PREDICTORS OF MULTIVITAMIN SUPPLEMENT USE AMONG AFRICAN-AMERICAN FEMALE STUDENTS: A PROSPECTIVE STUDY UTILIZING THE THEORY OF PLANNED BEHAVIOR

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Background: Public health officials recommend that women capable of becoming pregnant use folic acid-containing supplements (FAS) to prevent neural tube defects (NTD) in their newborn infants. However, the knowledge about NTD prevention and the prevalence of the use of FAS among women capable of becoming pregnant increased only modestly since the issuing of the recommendation in 1992. Since most commonly available multivitamin supplements (MVS) contain the recommended 400 μg of folic acid, finding out reasons why women take MVS and utilizing these factors in educational campaigns may contribute to increasing the use of FAS.

Methods: The Theory of Planned Behavior variables and the self-reported use of MVS were measured by two separate surveys within one week. A preliminary open-ended questionnaire was utilized to elicit beliefs about MVS. A convenience sample of 100 African-American female college students, mean age 20.99 (SD=1.7) years, participated in this study.

Results: Approximately 65% of variance in behavioral intention was explained by attitude, subjective norms, and perceived behavioral control ($P<.001$). Subjective norms had the greatest influence ($\beta=0.348$, $P<.001$), followed by PBC ($\beta=0.336$, $P<.001$), and attitude ($\beta=0.228$, $P<.038$). Behavioral intention significantly predicted the use of MVS accounting for ≈59.2% of variance.

Conclusion: Consistent with the results of the present study, educational campaigns that target African-American female college students to encourage the use of MVS should focus on the impact of physicians, family, and peers. (*Ethn Dis*. 2005;15:540–547)

Key Words: Theory of Planned Behavior, Multivitamin Supplements, Folic Acid, African American, Students

INTRODUCTION

Several observational and interventional studies conducted in recent years clearly showed that neural tube defects (NTD) can be prevented with an adequate intake of folic acid, which is essential in embryonic cell division.[1–14] Since the effect of folic acid deficiency on NTD is permanent, prevention is crucial. To decrease the prevalence of NTD, the Centers for Disease Control and Prevention (CDC) recommended that all women of childbearing age consume daily doses of 400 μg of folic acid.[15] In addition, in the 1998 edition of the *Dietary Reference Intakes*, the Institute of Medicine, Food and Nutrition Board recommended that women capable of becoming pregnant consume 600 μg of folic acid daily, 400 μg of which was to be obtained from supplements, fortified foods, or a combination of the two.[16]

The prevalence of periconceptional folic acid supplement (FAS) use lags behind the current recommendation.[17–24] Although approximately 75% of women report hearing about folic acid, a substantially lower proportion of women, 5% to 15%, is aware of its NTD preventive effect.[17–24] Currently, approximately 30% to 44% of women of child-bearing age take multivitamins supplements (MVS).

African-American females have lower prevalence of awareness about the prevention of NTD with folic acid compared to Caucasian and Hispanic women.[19,24] In addition, African-American women have a lower prevalence of the use of FAS compared to Caucasian women.[18,19] Thus, African-American females are in need of effective educational campaigns that would result in an increase use of MVS. The objectives of this research were twofold: identification of specific factors important to the African-American females in the study population regarding the use of MVS and assessment of which of these factors could be useful in educational campaigns.

The Theory of Planned Behavior (TPB) (Figure 1) was used as a framework for understanding the effect of attitude, subjective norms, and perceived behavioral control (PBC) on behavioral intention. Behavioral intention is considered the most important direct predictor of behavior. The TPB proposes that PBC affects both behavioral intention and behavior.[25]

This report includes results of an application of the TPB to determine predictors of MVS use among African-American female college students. Stu-

African-American women have a lower prevalence of the use of FAS [folic acid supplement] compared to Caucasian women.[18,19]

