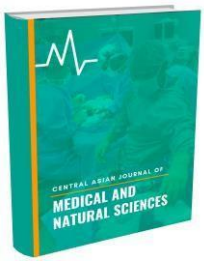

CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
https://cajmns.centralasianstudies.org/index.php/CAJMNS
*Volume: 05 Issue: 03 | July 2024 ISSN: 2660-4159*

*Article*

# Efficacy of the Health Belief Model-Based Intervention of change in Dietary Fat Reduction Among Female High school students

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**Abstract:** This study aims to examine the efficacy of Stage-matched intervention based on the Transtheoretical Model of Behavior Change in dietary fat reduction. The study included high school female students who age 16-18-years. An experimental design using randomized controlled trial was used to guide this study. The study included a simple random sample of 144 female high school students (72 students for the study groups and 72 for the control group). The study instrument includes participants' sociodemographic characteristics age, family's socioeconomic status , the Revised 1 Item Stage of Change Algorithm, the Processes of Change Questionnaire, the Decisional Balance Questionnaire, and the 32 Item Situational Temptation Questionnaire. Data were collected using a self-reported instrument. for the period from November 1st, 2021 to April 10th, 2022 Data were analyzed using the statistical package for social science for windows, version 26. The statistical measures of frequency, percent, mean, standard deviation, Repeated Measures Analysis of Variance,and One-way analysis of variance were used.The study results revealed that the administered Transtheoretical Model of Change-Stage-matched intervention moved subjects from lower Stages of Change to higher ones The age mean for participants in the study group is 17.32 ± 1.56 compared to 17.27 ± 1.09 for those in the control group. In the pretest and posttest I, more than a third of participants in the study group were in the Action Stage of Change for eating high-fat food. In the posttest II, less than a half were in the Preparation Stage of Change. There was a significant difference in the Self-Efficacy over time for participants in the study group with an omnibus effect of .789. The stages-matched intervention based on the Transtheoretical Model of Change significantly bettered the Self-Efficacy of reducing dietary fat for participants in the study group.

Keywords: Adolescents, Dietary Fat, Health Behavior, Transtheoretical Model of Change

**Citation: Eman Hammad Hafedh, Mohammed Baqer Habeeb Abd Ali**. Efficacy of the Health Belief Model-Based Intervention of change in Dietary Fat Reduction Among Female High school students. Central Asian Journal of Medical and Natural Science 2024, 5(2), 840-853.

Received: 05th July 2024
Revised: 09th July 2024
Accepted: 11th July 2024
Published: 19th July 2024



## 1. Introduction

Numerous studies conducted across different cultures, as well as prospective cohort studies and interventions focusing on dietary and lifestyle changes, have provided compelling evidence suggesting that adopting a healthy lifestyle that includes eating right, staying at a healthy weight, and living can significantly reduce the chances of developing cardiovascular diseases and experiencing premature death (1).

Health is a process which can be changed sophistically and dynamically. Indeed, health can be affected by person's lifestyle. As a result; stated that to maintain health, individuals should practice health promoting lifestyle behaviors ( 2)

The latest report published by World Health Organization (WHO) in 2017 indicated that stroke related death in Iraq reached14,315 or 8.13% of country's total deaths

(3). American Heart Association (AHA) recommended that the management of CHD patients cannot be ended with PCI alone, but they must be highly compliant with secondary prevention measures including a healthy lifestyle after PCI. An increasing diet rich in fruits and vegetables, maintaining normal body weight, ceasing smoking, maintaining regular follow up to keep .blood pressure and diabetes mellitus within control(4)

Researchers developed clinical guidelines for high-risk persons and those with obvious cardiovascular disorders, as well as advice for the general population, due to the connection of nutrition, lifestyle, and lipoprotein metabolism with the prevalence of atherosclerosis and its sequelae. Essential recommendations include cutting back on fat intake, particularly on saturated and trans fats, and aiming for or maintaining a healthy weight (body mass index < 25 kg/m2). (5) Fats play a crucial role as an energy source, and a high intake of total fats is linked to an overconsumption of energy, leading to weight gain and obesity, This may result in consequences such as diabetes, insulin resistance, and heart disease (5).

