

Applying the Multi Theory Model (MTM) of health behavior change for explaining fruits and vegetables consumption behavior among African American women in Mississippi, USA

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Abstract

Objective: The aim of this study was to explain fruit and vegetable consumption behavior through application of the multi-theory model (MTM) of health behavior change among African American women in Mississippi, USA.

Methods: This study utilized a cross sectional design. A 39-item face and content valid questionnaire based on MTM was completed by participants drawn from churches. The study utilized a convenience quota sampling. Participants who reported that they consumed more than five cups of fruits and vegetables within the last 24 hours were excluded from the study. Stepwise multiple regressions were conducted to explain fruit and vegetable consumption behavior.

Results: A total of 116 participants (66.5% response rate) completed the surveys. The mean age of participants was 48.8 years (SD 17.82, range 21 to 84). Modeling utilizing multiple regression showed that the MTM constructs of participatory dialogue ($P = 0.009$), behavioral confidence ($P = 0.0001$), and changes in the physical environment ($P = 0.0001$) accounted for 50.8% of the predictability in the intention to initiate fruit and vegetable consumption behavior. Further, 59.9% of the variance in sustenance of fruit and vegetable consumption behavior was explained by the constructs of practice for change ($P = 0.016$), emotional transformation ($P = 0.0001$), and changes in the social environment ($P = 0.0001$).

Discussion and Conclusion: The study provides credible support to reify MTM framework for developing programs to increase fruit and vegetable consumption among African American women.

KEY WORDS: Dietary behavior; females; health behavior; nutrition; obesity, theory.

Riassunto

Obiettivo: Questo studio è stato mirato a spiegare il comportamento relativo al consumo di frutta e vegetali attraverso l'applicazione del modello multi teorico (MTM) per il cambiamento del comportamento legato alla salute in donne afro americane del Mississippi, negli Stati Uniti d'America.

Metodi: Questo studio ha utilizzato un disegno trasversale. Un questionario a 39 item valido dal punto di vista del contenuto e di facciata basato sul modello MTM è stato completato dai partecipanti reclutati da chiese. Lo studio ha usato una quota di un campione di convenienza. I partecipanti che riferivano di aver consumato più di 5 porzioni di frutta e vegetali nelle ultime 24 ore sono stati esclusi dallo studio. Regressioni multiple con tecnica stepwise sono state condotte per spiegare il comportamento relative al consumo di frutta e vegetali.

Risultati: Un totale di 116 partecipanti (66.5% di tasso di rispondenti) ha completato i questionari. L'età media dei partecipanti era di 48.8 anni (DS 17.82, range: 21-84). Modelli di regressione multipla hanno evidenziato che i costrutti della teoria MTM relative al dialogo partecipativo ($P = 0.009$), la fiducia nel comportamento ($P = 0.0001$), e modifiche nell'ambiente fisico ($P = 0.0001$) spiegavano il 50.8% della predittività nell'intenzione di iniziare il consumo di frutta e vegetali. Inoltre, il 59.9% della varianza nel mantenimento del consumo di frutta e vegetali è stato spiegato dai costrutti della pratica per il cambiamento ($P = 0.016$), la trasformazione emotiva ($P = 0.0001$) ed i cambiamenti nell'ambiente sociale ($P = 0.0001$).

Discussione e Conclusione: Lo studio fornisce supporto credibile per reificare la cornice di riferimento del modello MTM per sviluppare programmi finalizzati all'incremento di frutta e vegetali tra le donne afro-americane.

TAKE-HOME MESSAGE

MTM is a robust theoretical model for explaining fruit and vegetable consumption behavior change among African American women. Future interventional programs should consider MTM as a framework for improving fruit and vegetable consumption among this population group.

Competing interests - none declared.