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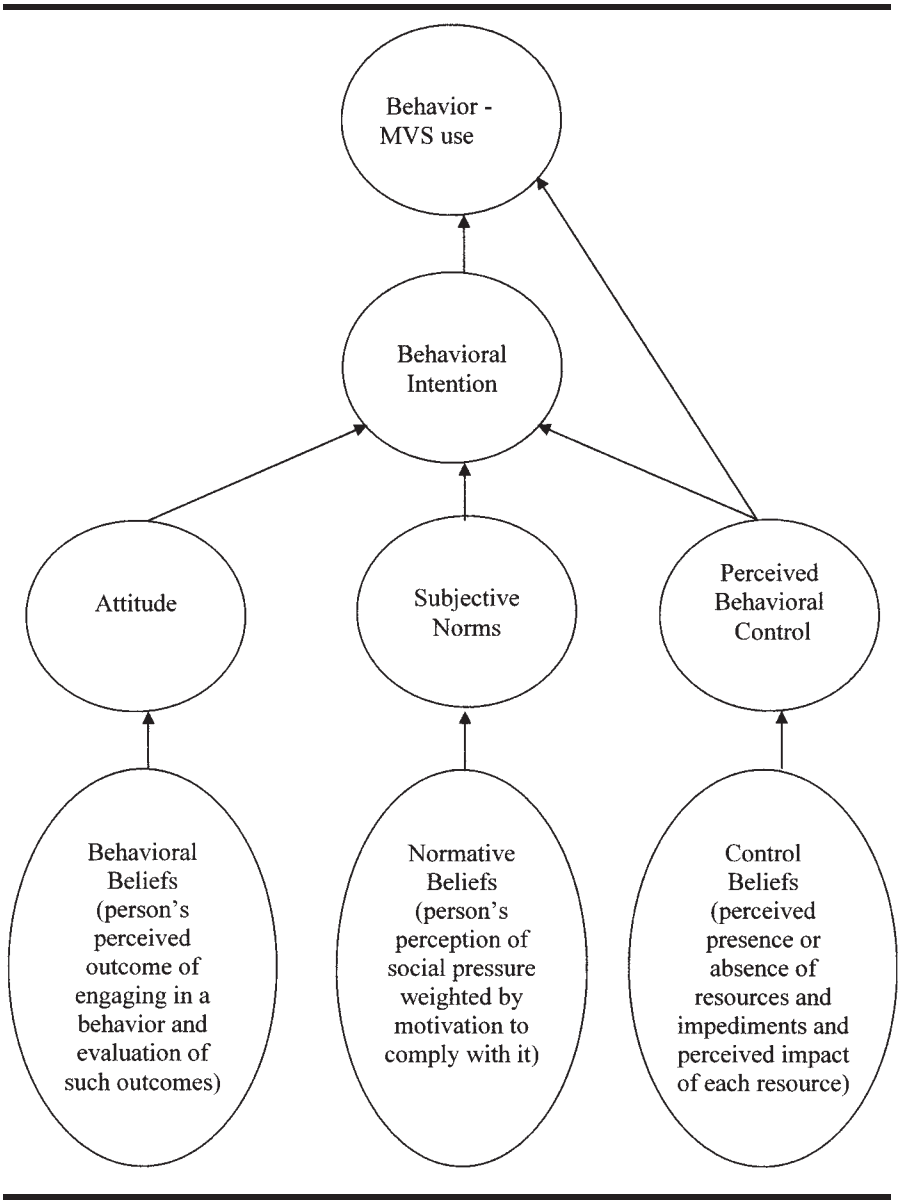

Fig 1. The Theory of Planned Behavior

dents participating in this study were enrolled at the University of Southern Mississippi (USM) during summer 2003.

METHODS

Two survey instruments titled *Survey of the Theory of Planned Behavior* (STBP) and *Survey of the Use of MVS* (SUMS) were developed for use in this study. The STPB was used to measure the variables of the TPB, behavioral intention, attitude, subjective norms, PBC, and behavioral, normative, and control beliefs (see Figure 1) affecting MVS intake by a group of African-American female students at the University of Southern Mississippi (USM). Additionally, demographic and socioeconomic information about study participants was collected. A preliminary open-ended survey was used to elicit behavioral, normative, and control beliefs about the use of MVS specific to the targeted population in order to construct the STPB. This preliminary survey was distributed twice to the same participants within a one-week period. To assess test-retest reliability, Pearson correlation was utilized to assess a linear correlation between responses (recorded on a five-point Likert scale) on the two administrations of the open-ended questionnaire. The correlation between the two measurements was 0.65, indicating moderately high temporal stability. Identified and validated beliefs were subsequently included in the STPB.