According to WHO, the prevalence of hypertension in the developed countries is around 35% and in the developing countries is 40% (6). In general, risk factors of CVD and CAD can be divided into two groups. The first group is non-adjusted risk factors such as age, sex, race, and family history. The second group is adjustable risk factors such as hypertension, diabetes mellitus (DM), dyslipidaemia, overweight, and smoking(7)

Obesity is linked to numerous long-term health issues. Despite the advantages of losing weight, a significant number of people do not actively pursue treatment. Obesity has substantial health effects, and is considered the second leading cause of preventable deaths after tobacco .Primary care visits are a common setting where efforts to address obesity can be made. It is possible to observe that in countries where obesity affects a large proportion of the population ,such as the United States, investments are made in public and private initiatives with the aim of preventing obesity among the young through special Nutrition programs ,interventions ,programs and actions encouraging healthy eating(8) .

Preserving a diet rich in fruits and vegetables and low in foods high in sugar and saturated fat is essential for maintaining good health among the populace and preventing non-communicable diseases.

Diets heavy in fat and low in carbohydrates are deficient in calcium, magnesium, iron, and potassium as well as in thiamin, B6, folate, and vitamins E and A. They have little dietary fiber as well. Consumption of high-fat meals produces more chylomicrons and remnants (9). Individuals with binge eating disorder eat uncommonly a lot of food in a brief timeframe and feel lost control and blame over these bingeing experiences. Researchers gauge that up to (60%) of individuals who fight with BED are female (10).

A high-fat diet alters dopamine reuptake, decreases the amount of rapid eye movement (REM) sleep, also possibly related to the release of cholecystokinin (11), and contributes to overconsumption of calories (12). Consuming a diet high in fat has been demonstrated to negatively impact high-intensity exercise performance, despite the implementation of carbohydrate loading prior to engaging in high-intensity activities (13).

Between the years 2015 and 2018, Adults 20 years of age or older had a 11.4% prevalence of elevated total cholesterol. It's interesting to note that the prevalence did not significantly differ between males (10.5%) and women (12.1%). Adults between the ages of 40 and 59 had the highest frequency, at 15.7%. Then came people who were 60 years of age or older, who had a prevalence rate of 11.4%. On the other hand, the lowest prevalence was found among individuals aged 20-39 years, with a rate of 7.5% (14).

Dr. Russell Wilde from the Mayo Clinic proposed that adopting a diet high in fat and low in carbohydrates could simulate the effects of fasting and induce a state of ketosis (15,16). By adopting healthy habits, people can reduce their risk of contracting chronic illnesses and enhance their quality of life. (17).Every woman of reproductive age who is capable of becoming pregnant is a candidate for preconception care (PCC), The term of

PCC (the period prior to pregnancy) has been used in North America since the 1980s to describe child bearing related health care(18).

Many changes that start in early adulthood eventually result in the development of chronic diseases, also known as the "aging diseases," years later. Numerous changes might occur more quickly or more slowly over time, depending on the person's genetic composition, food consumption, gastrointestinal health, and immune system performance. (9).

Dietary pattern explains the overall diet; the food, food groups and nutrients included; their variety and combination; and the amount and quantity with which

they are typically consumed. Among the most common methods for determining dietary patterns are a priori numerical indexes, which measure adherence to a

dietary pattern that has been predefined on the basis of previous scientific evidence.

The majority of individuals across the globe prioritize their well-being and strive to prevent illnesses and disabilities. However, despite this inclination, large number of individuals engage in behaviors that undermine their overall health (19).

The ability and willingness of a person to follow advised health measures is referred to as adherence. A more inclusive definition of adherence was put forth by R. Brian Haynes in 1979 and includes "the degree to which an individual's behavior (concerning medication intake, diet compliance, or implementing lifestyle modifications) aligns with medical or health recommendations" (pp. 1-2). This more inclusive definition broadens the definition of adherence to include maintaining good living habits in addition to adhering to prescription regimens. These practices include proper nutrition, regular exercise, stress management, quitting smoking, and avoiding alcohol abuse.

Theories seek to demonstrate cause–effect relationships and help to offer a basis to understand and predict how health-related behaviors, behavior change, and maintenance of change occur. As such, Consequently, they also serve as a framework for devising strategies and implementing interventions aimed at fostering behavioral change, while concurrently directing research on health behavior (20). The effectiveness of prevention and treatment programs ultimately relies on people's willingness to adopt and adhere to the necessary behaviors.

The term "behavioral health" was first used by Matarazzo et al. (1984). It describes the pervasive role that behavior plays in relation to health, whether it be excessive eating, laziness, unsanitary habits, unprotected sex, smoking, violence, or involvement in civic affairs, school, or church. This includes implications for the adolescent's place on the trajectory of normal, successful, or even healthy development. (21).