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INTRODUCTION

Obesity is a multi-factorial, complex condition impacting the health of individuals and communities. The highest rates of obesity in the nation are present in the southern region of the United States (US). The Magnolia state, Mississippi, is second in the nation with 37.3% of the state's population classified as obese, behind only West Virginia [1]. Mississippi's prevalence of adult obesity rates is 37.4% for women and 31.9% for men [1]. In addition, disparities clearly exist based on ethnic groups, African Americans account for 44.2% and whites for 31.9% of Mississippi's obese population [2]. This high percent of obesity in the state costs a lot and is a burden economically. In 2008, Mississippi spent \$925 million dollars on direct costs related to this health condition. It was projected that health care costs will be 3.9 billion in 2018 [1].

Institute of Medicine's (2012) report "Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation," highlighted access to healthy food as one of the strategies for reducing obesity [3]. Fruit and vegetable consumption is an essential component to healthy meals. It has been reported that approximately 72% of African American women eat less than the recommended five cups of fruits and vegetables per day [4]. Healthy People 2020 recommends fruit and vegetable consumption as a healthy strategy for weight reduction, disease prevention and health promotion [5].

Consuming fruits and vegetables have been linked to risk reduction for conditions such as obesity, cancers, cerebrovascular accidents, heart diseases, and many other chronic ailments [4]. These foods are essential in providing the nourishment that a body needs to grow and thrive. Bodily organs and systems are dependent on nutrients for protection. Fruits and vegetables provide fiber, vitamins (vitamin C, vitamin E, folic acid), minerals (potassium, selenium, manganese), carotenoids (lutein, zeaxanthin), flavonoids (quercetin, kaempferol), phenolic acids (chlorogenic acid, caffeic acid) and other phytochemicals (terpenes, lycopene, isothiocyanates) [6].

Meals high in fiber are essential for weight loss

and disease prevention. There are two types of fiber relevant to healthy diets, which are as follows: Water-soluble and insoluble. Water-soluble fiber is found in high concentrations in fruits and vegetables. Cholesterol reduction and lower blood glucose are just two of the benefits of adequate consumption of this type of soluble fiber. The second type of fiber is the insoluble fiber, which is primarily found in various types of vegetables and beans. High-fiber diets are healthy options for women focused on losing weight due to the zero content of fiber found in calories. Furthermore, when an individual consumes foods high in fiber, the result is a feeling of fullness, which is a consequence of fiber's water-absorbing process [7]. For example, consumption of an apple gives more of a 'feeling of fullness' as compared to drinking a half cup of apple juice that contains about the same calories but no fiber [8]. In addition, foods high in fiber such as an apple, primarily require more chewing which takes more effort and time to eat. Consequently, this lessens the quantity of calories consumed [8]. Therefore, research shows that there is an association with meals consisting of a substantial amount of fiber and low all-cause mortality [9].

At the global level, 1.7 million deaths (or approximately 2.8%) are attributed to not eating adequate amounts of healthy balanced diets with fruits and vegetables [10]. It is the recommendation of the US Department of Health and Human Services (USDHHS) that all Americans consume 1.5 - 2.0 cups of fresh fruits and 2-3 cups of vegetables per day especially among those adults who are physically active for less than 30 minutes per day [4]. The Surgeon General's report strongly recommends that fruits and vegetables consumption is increased daily [4]. According to the National Cancer Institute (NCI) data collected between 2007-2010 it was revealed that more than 50% of the Americans were consuming less than one cup of fruit and less than 1.5 cups of vegetables per day [11]. It was also found that nearly 76% were not meeting recommended fruits intake and 87% were not meeting recommendations for vegetables intake. Taking a closer examination of the Unit-

ed States, the average fruit intake nationwide was only 13%. For Mississippi, in particular, the rates were only 9% for recommended fruit intake. When further examining the nation's vegetable intake, the consumption rate was 8.9% nationally; however, the rural southern state of Mississippi reported a much lower intake rate of 5% [11]. From this data, it is evident that fruit and vegetable consumption is a problem in Mississippi and disparities are vast among African American women.