Standard-scaled statements related to behavioral intention, attitude, subjective norms, and PBC, adopted from literature and tailored to the targeted behavior (the use of MVS) also were included in the STPB.[25–29] Survey statements within behavioral intention, attitude, subjective norms, and PBC that exhibited the highest internal consistency within each of these variables were identified. Reliability analysis was conducted separately for each of the four above-listed variables of the TPB using Cronbach α reliability scores. As a result, only statements with the highest internal consistency (18 of the 25 statements included in the draft of the STPB used for the gathering of data for the internal consistency analysis) remained in the final STPB. The Cronbach α reliability scores were 0.95 for behavioral intention, 0.93 for attitude, 0.90 for subjective norms, and 0.84 for PBC.

Data collection took place during the summer 2003 semester. The research protocol was approved by the Human Subjects Protection Review Committee (HSPRC) at USM. In order to include students with a variety of majors, the classes where data collection took place were conveniently selected from all general education classes offered during the summer 2003 semester. The researcher requested permission from professors teaching the chosen classes to conduct the study in the classroom during a regular class period. Once this permission was obtained, the

researcher proceeded with the study protocol. Study participants were informed about the purpose and the protocol of the study and the voluntary nature of their participation. A letter to participants requesting their participation and explaining the purpose of the survey and the voluntary nature of participation was attached to each survey. In addition, the researcher verbally explained the survey purpose and the voluntary nature of participation to all students. Students were informed about the need of matching the STPB with SUMS. Respondents of these two surveys of the study were asked to create a unique identification code, which was not recognized by the researcher. All females attending the chosen classes were subsequently verbally asked by the researcher to complete the STPB. The SUMS were distributed among the same female respondents approximately one week later. The completion of both the STPB and the SUMS took place in classrooms during a regular class period. All collected surveys were kept in a locked file until the data were entered for analysis. Once the data were entered and analysis was completed, surveys were shredded. All female students present when data collection was taking place were asked to complete the survey, regardless of their age, ethnicity, or other factors. This paper describes results for African-American females included in the sample.

STATISTICS

SPSS for Windows software (version 10, SPSS Inc, Chicago, Ill) was used for all data analyses. Multiple linear regression analysis was performed to evaluate how well the combination of attitude, subjective norms, and PBC predicted behavioral intention among African-American respondents. Multiple logistic regression analysis was conducted to predict the self-reported use of MVS by the variables of the TPB. An independent sample *t* test was used to determine whether there was a statistically significant difference between MVS users and nonusers on the degree of agreement with statements included in the STPB.