Behavior-change theories typically concentrate on cognitive variables, including attitudes, beliefs, and expectations, as well as the elements that impact the explanation and forecasting of people's health-related choices concerning public engagement in screening, vaccination, and other preventive health initiatives. (20).

clearly increased risk of death with increasing weight. For individuals aged between 30 and 42, the risk of death increases by 1% for each 0.5 kg weight rise. For individuals between the ages of 50 and 62, this figure becomes 2% for each 0.5 kg weight rise(22).

The health beliefs of hypertensive patients regarding their condition have been found to determine lifestyle and medication regime adherence, thus significantly influencing the management and control of the condition, and impactingquality of life outcomes (23).

In Iraq, the statistical annual report issued by the Iraqi Ministry of Health (2020) stated that ischemic heart disease came first rank among the top 10 causes of death for males (14.1%) and for females (13.5%).

## 2. Materials and Methods

Design: A true experimental design "randomized controlled trial" was used to guide this study. Experimental designs assure a high degree of internal validity. Randomized controlled trials (RCTs) are conducted in order to produce definitive evidence for an intervention (Gray et al, 2017).

Sample and Sampling: The study included a simple random sample of female high school students who were recruited from Al-Adl High School for Females in Al-Baghdadi County, Anbar Governorate, Iraq. This school is selected using simple random sampling method by writing the names of all female high schools in the aforementioned county on identical pieces of paper. These pieces were folded in the same way and put into a container and stirred well by a colleague who draws one piece which revealed the aforementioned school. Within this school, the name of each student in each class were written on identical pieces of paper. These pieces were folded in the same way and put into a container and stirred well by a colleague who draws one piece with stirring well; the first drawn piece would be for the study group and the second drawn piece would be for the control group and so on till obtaining the recommended sample size. Twenty-four students were randomly selected from each grade ($10^{th}$, $11^{th}$, $12^{th}$). The sample size was calculated using the G*Power software version 3.1.9.2. Based on a moderate effect size (0.25), an alpha error probability of (0.05), a power of 0.95, three measurements, the recommended sample size would be 142. The final sample size is 144.

**Study Procedure**

The researchers handed in the study instrument to participants in the study and control groups at the same time., the participants were given instruction to confirm that they were aware that participation is entirely optional and that they can end it whenever they choose. Participants were assured by the student researcher that their information will be kept confidential and safe both before and after the study. The pretest was conducted for the period from October $1^{st}$, 2023 to October $4^{th}$, 2023. After collecting the copies of the study instrument in both groups, the researchers classified participants in the study group based on their Stages of Change. Thereafter, the Stage-matched intervention (Appendix G) was provided only for participants in the study group through face-to-face method, for the period from October $5^{th}$, 2023 to October $8^{th}$, 2023.The study intervention included five sessions: two sessions for each Stage of Change. Each session lasted for 40-45 minutes. The interval between administering the study intervention and posttest I was 12-weeks(December 24 ,2023) and the same duration was between posttest I and Posttest II. the researcher performed posttest-I for all study participants. Then, ten weeks later (March $17^{th}$, 2024) the researcher performed posttest-II.The study intervention considered the Stage-Matched method where there are a number of Processes of Change that correspond each Stage of Change.

## 3. Results

The age mean for participants in the study group is 17.32 ± 1.56. For the control group, the age mean is 17.27 ± 1.09. More than a half of participants in the study group are within normal weight-to-height proportion (*n = 39*; 54.2%), followed by those who are overweight (*n = 32*; 44.4%), and one who has obesity class I (*n = 1*; 1.4%). For participants in the control group, most are within normal weight-to-height proportion (*n = 48*; 66.7%), followed by those who are overweight (*n = 22*; 30.6%), and one who has obesity class I (*n = 1*; 1.4%).

**Table 1**. Participants' distribution according to their Stages of Change for eating high-fat food (study and control groups, n = 144)

| | Time | Precontemplation | Contemplation | Preparation | Action | Maintenance |
|---|---|---|---|---|---|---|
| | | f (%) | f (%) | f (%) | f (%) | f (%) |
| Study Group | Pretest | 1 (1.4) | 15 (20.8%) | 22 (30.6%) | 26 (36.1%) | 8 (11.1%) |
| | Posttest I | 1 (1.4%) | 15 (20.8%) | 22 (30.6%) | 26 (36.1%) | 8 (11.1%) |
| | Posttest II | 0 (0.0%) | 1 (1.4%) | 34 (47.2%) | 24 (33.3%) | 13 (18.1%) |
| Control Group | Pretest | 52 (72.2) | 12 (16.7%) | 15 (20.8%) | 7 (9.7%) | 4 (5.6%) |
| | Posttest I | 45 (62.5%) | 8 (11.1%) | 16 (22.2%) | 3 (4.2%) | 0 (0.0%) |
| | Posttest II | 40 (55.6%) | 5 (6.9%) | 7 (9.7%) | 16 (22.2%) | 4 (5.6%) |

