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Using the Transtheoretical Model of Change to Enhance High School Female Students' Self-Efficacy of Refraining from Carbonated Drinks Consumption

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Abstract

Objectives: To examine the efficacy of the Transtheoretical Model of Change-based intervention in enhancing students' Self-Efficacy by refraining from carbonated drinks.

Methods: We conducted a randomized controlled trial at Al-Russafa High School for girls in Baghdad City. The study involved a random sample of 144 female high school students, with 72 students in the intervention group and 72 in the control group. The research instrument collected data on participants' sociodemographic characteristics, including age, living arrangements, and family socioeconomic status. Additionally, we used the Stages of Change for Carbonated Drinks Consumption Behaviour Scale (Short Form) and the Stages of Change for Carbonated Drinks Consumption Behaviour Scale (Continuous Measure). Data analysis was performed using the Statistical Package for Social Science (SPSS) for Windows, version 27.

Results: The study results exhibit that more than half of participants in the study group are in the Precontemplation Stage of Change in the pretest time (n = 42; 58.3%), followed by those who are in the Preparation Stage of Change (n = 15; 20.8%), those who are in the Contemplation Stage of Change (n = 14; 19.4%), and one who is in the Maintenance Stage of Change (n = 1; 1.4%). In posttest 2, less than two-fifths became in the Action Stage of Change (n = 28; 38.9%), followed by those who became in the Preparation Stage of Change (n = 19; 26.4%), those who became in the Maintenance Stage of Change (n = 18; 25.0%), those who became in the Contemplation Stage of Change (n = 6; 8.3%), and one who stayed in the Precontemplation of Change (n = 1; 1.4%). The researchers concluded that the administered intervention based on the TTM efficaciously enhanced students' readiness to refrain from carbonated drinks consumption.

Conclusion: The administered Stage-matched intervention based on the TTM efficaciously enhanced students' Self-Efficacy in refraining from carbonated drinks consumption.

Keywords: Carbonated drinks, readiness to refrain, high school, female students

Introduction

A soft carbonated beverage is a non-alcoholic, sweet, light, flavored, water-based beverage that contains carbon dioxide to make it bubbly or frothy. Flavoring agents may be synthetic or natural, frequently colored, and may also include fruit pulp, fruit liquid, or caffeine. Fruit juice, high-fructose corn syrup, sugar, or sugar substitutes may be used as the sweetener.[1]

In 2010, it was estimated that adults aged 20 and older in 187 countries consumed 0.58 servings per day of sugar-sweetened beverages SSBs.[2] When discussing the effects of effervescent beverages on human health, the effects on the gastrointestinal tract are of primary concern. Bicarbonate has various functions in the human body, including influencing the pH balance of the blood, contributing to vasodilation, inflammation, and tissue recovery, and stimulating relaxation.[3]

Carbonated drinks can cause gastric distention. In addition to causing harmless problems such as hiccups, carbonated drinks can cause irritable bowel syndrome (IBS). In addition, stomach distension can reduce the effectiveness of gastric acid in digesting foods that require sufficient acidity. Individuals with IBS are advised, among other things, to eliminate carbonated drinks from their diet to allow the GI lining to heal. The best method to prevent acid reflux and heartburn is to avoid drinking acidic carbonated beverages.[4]

Carbonated drinks have unique properties that may increase gastroesophageal reflux disease, such as high acidity and carbonation levels. Many Carbonated drinks have an acidic pH and cause symptoms similar to gastroesophageal reflux disease (GERD).[5]

Adolescence is largely a time of transition. Adolescence is a time to develop and solidify good dietary and lifestyle habits.[6-10] Additionally, adolescents are freer to choose what they eat and drink both inside and outside of school. Therefore, we must determine the perceived advantages and disadvantages of consuming carbonated drinks that are pertinent to adolescents in particular.

The excessive consumption of carbonated drinks is harmful to the health of adolescents because they lack essential nutrients and harm their general and oral health. Carbonated drinks contain phosphoric acid, sugar, caffeine, coloring agents, and flavoring agents. These beverages contain phosphoric acid as the active ingredient. Phosphoric acid has a pH that is less than 3, which is the same as thionic acid. So that these beverages do not taste acidic, manufacturers include an excessive amount of sugar. To sterilize water, a high concentration of phosphoric acid is introduced, reducing the pH of the liquid. Regular consumption of soft beverages (1-.5L per week) softens the teeth.[11]

To study this subject, a variety of theoretical foundations could be taken. Consider if adolescents have considered or tried to cut back on their consumption of carbonated drinks as an illustration. The Transtheoretical Model offers a possible framework for investigating this problem. It has been

used to study some of the health problems in Iraq.[12-14] This study aims to examine the efficacy of the Transtheoretical Model of Change-based intervention in enhancing students' Self-Efficacy by refraining from carbonated drinks.