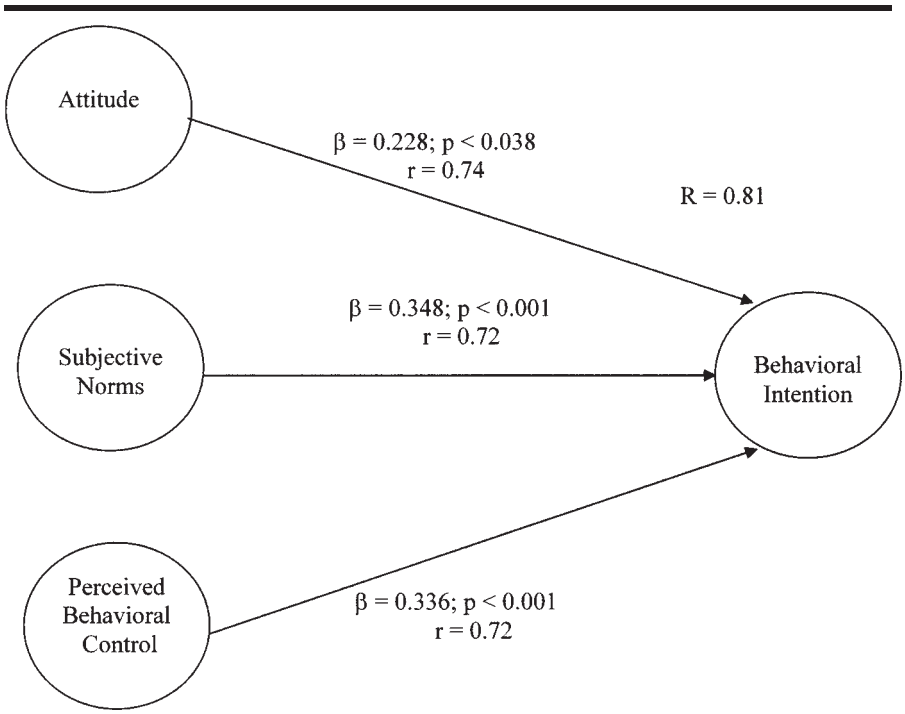

Fig 2. Results of multiple linear regression analysis

RESULTS

The sample included 100 African-American students, mean age of 20.99 (SD=1.7) years, who completed the STPB. Eighty one participants (81%) completed the SUMS. The reported weekly usage of MVS ranged from zero to seven days. Overall, 24.6% of the participants who completed the SUMS used MVS at least once during the week prior to completion of the SUMS. However, only 4.9% of participants used MVS daily.

The linear combination of attitude, subjective norms, and PBC were significantly correlated with behavioral intention (R=0.813) and together accounted for 65.1% (adjusted R square) of the variance in behavioral intention F (3, 96)=62.49, $P<.001$). As shown in Figure 2, subjective norms had the greatest influence (β=0.348, $P<.001$), followed by PBC (β=0.336, $P<.001$), and attitude (β=0.228, $P<.038$).

Overall, 91.0% of subjects were correctly classified as MVS users or nonusers. Multiple logistic regression analysis was used to calculate the odds ratio as an estimate of the likelihood of using MVS. The independent variables for the analysis were entered in the following order: behavioral intention and PBC were entered in the first step, followed by attitude and subjective norms in the second step, and the three beliefs variables in the third step. Hosmer and Lemeshow test of model fit showed that model adequately fits the data (Hosmer and Lemeshow chi-square=4.944 (df=8) $P<0.763$). The odds of using MVS increased almost five fold (Exp(B)=4.951; $P<.007$) for every increase of one unit of behavioral intention. None of the other variables

significantly contributed to the prediction of the use of MVS. This model (Figure 3) accounted for 59.2%, F (2, 75)=22.35, *P*=.001, of the variance in the use of MVS (Nagelkerke R square=0.592).

The statements within behavioral, normative, and control beliefs and percentage of participants who strongly agreed with these statements in terms of their importance to the use of MVS are shown in Table 1. The independent sample *t* test analysis revealed several statistically significant differences in the evaluation of statements from behavioral and normative belief variables but not from control variables (Table 2).