f: Frequency; %: Percent

The study results reveal that in the pretest and posttest I, more than a third of participants in the study group were in the Action Stage of Change for eating high-fat food (*n = 26*; 36.1%), followed by those who were in the Preparation Stage of Change (*n* = 22; 30.6%), those who were in the Contemplation Stage of Change (*n = 15*; 20.8%), those who were in the Maintenance Stage of Change (*n = 8*; 11.1%), and one who was in Precontemplation Stage of Change (*n = 1*; 1.4%). In the posttest II, less than a half were in the Preparation Stage of Change (*n = 34*; 47.2%), followed by those who were Action Stage of Change (*n = 24*; 33.3%), those who were in the Maintenance Stage of Change (*n = 13*; 18.1%), and one who still in the Contemplation Stage of Change (*n = 1*; 1.4%).

The study results display that most of participants in the control group in the pretest were in the Precontemplation Stage of Change (*n = 52*; 72.2%), followed by those who were in the Preparation Stage of Change (*n = 15*; 20.8%), those who were in the Contemplation Stage of Change (*n = 12*; 16.7%), and those who were in the Action Stage of Change (*n = 7*; 9.7%). In the posttest I, most were in the Precontemplation Stage of Change (*n = 45*; 62.5%), followed by those who were in the Preparation Stage of Change (*n = 16*; 22.2%), those who were in the Contemplation Stage of Change (*n = 8*; 11.1%), and those who were in the Action Stage of Change (*n = 3*; 4.2%).

In the posttest II, more than a half were in the Precontemplation Stage of Change (*n = 40*; 55.6%), followed by those who were in the Action Stage of Change (*n = 16*; 22.2%), those who were in the Preparation Stage of Change (*n = 7*; 9.7%), those who were in the Contemplation Stage of Change (*n = 5*; 5.9%), and those who were in the Maintenance Stage of Change (*n = 4*; 5.6%).

**Table2.** Descriptive statistics of Processes of Change over time

| Processes of Change | Mean | Std. Deviation | N |
|---|---|---|---|
| Study Pretest | 190.72 | 34.77 | 72 |
| Study Posttest I | 222.91 | 20.81 | 72 |

| | | | |
|---|---|---|---|
| Study Posttest II | 238.90 | 7.09 | 72 |
| Control Pretest | 195.98 | 43.44 | 72 |
| Control Posttest I | 180.16 | 9.15 | 72 |
| Control Posttest II | 195.93 | 13.48 | 72 |

N: Number, Std. Deviation: Standard Deviation

The study results display that there is a remarkable, consistent increase in the values of the Processes of Change for participants in the study group (Pretest = 190.72, Posttest II = 222.91, Posttest II = 238.90) respectively. While for participants in the control group, there was a fluctuation in these values over time (Pretest = 195.98, Posttest II = 180.16, Posttest II = 195.93) respectively.

**Table3.** Multivariate Tests of the Within-subjects for the Processes of Change

| Effect | | Value | F | Hypothesis df | Error df | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| POC Study | Pillai's Trace | .716 | 88.316[b] | 2.000 | 70.000 | .000 | .716 |
| | Wilks' Lambda | .284 | 88.316[b] | 2.000 | 70.000 | .000 | .716 |
| | Hotelling's Trace | 2.523 | 88.316[b] | 2.000 | 70.000 | .000 | .716 |
| | Roy's Largest Root | 2.523 | 88.316[b] | 2.000 | 70.000 | .000 | .716 |
| Effect | | Value | F | Hypothesis df | Error df | Sig. | Partial Eta Squared |
| POC Control | Pillai's Trace | .472 | 31.309[b] | 2.000 | 70.000 | .000 | .472 |
| | Wilks' Lambda | .528 | 31.309[b] | 2.000 | 70.000 | .000 | .472 |
| | Hotelling's Trace | .895 | 31.309[b] | 2.000 | 70.000 | .000 | .472 |
| | Roy's Largest Root | .895 | 31.309[b] | 2.000 | 70.000 | .000 | .472 |

a. Design: Intercept
Within Subjects Design: Processes of Change
b. Exact statistic
c. Computed using alpha = .05

There are significant differences in the values of the Processes of Change over time for participants both in the study and control groups (F = 88.316, df = 2, p < .05 vs. F = 31.309, df = 2, p < .05).

