose minimal risks. Both qualitative and quantitative data were collected from the subjects who voluntarily attended a six-week self-management intervention program specific to diabetes and obesity prevention at Mission Community Hospital San Fernando (MCH-SF). Healthy cooking classes were co-taught by an MCH-SF health educator and a team of graduate students from CSUN’s Marilyn Magaram Center for Food Science, Nutrition, and Dietetics. Health education was provided in Spanish and English on diabetes and weight loss, their potentially devastating effects on health, how to shop smarter, and how to prepare family favorite meals with reduced sodium, calories, and fat. On the first visit, participants were asked to sign an informed consent (administered by the hospital) and were given an opportunity to ask any questions. Pre-post tests lasting 15 minutes and asking for “yes,” “no,” or “I don’t know” answers measured each participant’s knowledge and perceptions about obesity before and after the completion of classes (see the Appendix). Self-reported socio-demographic variables (age, ethnicity, household size, health insurance, years of education completed, medical history [including self-assessed health status and physical activity], and behavioral information [including smoking and alcohol consumption]) were collected by a questionnaire. During visits one, three, and six, other variables (height, body weight, BMI from Omron, blood glucose, and cholesterol) were taken according to a standard protocol (WHO, 1995) by a team of...
trained health personnel. The questionnaire and pre-post test were provided in English and Spanish. Participants were asked to refrain from exercising or eating a heavy meal for three hours prior to measurement. For feasibility reasons, we chose not to extend the criteria to measure nutritional status. All identifiable information collected was removed and replaced with a code. The research data were entered electronically on a secured version of Microsoft Excel 2010 with protection by a graduate student, and the originals were kept by MCH-SF.

Sample

Subjects were a convenience sample of 24 females who volunteered from the existing Project ALTO (focusing on diabetes screening, prevention, and physical exercise education classes) at a MCH-SF Diabetes Teaching Kitchen funded by Kaiser Hospital Foundation and the Marilyn Magaram Center. The data analyses were conducted using 22 of the females’ self-reported and measured data. Exclusion criteria included being pregnant and/or under 20 years of age.

Ages of the participants ranged from 21 to 71 years. The mean age was 40. Most of the women possessed elementary education and were housewives.

The ethnic backgrounds of the adults were as follows: 81.8% Hispanics, 13.6% Latinos, and 4.5% Native Americans.

Measurement

All of the measuring devices were calibrated prior to measurement according to their manuals. Weight was obtained without shoes, heavy outer garments, jewelry, keys, and sunglasses to the nearest 0.1 kg using the Detecto PD300 Physician Scale. Standing height was measured without shoes to the nearest 0.1 centimeter with a mechanically
adjustable height rod attached to the scale. The total estimated time for these measurements was four seconds. Standard BMI was computed as weight divided by height squared (kg/m²).

Participants were assessed on the Omron HBF-306C Fat Loss Monitor for BMI, which involved self-reported data of each participant’s age, height, weight, gender, and fitness level (athlete or normal). Still wearing light clothing, the participants grasped the handle electrodes for approximately seven seconds until the process was complete. Overweight and obesity were defined using accepted BMI classification by NIH and WHO (NIH, 1998; WHO, 2000).

Glucose (Roche Glucose Meter Model Acctu-chek) and total cholesterol (Accutrend Plus-Roche Cholesterol Meter) in the capillary whole blood of each individual were determined by the strip method. The tests lasted five seconds and three minutes, respectively.
CHAPTER IV

RESULTS

Analysis was conducted using SPSS 20.0 for Windows. Paired T-test correlated two variables and tested whether the mean between-measurement differences were equal to zero for measured and alternative BMI over the six weeks. The α level for a significant test was considered $p < 0.05$. The results of the analysis are presented in this chapter.

**Paired T-test Analysis**

A paired-samples t-test compared the mean test scores of before (week 1) and after (week 6) BMI measurements using a kg/m² ratio (BMI_m) with BMI alternative (BMI_a) using Omron. The mean and standard deviations for both BMI scores over the six weeks are reported in Table 1.