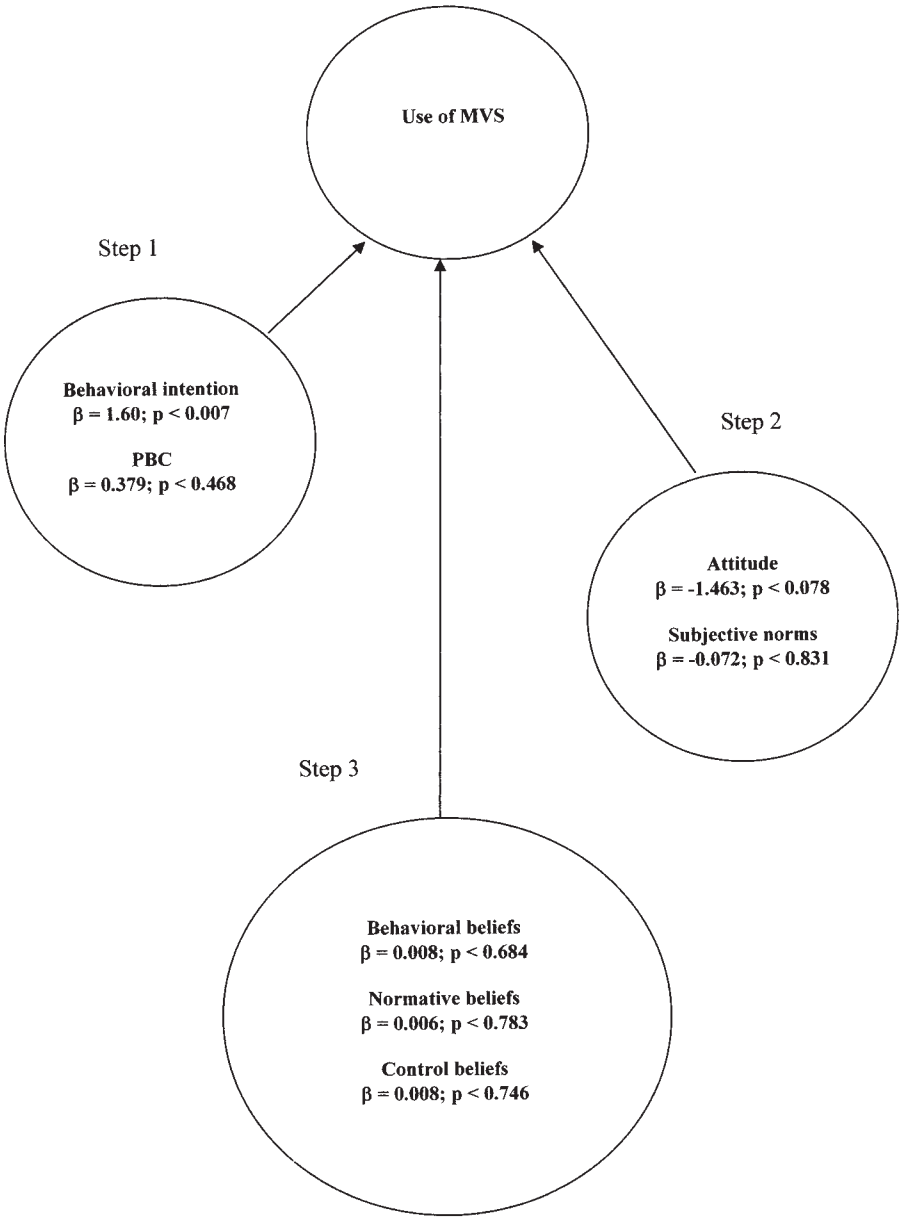

Fig 3. Results of logistic regression analysis

DISCUSSION

In the present study, as expected, behavioral intention significantly predicted the use of MVS. Behavioral intention ultimately is a result of underlying beliefs about a given behavior. Thus, to determine the specific predictors of a behavior the researcher analyzed how respondents evaluated each of the statements within each of the belief variables included in the STPB. In addition, the researcher performed independent sample *t* test analysis to determine whether MVS users and nonusers scored those statements equally.

A variety of factors important to African-American female college students were identified. Table 1 shows the most important of these factors. They include getting nutrients one may miss in one's diet, getting extra energy, and improvement of health. In addition, >80% of participants strongly agreed with value statements of two of the three above-listed expectancy components of the beliefs, namely, the importance of health and the importance of getting all nutrients. Evaluation of these value statements and corresponding expectancy statements seem to indicate that the importance of getting all nutrients and the importance of health may be considered predictors of MVS use. However, as evident from Table 2, no statistically significant difference was seen in the mean score of MVS users and nonusers related to the statement that taking MVS would improve their health. Furthermore, no statistically significant difference was seen in how MVS users and nonusers assessed the importance of the corresponding value of that belief statement. Similarly, no statistically significant difference was seen between the two groups in the mean score of the statement stating that taking MVS would help to get nutrients students miss in their diet (Table 2). The same was true with the value statement of the discussed belief. Thus, neither of these beliefs can really be considered a pre-

Table 1. Expectancy (beliefs) and corresponding value statements of behavioral, normative, and control beliefs