**Table 4.** Tests of within-subjects effects for the Processes of Change

| Measure: MEASURE_1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Source | | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
| POC Study | Sphericity Assumed | 86721.694 | 2 | 43360.847 | 121.232 | .000 | .631 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Greenhouse-Geisser | 86721.694 | 1.270 | 68264.004 | 121.232 | .000 | .631 |
| | Huynh-Feldt | 86721.694 | 1.283 | 67589.306 | 121.232 | .000 | .631 |
| | Lower-bound | 86721.694 | 1.000 | 86721.694 | 121.232 | .000 | .631 |
| Error (POC Study) | Sphericity Assumed | 50788.972 | 142 | 357.669 | | | |
| | Greenhouse-Geisser | 50788.972 | 90.197 | 563.086 | | | |
| | Huynh-Feldt | 50788.972 | 91.098 | 557.521 | | | |
| | Lower-bound | 50788.972 | 71.000 | 715.338 | | | |
| Source | | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
| POC Control | Sphericity Assumed | 11970.194 | 2 | 5985.097 | 8.382 | .000 | .106 |
| | Greenhouse-Geisser | 11970.194 | 1.225 | 9767.999 | 8.382 | .003 | .106 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Huynh-Feldt | 11970.194 | 1.236 | 9685.628 | 8.382 | .003 | .106 |
| | Lower-bound | 11970.194 | 1.000 | 11970.194 | 8.382 | .005 | .106 |
| Error (POC Control) | Sphericity Assumed | 101389.139 | 142 | 714.008 | | | |
| | Greenhouse-Geisser | 101389.139 | 87.007 | 1165.299 | | | |
| | Huynh-Feldt | 101389.139 | 87.747 | 1155.473 | | | |
| | Lower-bound | 101389.139 | 71.000 | 1428.016 | | | |

a. Computed using alpha = .05

b.

There was a (a priori p = 0.01) significant difference (F (1.270, 90.197) = 121.232, p = 0.01) in the Processes of Change over time for participants in the study group. The omnibus effect (measure of association) for this analysis is .631, which indicates that approximately 63% of the total variance in the Processes of Change values is accounted for by the variance in the administered intervention.

For the control group, there was a (a priori p = 0.01) significant difference (F (1.225, 87.007) = 8.382, p = 0.01) in the Processes of Change over time. The omnibus effect (measure of association) for this analysis is .106, which indicates that approximately 10% of the total variance in the Processes of Change values is accounted for by the chance.

**Table5.** Pairwise comparison of the Processes of Change Values between Study and Control Groups

| **Pairwise Comparisons** | | | | | | |
|---|---|---|---|---|---|---|
| Measure: MEASURE_1 | | | | | | |
| (I) POC Study | (J) POC Study | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
| | | | | | Lower Bound | Upper Bound |
| 1 | 2 | -32.194* | 2.410 | .000 | -38.103 | -26.286 |
| | 3 | -48.181* | 4.178 | .000 | -58.424 | -37.937 |
| 2 | 1 | 32.194* | 2.410 | .000 | 26.286 | 38.103 |
| | 3 | -15.986* | 2.559 | .000 | -22.260 | -9.712 |
| 3 | 1 | 48.181* | 4.178 | .000 | 37.937 | 58.424 |
| | 2 | 15.986* | 2.559 | .000 | 9.712 | 22.260 |
| Measure: MEASURE_1 | | | | | | |

| (I) POC Control | (J) POC Control | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 1 | 2 | 15.819* | 5.264 | .011 | 2.913 | 28.726 |
| | 3 | .056 | 5.266 | 1.000 | -12.857 | 12.968 |
| 2 | 1 | -15.819* | 5.264 | .011 | -28.726 | -2.913 |
| | 3 | -15.764* | 2.016 | .000 | -20.708 | -10.820 |
| 3 | 1 | -.056 | 5.266 | 1.000 | -12.968 | 12.857 |
| | 2 | 15.764* | 2.016 | .000 | 10.820 | 20.708 |