Scarinci et al. (2014) conducted a cluster randomized control study in the Black Belt area of Alabama on 565 African American female participants [12]. Alabama's black belt area is in the southern region of the state and named for its richness of black soil and high population of African Americans. This work included an intervention that conceptualized a framework on self-efficacy and used community-based participatory research (CBPR). Findings from this work revealed that evidence-based programs, which emphasized effective strategies such as self-efficacy, goal setting and small group education, were effective methods for increasing fruit and vegetable consumption in African Americans. Self-efficacy for promoting consumption of fruits and vegetables among African American women also has support from many other studies [13–15]. Social support has also been found to be a useful construct in predicting fruit and vegetable consumption in African Americans [16]. Availability and accessibility to fruits and vegetables have been found to be associated with consumption of fruits and vegetables in the African American community [17, 18]. However, it has often been noted the strategies that are effective in other cultures for obesity prevention and reduction are often resistant to bring about changes in the African American community. One possible reason for this could be due to the African American's perception that being heavier is considered acceptable and desirable which may make obesity prevention approaches difficult to assimilate. Therefore, strategies that focus on health behavior changes targeting healthy eating may be more effective than interventions focused on weight loss

[12]. It is in this backdrop, that the purpose of this study was to predict fruit and vegetable consumption behavior using the multi-theory model (MTM) of health behavior change among African American women drawn from Mississippi faith-based settings.

METHODS

Theoretical framework

The study uses the fourth generation, multi theory model (MTM) of health behavior change. This work is based on collective intelligence incorporating multiple established theories with the notion of exclusive use in the profession of health education and promotion [19, 20]. The model is fitting as it represents a conceptualized framework which can be utilized through evidence-based interventions, catering to both one time and long-term behavior change. The MTM of health behavior change is divided into two components with an objective to predict initiation of the behavior change and sustenance or maintenance of the health behavior change. The first component, initiation, requires implementing educational processes to commence the health behavior change. The second component, sustenance or continuation of the health behavior change is evident in long-term practice. This long-term goal supports African American women practicing healthy dietary habits particularly consuming fruits and vegetables over the course of a lifetime. Initiation model encompasses three building blocks namely participatory dialogue; behavioral confidence; and changes in the physical environment. The construct of participatory dialogue focuses on over scoring advantages over disadvantages of the desired health behavior change. Participatory dialogue is similar to the trans-theoretical model's weighing of pros and cons [21]; but differs in the process where it consists of a two-way communication or mutual exploration, which was also emphasized by Freire's model of adult education [22]. The second construct is 'behavioral confidence' derived from Bandura's self-efficacy and Ajzen's perceived behavioral control [23, 24]. Behavioral

confidence is somewhat different than these conceptualizations as it broadens the scope of this construct by not limiting the sources just to self but by also including external sources such as God or powerful others. This construct also goes beyond the focus on the 'here and now' and expands it to include focus on 'future' behavior change. These differences are helpful for those who value others (children, parents, spouse) more than they value themselves such as women, mothers, or those often struggling with maintaining healthy self-esteem. Therefore, this conceptualization is quite useful for some in the African American community due to its strong spiritual beliefs [25]. The third construct for initiation of a behavior is the 'changes in physical environment' and requires access to available resources. In the case of fruits and vegetables behavior, the target population must be able to afford these and have them available in their immediate environment. The second component is called sustenance or maintenance of health behavior change, which consists of three main constructs for continuations of long-term health behavior change. The first construct is called 'emotional transformation' and entails mobilizing one's emotions or feelings and directing those toward the goal of behavior change. The second construct, 'practice for change' requires constant rehearsal and reflection of making the health behavior change. In this regard, innovative processes such as smart phone apps and social media outlets have shown to be effective at reinforcing positive change. Additional processes include but are not limited to writing in a diary or journal and making notes of daily and weekly food choices. 'Changes in the social environment' is the final construct of the second component of the MTM model. It pertains to the social support, which can be natural or artificial and can come from family, friends, and health professionals.