Method

A randomized controlled trial was used to guide this study. The study was conducted at Al-Russafa High School for females in Baghdad City.

Sample and Sampling

The study included a simple random sample of (144) female high school students (72 students in the study group and 72 students in the control group). Microsoft Office Word was used to generate the lists of Al-Rusafa High School female pupil names for simple random sampling. Each grade's students' names were cut from identical pieces of paper of the same color and pleated in the same manner. Each grade's pupils' names were placed in a separate container. One of the student researcher's peers began to alternately agitate the pieces of paper and draw on each one. The first item drawn would be assigned to the study group, while the second would be assigned to the control group, and so on, until the required sample size for each grade in both the study and control groups. The sample size was determined using the G*Power software based on an effect size of 0.25, an alpha error probability of 0.05, a power of 0.95, two groups, and three repetitions. Consequently, the recommended sample size is 142. The entire number of study participants is 144.

Measures

The study instrument consists of participants' sociodemographic characteristics of age, living arrangement, and family's socioeconomic status, Stages of Change for Carbonated Drinks Consumption Behavior Scale (Short Form), Stages of Change for Carbonated Drinks Consumption Behavior Scale (Continuous Measure).

Data were analyzed using the statistical package for social science (SPSS) for Windows, version 27.

Results

The study results display that the mean age of participants in the study group is 16.79 ± 1.18; less than the third age 16 years (n = 23; 31.9%), followed by those aged 17 years (n = 17; 23.6%), those who age 18-years (n = 16; 22.2%), those who age 15-years (n = 10; 13.9%), and those who age 19-years (n = 6; 8.3%) (Table 1).

Table 1. **Participants' sociodemographic characteristics**

Variable	Study group (N = 72)		Control group (N = 72)	
	Frequency	Percent	Frequency	Percent
Age				
Study: M (SD): 16.79 ± 1.18				
Control: M (SD): 16.75 ± 1.15		*		*
15	10	13.9	10	13.9
16	23	31.9	24	33.3
17	17	23.6	17	23.6
18	16	22.2	16	22.2
19	6	8.3	5	6.9
Academic Achievement				
Poor	6	8.3	6	8.3
Fair	4	5.6	4	5.6
Good	14	19.4	16	22.2
Very good	26	36.1	25	34.7
Excellent	22	30.6	21	29.2
Living Arrangement				
Live with parents	59	81.9	60	83.3
Live with mother	9	12.5	9	12.5
Live with relatives	4	5.6	3	4.2
Socioeconomic Class				
Upper lower class	10	13.9	10	13.9
Lower middle class	25	34.7	26	36.1
Upper middle class	36	50.0	35	48.6
Upper class	1	1.4	1	1.4

M: mean; SD: standard deviation. *Percent is not exactly 100.0%.

Table 2. **Carbonated drinks consumed by participants**

Variable	Study group (N = 72)		Control group (N = 72)	
	Frequency	Percent	Frequency	Percent
Pepsi	61	84.7	63	87.5
Mirinda	17	23.6	16	22.2
Seven up	33	45.8	31	43.1
Soda	17	23.6	17	23.6
Shani	19	26.4	20	27.8

Table 3. **Participants' distribution according to the stages of change over time**

Pretest	Study group (N = 72)		Control group (N = 72)	
	Frequency	Percent	Frequency	Percent
Precontemplation	42	58.3	42	58.3
Contemplation	14	19.4	14	19.4
Preparation	15	20.8	15	20.8
Action	0	0.0	0	0
Maintenance	1	1.4	1	1.4
Posttest 1				
Precontemplation	13	18.1	42	58.3
Contemplation	17	23.6	14	19.4
Preparation	12	16.7	15	20.8
Action	27	37.5	0	0
Maintenance	3	4.2	1	1.4
Posttest 2				
Precontemplation	1	1.4	42	58.3
Contemplation	6	8.3	14	19.4
Preparation	19	26.4	15	20.8
Action	28	38.9	0	0
Maintenance	18	25.0	1	1.4

For the control group, the mean age is 16.75 ± 1.15, with one-third aged 16 years (n = 24; 33.3%), followed by those aged 17 years (n = 17; 23.6%), those aged 18 years (n = 16; 22.2%), those who age 15-years (n = 10; 13.9%), and those who age 19-years (n = 5; 6.9%).