Beliefs/Value	Statements	Percent of Responses Scored 6 or 7 (Strongly Agree)
	Behavioral Beliefs	
Expectancy	Taking a multivitamin supplement each day next week would improve my health.	52.0
Corresponding value	Being healthy is important to me.	89.9
Expectancy	Taking a multivitamin supplement each day next week would help me to get nutrients I do not get in my diet.	68.0
Corresponding value	Getting all nutrients I need is important to me.	83.0
Expectancy	Taking a multivitamin supplement each day next week would give me extra energy.	53.6
Corresponding value	Getting extra energy from multivitamin supplements is important to me.	52.0
Expectancy	Taking a multivitamin supplement each day next week would help me look and feel better.	42.0
Corresponding value	Looking and feeling good is important to me.	86.0
	Normative Beliefs	
Expectancy	My family (eg, parents, siblings) thinks I should take a multivitamin supplement each day next week.	40.2
Corresponding value	It is important to me what my family thinks about my taking multivitamin supplements.	33.4
Expectancy	My peers approve of my taking a multivitamin supplement each day next week.	26.0
Corresponding value	It is important to me what my peers think about my taking multivitamin supplements.	14.0
Expectancy	My doctor wants me to take a multivitamin supplement each day next week.	21.0
Corresponding value	It is important to me what my doctor thinks about my taking multivitamin supplements.	57.6
	Control Beliefs	
Expectancy	It would be difficult for me to remember to take a multivitamin supplement each day next week.	42.0
Corresponding value	Remembering to take multivitamin supplements would make taking them more difficult.	31.3
Expectancy	I can afford buying multivitamin supplements.	46.5
Corresponding value	The cost of multivitamin supplements would prevent me from taking them.	22.0

dictor of MVS use in the sample used in this study.

Multivitamin supplement users and nonusers also significantly differed in their evaluation of a belief about whether or not MVS use would help them to feel and look better. The corresponding value statement of this belief was not significantly differently scored by the two different groups.

Statistically significant differences were found in how MVS users and nonusers scored all belief statements within normative beliefs. In addition, two of three corresponding value statements of those beliefs were also statistically significantly different. In this sample of students, subjective norms had the greatest impact on predicting behavioral intention to use MVS. This finding is different from the results of analysis of the combined sample of Caucasian and African-American respondents. In that sample, attitude had the greatest impact followed by subjective norms. This indicates that social influence regarding the use of MVS played an important role in deciding whether or not to use MVS among the African-American females in this study. This finding is consistent with observations about social effects on engaging in other types of preventive health behavior, such as breast or cervical cancer screening.[30,31] Social support, which may include family, extended family, church, and community leaders, may have a strong impact on behavior in the African-American culture. Such impact has been observed in promotion of cancer screening described as Save Our Sisters Project.[32]

The results of the present research show that only 21% of all participants strongly agreed with the statement that their doctor would want them to take a MVS and as many as 49% strongly disagreed with that statement. However, ≈57% of respondents indicated that what their doctor said about taking MVS was important. These findings indicate that, even though respondents felt their doctor's recommendation was important, many of them did not believe that their doctors want them to take it. There was a statistically significant difference in how MVS users and nonusers scored both the belief and its corresponding value statement regarding what they believed their doctor thinks about MVS (Table 2). The mean score of the statement, "My doctor wants me to take a multivitamin supplement each day next week," indicates a negative and positive assessment for MVS nonusers and users, respectively (scores lower than 4 indicate a negative assessment). Thus, it is reasonable to

Table 2. Comparison of mean scores of expectancy (beliefs) and corresponding value statements between MVS users and nonusers (independent sample *t* test)