Table 1

*Descriptive statistics for measured and alternative BMI scores*

<table>
<thead>
<tr>
<th>Six-Week Measurements</th>
<th>Mean</th>
<th>N</th>
<th>SD</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 BMI-m1</td>
<td>32.6</td>
<td>22</td>
<td>7.99</td>
<td>1.7</td>
</tr>
<tr>
<td>(Week 1) BMI-a1</td>
<td>32.1</td>
<td>22</td>
<td>7.42</td>
<td>1.5</td>
</tr>
<tr>
<td>Pair 2 BMI-m6</td>
<td>32.7</td>
<td>14</td>
<td>7.39</td>
<td>1.9</td>
</tr>
<tr>
<td>(Week 6) BMI-a6</td>
<td>32.6</td>
<td>14</td>
<td>7.29</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**Correlations for Measured and Alternative BMI Scores**

Results showed that measured BMI scores and alternative BMI scores are highly correlated ($r = .945$, $p = .0$) in week one. This was also confirmed for week six scores, as shown in table 2.
Table 2

*Correlations between measured and alternative BMI scores*

<table>
<thead>
<tr>
<th>Six-Week Measurements</th>
<th>N</th>
<th>r value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 (week 1) BMI_m1 &amp; a1</td>
<td>22</td>
<td>0.945</td>
<td>.00</td>
</tr>
<tr>
<td>Pair 2 (week 6) BMI_m6 &amp; a6</td>
<td>14</td>
<td>0.997</td>
<td>.00</td>
</tr>
</tbody>
</table>

Comparison of Measured and Alternative BMI Scores

Table 3

*Comparison between measured and alternative BMI scores*

<table>
<thead>
<tr>
<th>Six-Week Measurements</th>
<th>t value</th>
<th>df</th>
<th>2-tailed p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 (week1) BMI_m1 - a1</td>
<td>.814</td>
<td>21</td>
<td>.425</td>
</tr>
<tr>
<td>Pair 2 (week 6) BMI_m6 - a6</td>
<td>.713</td>
<td>13</td>
<td>.488</td>
</tr>
</tbody>
</table>

A two-tailed paired t-test revealed no significant difference ($t = .814, p = .425$) between measured and alternative BMI scores in week one. Over the six weeks, all $p$ values are greater than .05 (see Table 3). Therefore, the null hypothesis will be accepted; there will be no statistically significant difference between BMI scores using the Omron HBF-306C Fat Loss Monitor and BMI based on measured weight (kg) and height (m$^2$).
CHAPTER V

DISCUSSION

The purpose of the study was to analyze the validity of the Omron HBF-306C for BMI computation and to provide a clinically comprehensible, inexpensive, and quick alternative BMI screening tool to track BMI in an individual in ambulatory care settings. The above results showed no significant difference between BMI using Omron HBF-306C and BMI based on weight (kg) and height (m^2). Moreover, a period of change also did not affect the relationship between both BMI measurements.

To focus on the purpose of the study and research questions, we chose not to extend our study analyses. This study analyzed only BMI measurements and did not include blood glucose, cholesterol, and questionnaire scores. We will use the excluded data in future studies in addition to measure a 24-hour dietary recall in a controlled environment.

**Discussion of Findings**

Descriptive statistics for both BMI mean scores in week six were slightly higher (Table 1). Similarly, in correlations of self-reported (Omron) and measured BMI (kg/m^2), r values are slightly high in week six (see Table 2). This may be due to the fact that some subjects were extremely diligent in following the intervention program in the beginning. Later, they reverted to their old habits. There was a decrease in both BMI scores among the majority of subjects from weeks one to three; however, week one scores returned for some subjects by week six. We conducted measurements in week three to engage subjects and not lose their interest in the intervention program. Though it was not included in the analysis, we wanted to assess the pre and post measurement status.
Mean scores in particular were a little higher but not statistically significant in alternative BMI (Omron) compared to measured BMI. This difference may be due to self-reported data used to calculate alternative BMI (Table 1). Similar to Gillum et al. (2005), we observed underreporting of weight and over reporting of height, causing a slight underestimation of BMI in the first week. Underreporting of the weight is due to body image and the desire to be slim, which is particularly prevalent among women of all age groups. Our findings are in agreement with other reports where women tried to report a smaller body weight when calculating their BMI due to the fact that they want to conform with the norms of society where slim means “beautiful” and/or because they are undergoing social, attention, and thought problems (Bogt et. al., 2005).