Concerning academic achievement, more than third in the study group whose achievement is very good (n = 26; 36.1%), followed by those whose achievement is excellent (n = 22; 30.6%), those whose achievement is good (n = 14; 19.4%), those whose achievement is poor (n = 6; 8.3%), and those whose achievement is fair (n = 4; 5.6%).

For the control group, more than a third whose achievement is very good (n = 25; 34.7%), followed by those whose achievement is excellent (n = 21; 29.2%), those whose achievement is good (n = 16; 22.2%), those whose achievement is poor (n = 6; 8.3%), and those whose achievement is fair (n = 4; 5.6%).

Regarding the living arrangements, the majority of participants in the study group reported that they have been living with their parents (n = 59; 81.9%), followed by those who have been living with their mother (n = 9; 12.5%), and those who have been living with their relatives (n = 4; 5.6%).

Table 4. **Descriptive statistics for the values of the stages of change (continuous measure) over time**

Stages of change	Mean	Standard deviation	Number
Study pretest	62.2361	9.37556	72
Study posttest 1	69.1250	10.21313	72
Study posttest 2	93.6250	19.18438	72
Control pretest	62.1944	9.46102	72
Control posttest 1	62.7222	8.73752	72
Control posttest 2	62.9861	8.57361	72

For the control group, the majority reported that they have been living with their parents (n = 60; 83.3%), followed by those who have been living with their mother (n = 9; 12.5%), and those who have been living with their relatives (n = 3; 4.2%).

Concerning the socioeconomic class, half of the participants in the study group are classified as upper middle class (n = 36; 50.0%), followed by those who are classified as lower middle class (n = 25; 34.7%), those who are classified as upper lower class (n = 10; 13.9%), and one who is classified as upper class (n = 1; 1.4%).

For the control group, less than half are classified as upper middle class (n = 35; 48.6%), followed by those who are classified as lower middle class (n = 26; 36.1%), those who are classified as upper lower class (n = 10; 13.9%), and one who is classified as upper class (n = 1; 1.4%).

The study results display that the most consumed carbonated drink for participants in the study and control groups is Pepsi (n = 61; 84.7, 63; 87.5%) (Table 2) respectively.

The study results exhibit that more than half of participants in the study group are in the Precontemplation Stage of Change in the pretest time (n = 42; 58.3%), followed by those who are in the Preparation Stage of Change (n = 15; 20.8%), those who are in the Contemplation Stage of Change (n = 14; 19.4%), and one who is in the Maintenance Stage of Change (n = 1; 1.4%) (Table 3).

In posttest 1, less than two-fifths became in the Action Stage of Change (n = 27; 37.5%), followed by those who became in the Contemplation Stage of Change (n = 17; 23.6%), those who became in the Precontemplation Stage of Change (n = 13; 18.1%), those who became in the Preparation Stage of Change (n = 12; 16.7%), and those who stepped to the Maintenance of Change (n = 3; 4.2%).

In posttest 2, less than two-fifths became in the Action Stage of Change (n = 28; 38.9%), followed by those who became in the Preparation Stage of Change (n = 19; 26.4%), those who became in the Maintenance Stage of Change (n = 18; 25.0%), those who became in the Contemplation Stage of Change (n = 6; 8.3%), and one who stayed in the Precontemplation of Change (n = 1; 1.4%).

For the control group, the study results exhibit that more than half are in the Precontemplation Stage of Change at all times (n = 42; 58.3%), followed by those who are in the Preparation Stage of Change (n = 15; 20.8%), those who are in the Contemplation Stage of Change (n = 14; 19.4%), and one who is in the Maintenance Stage of Change (n = 1; 1.4%).

The values of the Stages of Change (Continuous Measure) (Table 4), for the study group noticeably increase over time compared to the control group (Pretest = 62.23 vs. 62.19, Posttest I = 69.12 vs. 62.72, Posttest II = 93.62 vs. 62.98)

respectively. A higher score means participants use more Stages of Change (Continuous Measure).

There are significant differences in the values of the Stages of Change (Continuous Measure) (Table 5), over time for participants in the study and control groups (F = 71.109, df = 2, p < .01 vs. F = 9.663, df = 2, p < .01).

Mauchly's Test of Sphericity is significant (p >.05), which indicates that these data do not violate the sphericity assumption of the univariate approach to repeated-measures ANOVA (Table 6). So, we accept the assumption that the variances of the differences between levels are equal.

There was a (a priori P = 0.01) significant difference (F (1.565, 126.982) = 101.379, P = 0.01) in the Stages of Change (Continuous Measure) over time for participants in the study group. The omnibus effect (a measure of association) for this analysis is .588, which indicates that approximately 58% of the total variance in the Stages of Change (Continuous Measure) values is accounted for by the variance in the administered intervention (Table 7).