Study design

The study used a cross sectional study design. The independent variables were the constructs of the MTM (participatory dialogue, behavioral confidence, changes in physical environ-

ment, emotional transformation, practice for change, and changes in social environment), which was divided in two models. The dependent variable for the initiation model was the 'intent to start consuming recommended cups of fruits and vegetables' and the dependent variable for the sustenance model was the 'intent to continue consuming recommended levels of fruits and vegetables'.

Study population and sample

The study population came from the state of Mississippi, which is located in the southern region of the United States. In 2000, approximately 59 of the state's 82 counties had 50.0 percent or more rural residents [25]. Furthermore, 21 counties fell into the category of being classified as 100.0 percent rural [26]. In comparison to the other states, Mississippi is ranked #1 in terms of the largest percentage of African Americans (37.3%). American Community Survey (2018) documents that Jackson, the capital city, is second in the nation with 80% African Americans [27]. In 2015, 30.9% (166,852) of Jackson, Mississippi's population lived below the poverty line, which is noted to be higher than the national average at 14.7%. The state's largest demographic group living in poverty is that of women between the ages of 25-34 years. Furthermore, in 2016, 22.6% of working waged women lived below the poverty line. When looking at the Mississippi African American community in 2016, 32.3% lived below the poverty line [28].

The study utilized a convenience quota sampling. Sample size was calculated using G*Power with an alpha of 0.05, power as 0.80, three predictors with an effect size of 0.10 (medium) as 116 which was inflated by 10% for missing values to 125.

Participants completed a 39-item face and content valid questionnaire in churches using MTM as a framework. African American female participants were recruited by flyers, church bulletins, church announcements, and word of mouth. Participants were ineligible for the study based on reporting consumption of more than five cups of fruits and vegetables within the last 24 hours of taking the

survey. The selection of a church as the site of the study was chosen due to the significant influence that religiosity plays in the African American woman, family and community.

Instrumentation

The participants who consented were asked to complete the 39-item survey. The first two questions were screening questions that asked the participants as to how many cups of fruits and vegetables they consumed. Only if they did not consume the recommend five cups they were included in the study. Eight questions asked respondents about their standard socio-demographic information (gender, age, ethnicity, marital status, living arrangement, household income, employment status and highest degree of education received). The remaining 29 questions measured the following MTM constructs for the two models: Initiation and Sustenance Models.

Initiation model

Advantages (participatory dialogue) were measured with five items (i.e., if you consume five cups of fruits and vegetables every day you will ... 'be healthy', 'have a variety in meals', '... manage your weight', '...have more energy', and '...have tasty food'). There was a five-point scale corresponding to each item (0 = never to 4 = always). Responses for individual items were added together for range from 0-20 units. Disadvantages (participatory dialogue) were measured with five items (i.e., if you consume five cups of fruits and vegetables every day you will ... 'not have enough proteins in your diet', '...be hungry most of the time', '... have less energy', 'have more food-related expenses', and '... enjoy meals less'. There was a five-point scale corresponding to each item (0 = never to 4 = always). Responses for individual items were added together for a range from 0-20 units. For deriving the score on participatory dialogue, the score of disadvantages was subtracted from the score of advantages resulting in a range of score from -20 - + 20 units. For measuring behavioral confidence five items were used. Participants were asked about their level of certainty to consume five cups of

fruits and vegetables every day you will ...'not have enough proteins in your diet', '... be hungry most of the time', '... have less energy', '... have more food-related expenses', and 'enjoy meals less'. There was a five-point scale corresponding to each item (0 = not at all sure to 4 = completely sure). Responses for individual items were added together for a range from 0 - 20 units.