No.	Statements	Nonusers/ Users	*n*	Mean	*t*	Significance
1a	Taking a multivitamin supplement each day next week would improve my health.	Nonusers/ users	65 16	4.66 5.63	−1.56	0.133
1b	Being healthy is important to me.	Nonusers/ users	64 16	6.38 6.88	−1.34	0.184
2a	Taking a multivitamin supplement each day next week would help me to get nutrients I do not get in my diet.	Nonusers/ users	65 16	5.23 6.06	−1.65	0.110
2b	Getting all nutrients I need is important to me.	Nonusers/ users	65 16	6.02 6.81	−1.95	0.055
3a	Taking a multivitamin supplement each day next week would give me extra energy.	Nonusers/ users	65 16	4.51 6.06	−3.05	0.003
3b	Getting extra energy from multivitamin supplements is important to me.	Nonusers/ users	65 16	4.37 6.13	−3.05	0.003
4a	Taking a multivitamin supplement each day next week would help me look and feel better.	Nonusers/ users /	65 16	4.26 6.00	−3.49	0.002
4b	Looking and feeling good is important to me.	Nonusers/ users	65 16	6.11 6.88	−1.76	0.082
5a	My family (eg, parents, siblings) thinks I should take a multivitamin supplement each day next week.	Nonusers/ users	64 16	3.03 4.88	−2.86	0.009
5b	It is important to me what my family thinks about my taking multivitamin supplements.	Nonusers/ users	65 16	3.78 5.06	−1.91	0.070
6a	My peers approve of my taking a multivitamin supplement each day next week.	Nonusers/ users	65 16	3.43 5.25	−3.32	0.003
6b	It is important to me what my peers think about my taking multivitamin supplements.	Nonusers/ users	65 16	2.48 4.00	−2.75	0.007
7a	My doctor wants me to take a multivitamin supplement each day next week.	Nonusers/ users	65 16	2.74 5.13	−3.78	0.001
7b	It is important to me what my doctor thinks about my taking multivitamin supplements.	Nonusers/ users	65 16	4.82 6.73	−3.51	0.001
8a	It would be difficult for me to remember to take a multivitamin supplement each day next week.	Nonusers/ users	65 16	4.17 4.31	−0.2	0.846
8b	Remembering to take multivitamin supplements would make taking them more difficult.	Nonusers/ users	64 16	3.47 4.56	−1.75	0.094
9a	I can afford buying multivitamin supplements.	Nonusers/ users	65 16	4.48 5.25	−1.29	0.211
9b	The cost of multivitamin supplements would prevent me from taking them.	Nonusers/ users	65 16	2.98 4.00	−1.40	0.175

Mean score of >4 indicates a positive evaluation of a statement and a score of <4 indicates a negative evaluation of a statement.

No. 1 through 4—statements within behavioral belief variable; 5 through 7—statements within normative belief variable; 8 and 9—statements within control belief variable; a—expectancy components (beliefs) of the belief variables; b—corresponding value statements.

conclude that the relatively low intake of MVS by this population may be a result of what many of the respondent believed their physician thought about them taking MVS. Our conclusion is supported by the fact that many of the MVS nonusers did not think their doctor wanted them to take them. Such a belief may also have been a result of never being encouraged by a physician to take a MVS. This finding may also indicate that physicians who would encourage African-American female students to take MVS could have a great impact on the prevalence of the use of MVS in this ethnic and age group of females. In particular, physicians working in campus health clinics should consider encouraging female students to take a daily MVS because during college they become the primary healthcare providers for many female students.

While the percentage of African-American students agreeing with the belief statements about peers wanting them to use MVS is small, a significant difference was seen in the mean score of MVS users and nonusers. The same was true with the corresponding value statements. Thus, while small, the perceived impact of peers may also contribute to one's decision about taking MVS. A similar observation is true regarding the impact of family, although the mean score of the value statement related to that statement was not statistically

. . .it is reasonable to conclude that the relatively low intake of MVS [multi-vitamin supplement] by this population may be a result of what many of the respondents believed their physician thought about them taking MVS.

different between MVS users and nonusers.

Even though theoretically control beliefs indirectly impacted the use of MVS, as evident from Table 1, the impact of control factors was negligible. Almost 50% of participants felt that they could afford to buy MVS while only 22% of respondents agreed that the cost of MVS would prevent them from taking them. This conclusion is strengthened by the fact that both MVS users and nonusers scored all control statements similarly (Table 2).

The researchers used a convenience sample of female students enrolled in 19 chosen classes during the summer 2003 semester who volunteered to complete the STPB and the SUMS. Thus, the sample in this study may not be representative of all undergraduate students. In particular, the results described in this paper may not be applicable to students other than those of African-American ethnic background. Also, data used in this study were self-reported and thus, they may have been subject of self-presentation reported bias.

CONCLUSION

Consistent with the results of the present study, educational campaigns that target populations of college-age African-American females to encourage the use of MVS should include normative factors including the impact of campus physicians, family, and peers. The results of the present study could contribute to the increase in the use of MVS among college age African-American females and consequently to a decline in the occurrence of NTD in this population.

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