For the control group, there was a (a priori P = 0.01) significant difference F (1.788, 71.000) = 12.985, P = 0.01) in the Stages of Change (Continuous Measure) over time. The omnibus effect (a measure of association) for this analysis is .155, which indicates that approximately 15% of the total variance in the Stages of Change (Continuous Measure) values is accounted for by chance.

Participants' Stages of Change (Continuous Measure) (Table 8), in the study group in the pretest time statistically differ from such Stages in posttest I (P = .000) and posttest II (P = .000). Such Stages in posttest I statistically differ from that in the pretest time (P = .000) and posttest II (P = .000). Such Stages in the posttest II statistically differ from that in the pretest time and that in the posttest I (P = .000).

For the control group, the Stages of Change (Continuous Measure) in the pretest time statistically differ from such SOC in the posttest I (P = .005) and posttest II (P = 0.000). Such SOC in the posttest statistically differ from these in the pretest time (P = .005) but do not statistically differ from these in the posttest II (P = .144). Ultimately, such SOC in the posttest II statistically differ from these in the pretest time (P = 0.005) but they do not statistically differ from these in the posttest I (P = .144).

Discussion

This experimental randomized controlled trial aims mainly to examine the efficacy of Stage-matched intervention based on the Transtheoretical Model of Change in the carbonated drink consumption behavior among high school female students.

The study results exhibit that more than half of the participants in the study group were in the Precontemplation Stage of Change in the pretest time (n = 42; 58.3%). In posttest 1, this proportion has decreased to less than a fifth (n = 13, 18.1%). In the posttest 2, this proportion has remarkably decreased (n = 1, 1.4%). The Ferguson's delta value over time is 0.4025.

Concerning the Contemplation Stage of Change, less than a fifth were (n = 14; 19.4%) in the pretest, this proportion has slightly decreased (n = 17; 23.6%), while it remarkably dropped in the posttest 2 (n = 6; 8.3%). The Ferguson's delta value over time is 0.6504.

Regarding the Preparation Stage of Change, around fifth (n = 15; 20.8%) were in the pretest time, this proportion

Table 5. **Multivariate tests of the within-subjects for the stages of change (continuous measure) over time**

Multivariate Tests							
	Effect	**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta squared**
SOC study	Pillai's trace	.670	71.109[a]	2.000	70.000	.000	.670
	Wilks' lambda	.330	71.109[a]	2.000	70.000	.000	.670
	Hotelling's trace	2.032	71.109[a]	2.000	70.000	.000	.670
	Roy's largest root	2.032	71.109[a]	2.000	70.000	.000	.670
	Effect	**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta squared**
SOC control	Pillai's trace	.216	9.663[a]	2.000	70.000	.000	.216
	Wilks' lambda	.784	9.663[a]	2.000	70.000	.000	.216
	Hotelling's trace	.276	9.663[a]	2.000	70.000	.000	.216
	Roy's largest root	.276	9.663[a]	2.000	70.000	.000	.216

[a]Exact statistic.

Table 6. **Mauchly's test of sphericity for the stages of change (continuous measure)**

Mauchly's test of sphericity							
Measure: MEASURE_1							
Within subjects effect	**Mauchly's W**	**Approx. chi-square**	**df**	**Sig.**	**Epsilon[a]**		
					Greenhouse-geisser	**Huynh-feldt**	**Lower-bound**
SOC study	.977	1.639	2	.441	.977	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix. [a]May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Table 7. **Tests of within-subjects effects for the stages of change (continuous measure)**

Tests of within-subjects effects							
Measure: MEASURE_1							
	Source	**Type III sum of squares**	**df**	**Mean square**	**F**	**Sig.**	**Partial Eta squared**
SOC study	Sphericity assumed	39191.259	2	19595.630	101.379	.000	.588
	Greenhouse-geisser	39191.259	1.565	25042.217	101.379	.000	.588
	Huynh-feldt	39191.259	1.594	24586.478	101.379	.000	.588
	Lower-bound	39191.259	1.000	39191.259	101.379	.000	.588
Error (SOC study)	Sphericity assumed	27447.407	142	193.292			
	Greenhouse-geisser	27447.407	111.116	247.017			
	Huynh-feldt	27447.407	113.175	242.521			
	Lower-bound	27447.407	71.000	386.583			
	Source	**Type III sum of squares**	**df**	**Mean square**	**F**	**Sig.**	**Partial Eta squared**
SE control	Sphericity assumed	23.398	2	11.699	12.985	.000	.155
	Greenhouse-geisser	23.398	1.788	13.083	12.985	.000	.155
	Huynh-feldt	23.398	1.832	12.774	12.985	.000	.155
	Lower-bound	23.398	1.000	23.398	12.985	.001	.155
Error (SE control)	Sphericity assumed	127.935	142	.901			
	Greenhouse-geisser	127.935	126.982	1.008			
	Huynh-feldt	127.935	130.046	.984			
	Lower-bound	127.935	71.000	1.802			