'Changes in the physical environment' were assessed using three items that asked participants about their level of certainty to 'be able to consume five cups of fruits and vegetables' '... have fruits and vegetables available to you for all meals?' '...be able to eat fruits and vegetables at a restaurant?', '... be able to afford fruits and vegetables for meals?' There was a five-point scale corresponding to each item (0 = not at all sure to 4 = completely sure). Responses for individual items were added together for scores ranging from 0 - 12 units.

For measuring intent for initiation, participants responded to 'how likely is it that you will eat five cups of fruits and vegetables in the upcoming week?' This item was scored on a five-point response scale (not at all likely = 0 to completely likely = 4 thus yielding a possible range of 0 - 4 units).

Sustenance model

For assessing emotional transformation three items were used that asked participants about their level of certainty of 'directing feelings/emotions', 'motivating themselves', and 'overcoming self-doubt', 'how sure are you that you can' '...direct your emotions/feelings to the goal of eating five cups of fruits and vegetables every day', motivate yourself to eat five cups of fruits and vegetables every day, 'overcome self-doubt in accomplishing the goal of eating five cups of fruits and vegetables every day?'. This item was scored on a five-point response scale (not all sure = 0 to completely sure = 4) with a possible range of 0 - 12 units.

Practice for change was assessed using three items that asked participants about their level of surety of 'keeping a self-diary to monitor eating five cups of fruits and vegetables every day,' 'be able to eat five cups of fruits and veg-

etables every day if you encounter barriers?', and 'change your plan for eating five cups of fruits and vegetables every day if you face difficulties?'. Each item was scored on a five-point scale (0 = not at all sure to 4 = completely sure). Responses for individual items were added together for maximum possible score (ranging from 0 – 12 units).

Changes in social environment was assessed using three items that asked participants about their level of surety of asking help from 'family member', 'friend', and 'health professional' to support consumption of five cups of fruits and vegetables. Each item was scored on a five-point scale (0 = not at all sure to 4 = completely sure). Responses for individual items were added together for maximum possible score (ranging from 0 – 12 units).

To measure sustenance, participants were asked 'how likely is it that you will eat five cups of fruits and vegetables from now on?' This item was followed by five-point response scale (not at all likely = 0 to completely likely = 4 thus yielding a possible range of 0 – 4 units).

Face and content validity

For establishing face and content validity of the instrument, a panel of six experts was constituted from six educational institutions of higher education. These panelists provided qualitative feedback on the instrument draft over a two-round process. The Flesch-Kincaid Reading Ease of the instrument was 72.9 and Flesch-Kincaid Grade level of the instrument was 4.6 and thus acceptable for administration to African American women.

Construct Validity

For construct validation a confirmatory factor analysis (CFA) was undertaken. The maximum likelihood method for confirmatory factor analysis was performed on all seven subscales. The criteria of Eigen value over 1 and factor loadings over 0.32 were used to interpret the factor structures. The results have been reported in the Results section.

Reliability

For establishing internal consistency reliability

of the subscales and the entire scale Cronbach's alphas were computed. The results of computation of Cronbach's alpha for all subscales and the entire scale have been reported in the Results section.

Statistical analysis

All statistical analyses were performed by IBM-SPSS (Version 25.0). Descriptive statistics comprised of calculating frequencies and percentages for nominal and ordinal variables and the means and standard deviations were calculated for all interval/ratio variables. For inferential statistics, stepwise multiple regression modeling was employed. Relying on the SPSS default setting, the a priori criteria of the probability for the F to enter the predictor in the model was ≤ 0.05 and for removal was ≥ 0.10 .