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

Participants' Processes of Change in the study group in the pretest time statistically differ from such POC in the posttest I ($p$ = .001) and posttest II ($p$ = .000). Such POC in the posttest I statistically differ from these in the pretest time ($p$ = .001) and posttest II ($p$ = .000). Such POC in the posttest II statistically differ from these in the pretest time and these in the posttest I ($p$ = .000) and ($p$ = .000).
For the control group, the POC in the pretest time statistically differ from such POC in the posttest I ($p$ = .011), but they do not differ from these in the posttest II ($p$ = 1.000). Such POC in the posttest statistically differ from these in the pretest time ($p$ = .011) and posttest II ($p$ = .000). Ultimately, such POC in the posttest II do not statistically differ from these in the pretest time ($p$ = 1.000), but they differ from these in the posttest I ($p$ = .000).

**Table 6.** Descriptive statistics of Self-Efficacy over time

| **Decisional Balance** | Mean | Std. Deviation | N |
|---|---|---|---|
| Study Pretest | 63.66 | 15.36 | 72 |
| Study Posttest I | 96.09 | 20.92 | 72 |
| Study Posttest II | 122.97 | 12.11 | 72 |
| Control Pretest | 90.37 | 22.50 | 72 |
| Control Posttest I | 96.84 | 7.17 | 72 |
| Control Posttest II | 100.00 | 6.62 | 72 |

N: Number, Std. Deviation: Standard Deviation

The study results display that there is a noticeable, consistent increase in the values of the Self-Efficacy for participants in the study group (Pretest = 63.66, Posttest II = 96.06, Posttest II = 122.97) respectively. While for participants in the control group, there was a fluctuation in these values over time (Pretest = 90.37, Posttest II = 96.84, Posttest II = 100.00) respectively.

**Table 7.** Multivariate Tests of the Within-subjects for the Self-Efficacy

| Effect | | Value | F | Hypothesis df | Error df | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| | Pillai's Trace | .921 | 410.014[b] | 2.000 | 70.000 | .000 | .921 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SE Study | Wilks' Lambda | .079 | 410.014[b] | 2.000 | 70.000 | .000 | .921 |
| | Hotelling's Trace | 11.715 | 410.014[b] | 2.000 | 70.000 | .000 | .921 |
| | Roy's Largest Root | 11.715 | 410.014[b] | 2.000 | 70.000 | .000 | .921 |
| Effect | | Value | F | Hypothesis df | Error df | Sig. | Partial Eta Squared |
| SE Control | Pillai's Trace | .207 | 9.128[b] | 2.000 | 70.000 | .000 | .207 |
| | Wilks' Lambda | .793 | 9.128[b] | 2.000 | 70.000 | .000 | .207 |
| | Hotelling's Trace | .261 | 9.128[b] | 2.000 | 70.000 | .000 | .207 |
| | Roy's Largest Root | .261 | 9.128[b] | 2.000 | 70.000 | .000 | .207 |

a. Design: Intercept
Within Subjects Design: Decisional Balance
b. Exact statistic
c. Computed using alpha = .05
SE: Decisional Balance

There are significant differences in the values of the Self-Efficacy over time for participants both in the study and control groups ($F = 410.014$, $df = 2$, $p < .05$ vs. $F = 9.128$, $df = 2$, $p < .05$).

**Table 8.** Pairwise comparison of the Self-Efficacy values between study and control groups

| **Pairwise Comparisons** | | | | | | |
|---|---|---|---|---|---|---|
| Measure: MEASURE_1 | | | | | | |
| (I) SE Study | (J) SE Study | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
| | | | | | Lower Bound | Upper Bound |
| 1 | 2 | -32.431* | 3.200 | .000 | -40.277 | -24.584 |
| | 3 | -59.306* | 2.438 | .000 | -65.284 | -53.327 |
| 2 | 1 | 32.431* | 3.200 | .000 | 24.584 | 40.277 |
| | 3 | -26.875* | 1.926 | .000 | -31.598 | -22.152 |
| 3 | 1 | 59.306* | 2.438 | .000 | 53.327 | 65.284 |
| | 2 | 26.875* | 1.926 | .000 | 22.152 | 31.598 |
| Measure: MEASURE_1 | | | | | | |
| (I) SE Control | (J) SE Control | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
| | | | | | Lower Bound | Upper Bound |
| 1 | 2 | -6.472 | 2.697 | .057 | -13.085 | .140 |
| | 3 | -9.625* | 2.810 | .003 | -16.516 | -2.734 |
| 2 | 1 | 6.472 | 2.697 | .057 | -.140 | 13.085 |
| | 3 | -3.153* | .908 | .003 | -5.380 | -.926 |
| 3 | 1 | 9.625* | 2.810 | .003 | 2.734 | 16.516 |
| | 2 | 3.153* | .908 | .003 | .926 | 5.380 |

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

Participants' Self-Efficacy in the study group in the pretest time statistically differs from such a SE in the posttest I ($p$ = .000) and posttest II ($p$ = .000). Such a SE in the posttest I statistically differs from that in the pretest time ($p$ = .000) and posttest II ($p$ = .000). Such a SE in the posttest II statistically differs from that in the pretest time and that in the posttest I ($p$ = .000) and ($p$ = .000).