Therefore, the problem in this research is the exclusion of social aspects, especially views regarding weight and height measurement. Women tend to maintain weight disparities according to body image and race (Ard, 2007) because of the pressure society places on them to stay thin (Veggi et. al., 2004). This might also affect the way that women reported the data (for Omron) in this research.

Thus, overall values cannot predict whether increasing the sample size will change the results. Subjects’ attendance was inconsistent; out of 22 participants, only 14 were present in week six. The questionnaire scores were not included in this study, but it is noteworthy that a majority of the sample size was unaware of BMI and the risk factors associated with increased BMI. However, in subsequent weekly classes, their interest and awareness increased in weight management, physical activity, healthy cooking, eating, and shopping.

Although there is no scientific evidence about using Omron for BMI calculation,
it is quite clear that Omron uses the same predetermined formula to calculate an individual’s BMI that is used to find standard BMI based on the manual. Thus, there will be no significant difference between the BMI from using the Omron HBF-306C Fat Loss Monitor for BMI and BMI based on weight (kg) and height (m²). Additionally, the monitor (Omron) also takes into consideration measuring the body fat percentage of the body—which the weight and height ratio calculating kilogram per meter square does not account for.

The most important aspect to be considered is how the Omron HBF-306C is a more-sensitive device than a simple weight and height ratio method. The Omron scores are affected by numerous variables including body composition, hydration status, consumption of food and beverages, ambient air and skin temperature, recent physical activity, and conductance of the examining table. Therefore, Omron HBF-306C values require standardization and control of these variables in order to produce an accurate BMI score.

In summary, to our knowledge, this is the first study to use the Omron HBF-306C Fat Loss Monitor for BMI calculation. We encountered certain limitations but were able to initiate the first step towards exploring a clinically comprehensive alternative BMI screening tool. More clinical trials would be needed with 24-hour dietary recall. In addition, future studies may consider and benefit from careful control for confounders.

**Limitations and Research Implications**

This thesis will add to the understanding of the use of Omron Fat Loss Monitor (HBF-306C) as an alternative tool for BMI calculation however, certain limitations to the study exist.
• Site: data collected only from the San Fernando city community clinic, thus results may be different in other parts of the Los Angeles County.

• Subject: small sample size included in this study could not be representative for all population in Los Angeles County.

• Measurement: physical activity and BMI from Omron were based on self reported data that may limit the results validity.

• Gender: the study is limited to female participants, therefore could not be generalized for all genders.

• Ethnicity: research aims Hispanic population to study; therefore results may not be the same in other ethnic groups.

**Implications**

Professionals may gain information that will enable them to use Omron (HBF-306C) as an inexpensive quick alternative BMI screening tool to track their patient and client’s BMI.

**Conclusion**

The main purpose of this research was to validate whether Omron HBF-306C is better than BMI calculation. The study showed that there is no statistically significant difference between the two BMI measurements, suggesting that valid scores are obtained by both. Professionals and the public can use this tool to discover BMI, but standardization and control of the above variables are recommended.
REFERENCES


23


review of randomized controlled trials. *BMC Cardiovascular Disorders, 6*, 43.


Body mass index (weight/height^2) or percentage body fat by bioelectrical impedance analysis: Which variable better reflects serum lipid profile? *International Journal of Obesity and Related Metabolic Disorders*, 23(7), 771–774.