RESULTS

A total of 400 surveys were distributed, of which 266 participated (66.5% response rate). Of 266, 116 participants (43.6% completion rate) met the inclusion criteria and completed the surveys. The study sample consisted of African American women, mean age was 48.8 years (SD 17.82) with a range from 21 to 84 years of age. Participants recorded fruits consumed in the past 24 hours were 1.20 (0.88) and vegetables consumed in the past 24 hours were 1.97 (0.99) which were both similar to the national average consumption. Over 36% of the participants were unmarried, approximately 59% owned property with mortgages, less than 30% had household incomes ranging from \$40,000 - \$49,999 and 44.8% of the participants were employed with incomes. Of this population (n = 116), 29.3% were formally educated with a bachelor's degree. Socio-demographic and behavioral characteristics of the participants are presented in Table 1.

For the study variables, namely the constructs of MTM, the means, standard deviations, and subscale Cronbach's alphas are offered in Table 2. Internal consistencies of all but one of the subscales as per the Cronbach's alpha's being over 0.70 were acceptable. Only one subscale, which was 'changes in the physical environ-

Table 1. Socio-demographic and behavioral characteristics of participants in the study (n = 116).

	Summary Statistics
Age (years)	48.8 (17.82)
Fruits consumed in the past 24 hours	1.20(0.88)
Vegetables consumed in the past 24 hours	1.97 (0.99)
Marital Status	
Now Married	42(36.2%)
Widowed	22(19.0%)
Divorced	13(11.2%)
Separated	10(8.6%)
Never married	29(25.0%)
Living Arrangement	
Owned property with mortgage	69(59.5%)
Owned, free and clear	25(21.6%)
Rented	18(15.5%)
Occupied without payment	3(2.6%)
Missing	1(0.9%)
Household Income	
Less than \$10,000	14(12.1%)
\$10,000-\$19,999	8(6.9%)
\$20,000-\$29,999	27(23.7%)
\$30,000-\$39,999	15(12.9%)
\$40,000-\$49,999	33(28.4%)
Over \$50,000	17(14.7%)
Missing	2(1.7%)
Employment Status	
Employed for wages	52(44.8%)
Self-employed	7(6.0%)
Out of work and looking	6(5.2%)
Out of work and not looking	13(11.2%)
Home-maker	19(16.4%)
Student	5(4.3%)
Missing	14(12.1%)
Education	
No degree	21(18.1%)
Associate degree	13(11.2%)
Bachelor's	34(29.3%)
Master's	26(22.4%)
Professional degree	3(2.6%)
Doctorate	1(0.9%)
Missing	18(15.5%)

Mean (SD) is presented for metric variables of age, fruits and vegetables consumed and *n* (%) for other categorical variables

Table 2. Descriptive statistics of study variables related to MTM constructs for change in fruits and vegetables ($n = 116$).

Constructs	Possible Range	Observed Range	Mean (SD)	Cronbach's Alpha
Initiation	0-4	0-4	2.41(.961)	--
Participatory dialogue: advantages	0-20	4-20	15.26(3.03)	0.75
Participatory dialogue: disadvantages	0-20	0-18	9.29(4.02)	0.72
Participatory dialogue: advantages-disadvantages score	-20+-20	-5+-20	5.93(5.29)	--
Behavioral confidence	0-20	0-20	12.57(4.81)	0.89
Changes in the physical environment	0-12	0-12	7.84(2.56)	0.67
Sustenance	0-4	0-4	2.30(0.94)	--
Emotional transformation	0-12	0-12	6.35(2.51)	0.90
Practice for change	0-12	0-12	3.42(2.50)	0.81
Changes in the social environment	0-12	0-11	6.37(3.03)	0.76
Entire scale	--	--	--	0.87

Table 3. Parameter estimates based on stepwise regression analysis to predict initiation for intention of fruits and vegetables consumption behavior change ($n = 107$).