For the control group, the SE in the pretest time does not statistically differ from such a SE in the posttest I ($p$ = .057), but it differs from that in the posttest II ($p$ = 0.003). Such a SE in the posttest does not statistically differ from that in the pretest time ($p$ = .057), but it differs from that in posttest II ($p$ = .003). Ultimately, such a SE in the posttest II statistically differs from that in the pretest time ($p$ = 0.003) and that in the posttest I ($p$ = .003).

## 4. Discussion

This experimental, randomized controlled trial aims to examine the efficacy of the health belief model –based intervention of change in dietary fat reduction among female high school students.

The study results display that the control group in the pretest time, most of participants were in the Precontemplation Stage of Change , less than quarter of participants were in the Preparation Stage of Change, followed by those who were in the Contemplation Stage of Change, those who were in the Action Stage of Change and those who were in the Maintenance Stage of Change .

In the posttest I, more than half of participants were in the Precontemplation Stage of Change , less than quarter were in the Preparation Stage of Change, followed by those who were in the Contemplation Stage of Change, followed by those who were in the Contemplation Stage of Change ,and those who were in the Action Stage of Change, no one were in the Maintenance Stage of Change .

In the posttest II, more than a half were in the Precontemplation Stage of Change, less than quarter were in the Action Stage of Change, followed by those who were in the Preparation Stage of Change , those who were in the Contemplation Stage of Change, and those who were in the Maintenance Stage of Change

According to the study results for the study group, during the pretest and posttest I, over one-third of the participants were in the Action Stage of Change for consuming high-fat foods, followed by one person in the Precontemplation Stage of Change, one participant in the Maintenance Stage of Change, and a third participant in the Preparation Stage of Change.

Less than half of participants in the posttest II were in the preparation stage of change, third were in the action stage, then came those in the maintenance stage, and one participant was still in the contemplation stage.

The study results revealed that there was a (19.4%) decrease in the percentage of participants in the study group who were in the Precontemplation Stage for eating high-fat food over time. Also, there was a (16.6%) decrease in the percentage of participants in the study group who were in the Preparation Stage of Change for eating high-fat food over time. There was a (16.7%) increase in the percentage of participants in the study group who were in the Maintenance Stage for eating high-fat food over time. These findings reflect the efficacy of the administered Stage-matched intervention.

These findings are inconsistent with that obtained by Rossi (1994) who reported that more than a half of females were in the Maintenance Stage of Change for dietary fat reduction ($n$ = *74*; 57.8%), followed by those who were in the Precontemplation Stage of Change ($n$ = *27*; 21.1%), those who were in the Contemplation Stage of Change ($n$ = *24*; 18.8%), and those who were in the Action Stage of Change ($n$ = *3*; 2.3%).

The study group's participants' Processes of Change (Pretest = 190.72, Posttest II = 222.91, Posttest II = 238.90) show a notable and continuous growth over time, according to descriptive statistics of the Processes of Change. In contrast, there was a change in the control group participants' scores over time (Pretest = 195.98, Posttest II = 180.16, Posttest II = 195.93).

There are significant differences in the values of the Processes of Change over time for participants both in the study and control groups ($F = 88.316$, $df = 2$, $p < .05$ vs. $F = 31.309$, $df = 2$, $p < .05$).

There was a significant difference in the Processes of Change over time for participants in the study group. The omnibus effect (measure of association) for this analysis is .631, which indicates that approximately 63% of the total variance in the Processes of Change values is accounted for by the variance in the administered intervention.

For the control group, there was a significant difference in the Processes of Change over time. The omnibus effect (measure of association) for this analysis is .106, which indicates that approximately 10% of the total variance in the Processes of Change values is accounted for by the chance.