Table 8. **Pairwise comparison of the Stages of Change (Continuous Measure) values between study and control groups**

Pairwise Comparisons						
Measure: MEASURE_1						
(I) SOC study	**(J) SOC study**	**Mean difference (I-J)**	**Std. error**	**Sig.[a]**	**95% Confidence interval for difference**	
					Lower bound	**Upper bound**
1	2	−6.889*	1.594	.000	−10.796	−2.982
	3	−31.389*	2.616	.000	−37.803	−24.974
2	1	6.889*	1.594	.000	2.982	10.796
	3	−24.500*	2.593	.000	−30.859	−18.141
3	1	31.389*	2.616	.000	24.974	37.803
	2	24.500*	2.593	.000	18.141	30.859
(I) SOC control	**(J) SOC control**	**Mean difference (I-J)**	**Std. error**	**Sig.[a]**	**95% Confidence interval for difference[a]**	
					Lower bound	**Upper bound**
1	2	−.528*	.161	.005	−.922	−.134
	3	−.792*	.179	.000	−1.231	−.353
2	1	.528*	.161	.005	.134	.922
	3	−.264	.131	.144	−.586	.058
3	1	.792*	.179	.000	.353	1.231
	2	.264	.131	.144	−.058	.586

Based on estimated marginal means. *The mean difference is significant at the .05 level. [a]Adjustment for multiple comparisons: Bonferroni.

slightly dropped in posttest 1 (n = 12; 16.7%), while this proportion rose in posttest 2 (n = 19; 26.4%). The Ferguson's delta value over time is 0.6878. This value reflects the fact that this stage witnessed the greatest change.

Concerning the Action Stage of Change, none of the participants was recorded in this stage in the pretest (n = 0; 0.0%), while more than a third were recorded in the posttest 1 time (n = 27; 37.5%), and this proportion has slightly increased in the posttest 2 time (n = 28; 38.9%). The Ferguson's delta value over time is 0.5091.

As per the Maintenance Stage of Change, one participant was recorded in this stage in the pretest time (n = 1; 1.4%), this

proportion has trivially increased in the posttest 1 time (n = 3; 4.2%), while this proportion has noticeably increased in the posttest 2 time (n = 18; 25.0%). The Ferguson's delta value over time is 0.3254. This value reflects the fact this stage witnessed the least change.

For the control group, there was no change in the proportions of participants across all Stages of Change.

Buchanan and Coulson[10] concluded that over half of the adolescents (55%) were classified into one of the pre-action stages (i.e., pre-contemplation or Contemplation).

The values of the Stages of Change (Continuous Measure) for the study group noticeably increased over time compared to the control group with significant differences in the values of the Stages of Change (Continuous Measure) over time for participants in the study and control groups. For participants in the study group, there was a (a priori) significant difference in the Stages of Change (Continuous Measure) over time. The omnibus effect (measure of association) for this analysis was .588, which indicates that approximately 58% of the total variance in the Stages of Change (Continuous Measure) values is accounted for by the variance in the administered intervention.

For the control group, there was a (a priori) significant difference (in the Stages of Change (Continuous Measure) over time. The omnibus effect (a measure of association) for this analysis was .155, which indicates that approximately 15% of the total variance in the Stages of Change (Continuous Measure) values is accounted for by chance.

Participants' Stages of Change (Continuous Measure) in the study group in the pretest time statistically differ from such Stages in posttest I and posttest II. Such Stages in the posttest I statistically differ from that in the pretest time and posttest II. Such Stages in posttest II statistically differ from those in the pretest time and posttest I.

For the control group, the Stages of Change (Continuous Measure) in the pretest time statistically differ from such SOC in the posttest I and posttest II. Such SOC in the posttest statistically differ from these in the pretest time but do not statistically differ from these in the posttest II. Ultimately, such SOC in the posttest II statistically differ from these in the pretest time but they do not statistically differ from these in the posttest I. These findings reflect the efficacious effect of the administered intervention with a consistent effect over time for participants in the study group.

Conclusion

The administered Stage-matched intervention based on the TTM efficaciously enhanced students' Self-Efficacy in refraining from carbonated drinks consumption.

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