Variables	<i>B</i>	<i>SE_B</i>	β	95% CI	<i>P-value</i>
Participatory Dialogue (Advantages outweighing disadvantages)	0.034	0.013	0.187	.009-.059	0.009
Behavioral Confidence	0.077	0.015	0.387	0.047-0.107	0.0001
Changes in Physical Environment	0.151	0.027	0.408	.097-0.206	0.0001

F(3, 103) = 16.777, $p < 0.001$, R2(Adjusted R2) = 0.522 (0.508)

Dependable variable is intention for initiation of fruits and vegetables consumption behavior change; *B* = unstandardized coefficient, *SE_B* = standard error of the coefficient; β = standardized coefficient, *P* = level of significance, *CI* = confidence interval

Table 4. Parameter estimates based on stepwise regression analysis to predict sustenance for intention of fruits and vegetables consumption behavior change ($n = 109$).

Variables	<i>B</i>	<i>SE_B</i>	β	95% CI	<i>P-value</i>
Emotional Transformation	0.149	0.028	0.412	.093 -.204	0.0001
Practice for Change	0.072	0.030	0.201	0.014-0.131	0.016
Changes in Social Environment	0.094	0.026	.303	.043-0.145	0.0001

Notes: F(3, 105) = 18.177, $P < 0.001$, R2, (Adjusted R2) = 0.610 (0.599)

Dependable variable is intention for sustenance of fruits and vegetables consumption behavior change; *B* = unstandardized coefficient, *SE_B* = standard error of the coefficient; β = standardized coefficient, *P* = level of significance, *CI* = confidence interval

ment', had a Cronbach's alpha of 0.67. However, since this was a new scale and Cronbach's alpha was very close to 0.70 it was also considered acceptable [29].

The confirmatory factor analysis (CFA) using the maximum likelihood method revealed one factor subscales for six of the seven subscales. The criteria of Eigen value over 1 and factor loadings over 0.32 were used to interpret the factor structures. Only the subscale of advantages revealed a two-factor solution with 'variety in meals' & 'tasty food' loading on one factor and 'being healthy', 'managing weight' and 'having more energy' loading on another factor. Since all of these were advantages it was decided to retain the subscale as it is.

Table 3 depicts the results of the initiation model using stepwise multiple regression modeling. All three constructs, participatory dialogue ($P = 0.009$), behavioral confidence ($P = 0.0001$), and changes in physical environment ($P = 0.0001$) were found to be significant predictors and together had an adjusted R^2 of 0.508.

Table 4 shows the results of the sustenance model done by stepwise multiple regression modeling. All three constructs, emotional transformation ($P = 0.001$), practice for change ($P = 0.016$), and changes in social environment ($P = 0.0001$) were found to be significant predictors and together had an adjusted R^2 of 0.599.

DISCUSSION

The purpose of this article was to apply MTM of health behavior change to explain initiation and maintenance of fruits and vegetables consumption behavior among African American women. The initiation model utilizing the three postulated MTM constructs explained 50.8% of the intent to start consuming fruits and vegetables among the study sample of African American women who were not consuming the recommended levels at the time of the study. The culturally appropriate intervention for African American women conducted by Scarinci and colleagues (2014) to promote consumption of fruits and vegetables supported the MTM construct of participatory dia-

logue in which through a discussion the advantages of behavior change are emphasized over the disadvantages [12]. Our study also found this construct of participatory dialogue to be statistically significant. Other studies underscoring the role of self-efficacy for fruits and vegetables consumption behavior have been conducted with African American women and lend credence to the construct of behavioral confidence from MTM as a crucial determinant [13-15]. Accessibility to fruits and vegetables through community gardens has been found to be associated with consumption of fruits and vegetables in African American community [17]. Financial incentives to low-income families have also been used to promote fruits and vegetables [30]. Overcoming potential barriers of availability of fruits and vegetables, convenience of accessibility, transportation issues have also been found to be important factors in promoting fruits and vegetables for low-income African American women [18]. These studies provide support to the MTM construct of changes in physical environment found statistically significant in our study. A similar study done with college students using MTM also found that the changes in the physical environment and behavioral confidence were significant predictors of the intention to initiate fruit and were responsible for about 40% of the variance in the intent to start this behavior [31]. Collectively, the studies demonstrate the usefulness of the constructs of MTM in starting the behavior change with regard to fruits and vegetables consumption behavior.