Comparing the Study and Control Groups' Processes of Change Values pairwise In the pretest period, the study group's Processes of Change showed a statistically significant difference from these POC in the posttest I ($p = .001$) and posttest II ($p = .000$). These POC in the pretest period ($p = .001$) and posttest II ($p = .000$) statistically differ from these in the posttest I. There is a statistically significant difference ($p = .000$) between the POC from the posttest II and the pretest period and the posttest I.

In the pretest period, the control group's POC differ from these POC statistically ($p = .011$) in the posttest I, but not in the posttest II ($p = 1.000$). There is a statistical difference between these POC in the posttest ($p = .011$) and in the pretest time ($p = .000$). In the end, these POC in the posttest II differ from these in the posttest I ($p = .000$), but they do not statistically differ from these in the pretest time ($p = 1.000$).

For those in the study group, there was a notable variation in the Processes of Change over Time. The omnibus effect for this study is.631, meaning that the variation in the administered intervention accounts for around 63% of the overall variance in the Processes of Change values. The study of pairwise comparisons revealed the presence of variations in their values over time. These results show that the TTM-based Stage-matched intervention's effects were constant and unchanging throughout time.

The processes of change over time differed significantly for the control group. The omnibus effect for this study is.106, meaning that the chance component accounts for around 10% of the overall variance in the Processes of Change values.

Descriptive self-efficacy statistics The study group's participants' Self-Efficacy values (Pretest = 63.66, Posttest II = 96.06, Posttest II = 122.97) show a discernible, steady improvement over time. However, these values fluctuated over time for participants in the control group (Pretest = 90.37, Posttest II = 96.84, Posttest II = 100.00), respectively.

Self-Efficacy levels in the study and control groups were compared pairwise. In both posttest I ($p = .000$) and posttest II ($p = .000$), participants' self-efficacy in the study group during the pretest period is statistically different from such a SE. A statistical difference is observed between the SE in the posttest I and that in the pretest time ($p = .000$ and posttest II, $p = .000$). A similar SE in the posttest II deviates statistically from those in the pretest period and the posttest I ($p = .000$ and $p = .000$),

In the case of the control group, the difference between the SE in the pretest period and that in the posttest I ($p = .057$) is not statistically significant, but it is in the posttest II ($p = 0.003$). A SE like this in the posttest is different from that in posttest II ($p = .003$) but not from that in the pretest time ($p = .057$). In the end, there is a statistical difference between the SE in the posttest II and the pretest period ($p = 0.003$) and the posttest I ($p = .003$).

There was a significant difference in the Self-Efficacy over time for participants in the study group with an omnibus effect for this analysis was .789, which indicates that approximately 78% of the total variance in the Self-Efficacy values is accounted for by the variance in the administered intervention.

For the control group, there was a significant difference in the Self-Efficacy over time with an omnibus effect for this analysis was .113, which indicates that approximately 11% of the total variance in the Self-Efficacy values is accounted for by the chance. These

findings reflect the value of the administered Stage-matched intervention in bettering students' confidence in dietary fat reduction.

The study implications for theory imply in that this is the first study worldwide that employs the TTM as a basis for delivering an intervention for dietary fat reduction among an aggregate "female adolescents". The implication for practice researchers believe in the feasibility of replicating the current study in many places worldwide.

## 5. Conclusion

This experimental, randomized controlled trial investigated the effectiveness of a health belief model-based intervention on dietary fat reduction among female high school students. The study revealed distinct stages of behavior change among participants over time, indicating shifts towards more active stages of change. Initially, the majority of participants were in the Precontemplation Stage, but by the final assessment, there was notable progress, particularly in advancing to the Action and Maintenance Stages of Change.

Specifically, significant decreases were observed in the Precontemplation and Preparation Stages, accompanied by an increase in the Maintenance Stage among intervention participants. These findings underscore the efficacy of the Stage-matched intervention in promoting healthier dietary behaviors.

Comparisons with previous research highlight both similarities and differences in stage distributions, emphasizing the unique contributions of the current study. Statistical analyses confirmed significant improvements in Processes of Change and Self-Efficacy over time within the study group, underscoring the impact of the intervention.

The implications of this study are twofold: it contributes to theoretical advancements by applying the Transtheoretical Model (TTM) to dietary behavior among female adolescents, and it offers practical insights for replicating similar interventions globally. These findings support the value of tailored interventions in enhancing dietary habits and fostering healthier lifestyles among young populations.

Overall, the study demonstrates the potential of targeted health interventions grounded in behavioral theory to induce meaningful changes in dietary habits, thereby promoting long-term health outcomes among adolescents.

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