APPENDIX

MEASURES USED IN THE THESIS

Pre Test

<table>
<thead>
<tr>
<th>Yes</th>
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2. Body mass index (BMI) is a measurement of body weight relative to height [ ] [ ] [ ]
3. BMI provides a general idea of the total amount of body fat [ ] [ ] [ ]
4. BMI between 18.5 and 24.9 is considered normal [ ] [ ] [ ]
5. BMI between 25 and 29.9 is considered overweight [ ] [ ] [ ]
6. There is an association between BMI and type 2 diabetes [ ] [ ] [ ]
7. Obesity is an established risk factor for type 2 diabetes at all ages [ ] [ ] [ ]
8. Weight gain in early adulthood may result in a younger age at onset of diabetes [ ] [ ] [ ]
9. There are multiple types of diabetes [ ] [ ] [ ]
10. Portion size plays a role in weight loss [ ] [ ] [ ]
11. Abdominal fat increases the risk of developing to diabetes and high blood pressure [ ] [ ] [ ]
12. Sugar intake and lack of effective insulin in the body is the cause of diabetes [ ] [ ] [ ]
13. Diet and regular exercise significantly improve insulin sensitivity [ ] [ ] [ ]
14. Diabetes may lead to heart attack and stroke [ ] [ ] [ ]
15. Diabetes can damage my kidneys [ ] [ ] [ ]
16. A fasting blood sugar of 110 is too high [ ] [ ] [ ]
17. Shaking and sweating are signs of high blood sugar [ ] [ ] [ ]
18. Frequent urination and thirst are signs of low blood sugar [ ] [ ] [ ]
19. If I have diabetes, my children have a higher chance of developing diabetes
   ☐ ☐ ☐
20. Medication, diet and exercise control diabetes
   ☐ ☐ ☐
21. The way I prepare my food is as important as the foods I eat
   ☐ ☐ ☐
22. Diabetic diet consist of small frequent meals throughout the day
   ☐ ☐ ☐
23. Do you know how to calculate your BMI? If yes, what is your BMI?
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### Examen de ingreso

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Basic Information Sheet

Name________________________________________________________________________

(Last) (First) (MI)

Date of Birth (MM/DD/Year) _____/___/_______ Gender Male Female

Name of Insurance Company (if any) ____________________________________________

Education: Elementary School Middle school High school

Some college College degree Graduate degree

Do you smoke? Yes If yes, how much a day? __________

Do you drink alcohol? Yes If yes, how much a day? __________

Ethnicity Hispanic/ Latino Other (specify) _________________

Household Size __________________________________________

Household Income <10,000 10,000 to 30,000 > 30,000

Employment Status Employed Disabled Retired Not Employed

What is your Occupation? _________________________________

How would you rate your overall state of health? Poor Fair Good Excellent

Do you do any Physical Activity? Yes

If yes, what type of activity __________ and how many hours/week? _____/_____.

Have you been diagnosed with diabetes? Yes

If yes, what was the date of your diagnosis? _____/_____/

Have you been diagnosed with hypertension? Yes

If yes, what was the date of your diagnosis? _____/_____/

Have you been diagnosed with heart disease? Yes

If yes, what was the date of your diagnosis? _____/_____/

39
Hoja de Información Básica

Nombre:________________________________________________________________________

(Apellido) (Primer nombre) (Iniciales del 2do nombre)

Fecha de nacimiento (MM/DD/AAAA): _____/___/____

Sexo

Masculino  Femenino

Tiene seguro de salud? Si   No, si tiene Nombre de su seguro de salud_________

Educación:

Escuela primaria  Escuela intermedia  Escuela secundaria/preparatoria

Grado universitario  Algo de universidad

¿Usted fuma?: No  Si  Si es si, cuántos al día? __________

¿Usted consume alcohol?: No  Si  Si es si, cuánto al día? ____________

Origen étnico:

Hispano/Latino  Otro, por favor especificar ________

¿Cuántos ocupantes hay en su casa, número de personas en la familia?: ___________

¿Cuál es el ingreso económico en su casa?  ≤10,000  10,000 a 30,000  ≥ 30,000

¿Cuál es su situación laboral?: Empleado  Discapacitado  Jubilado  Desempleado

Cuál es su ocupación? ________________

¿Cómo calificaría su estado de salud general?  Malo  Regular  Bueno

Excelente

¿Usted hace algún ejercicio/actividad física?  No  Si

Si es si, qué tipo de actividad _____________ y cuántas horas por semana? ______

¿Usted ha sido diagnosticado con diabetes?: No  Si

Si es si, ¿En qué fecha fue diagnosticado? _______/_____/_______

¿Usted ha sido diagnosticado con hipertensión?  No  Si

Si es si, ¿En qué fecha fue diagnosticado? _______/_____/_______
¿Usted ha sido diagnosticado con enfermedades al corazón?  

No  Si

Si es si, ¿En qué fecha fue diagnosticado?  _______ / ______ / ______