Approximately 60% of the intent in sustenance of fruits and vegetables consumption behavior among African American women was explained for by the three sustenance building blocks of MTM. All the variables were significant at $P < 0.05$. Social support has been found to be a useful construct in predicting fruit and vegetable consumption in African Americans [16] and our findings of changes in social environment as significant predictor are in consonance with that study. The constructs of emotional transformation and practice for change have not been used with regard to fruits and

vegetables consumption behavior among African American women but the statistical significance of these constructs in this study should behoove future researchers to reify these in interventional research for this behavior for this target population. In a study, done among college students using MTM, practice for change, emotional transformation, and changes in the social environment were statistically significant constructs that accounted for nearly 30% of the predictability in the intention to sustain fruit and vegetable consumption behavior [31]. So, all these studies point to the usefulness of the MTM for designing interventions to influence fruits and vegetables consumption behavior among African American women.

Study limitations

This study does not go without limitations. It does not address accessibility in rural areas, improve access or address the affordability of lack of affordability regarding the costs of healthy eating. The state of Mississippi has oppressive infrastructure in terms of poverty and accessibility to and from food retail. This limitation can perhaps be addressed through future interventional research. Another limitation is the instrument did not assess the health literacy level of the participants, did not explore the cooking patterns, or made enquiries about the variations of food preparation. In addition, this instrument relied on self-report, which is subject to various fallacies such as underreporting, over reporting, lying, dishonesty and so on. However, since this study was identifying underlying attitudes observational method for data collection could not be employed. Another limitation with regard to the instrument was that stability aspect of reliability was not tested through test re-retest correlation coefficients. Future researchers must establish this form of reliability, especially if this instrument is used for interventional research. Finally, the study used a cross sectional study design that has limitations when it comes to establishing cause-effect relationship.

Implications for practice

This research study has several implications

for use in the public health arena with regard to policy making, educational program development, implementation and evaluation. MTM and associated tools can be utilized in education, public health practice, public health policy, and towards conducting additional research. For health educators and dietitians, MTM is very pragmatic where it provides specific guidance to modify and evaluate the six constructs in educational programs geared toward promoting fruits and vegetable consumption behavior among African American women. Participatory dialogue can be built by providing opportunities for discussing in an open manner about the advantages and disadvantages of consuming fruits and vegetables and identifying ways of overcoming the disadvantages. Behavioral confidence can be built by learning the behavior in small steps, identifying the sources of confidence and overcoming the barriers. Changes in physical environment are more amenable through health promotion efforts of providing actual resources and supportive policies. The emotional transformation construct can be influenced by use of affective educational methods such as role plays, psychodramas or simulations. The practice for change construct can be developed through use of monitoring by smart phone apps or keeping a diary or journaling. Finally, the construct of changes in social environment can be altered through promoting the role of family, friends and health professionals in ensuring the regularity of this behavior.

CONCLUSION

The study supports that that the three postulated constructs of MTM for starting any health behavior change (participatory dialogue where advantages are more than disadvantages in the mind of the participant, behavioral confidence regarding health behavior change and changes in the physical environment that are supportive of the health behavior change) were essential for beginning behavior change pertaining to intake of five or more cups of fruits and vegetables per day among African American women and had almost half of the explanatory potential. The study also supported that

the postulated MTM constructs of emotional transformation (or diverting the feelings toward goals), practice for change (or continual pursuit of health behavior change) and changes in the social environment (or support from family, friends and others) were important in upholding behavior change with regard to intake of five or more cups of fruits and vegetables per day among African American women and had almost 60% explanatory poten-

tial. MTM is a strong framework that can be utilized for planning programs for enhancing fruits and vegetables consumption behavior among African American women.

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