

# Does Psychological Distress Interact With Patients' Illness and Treatment Perceptions to Predict Adherence to Dietary Recommendation Among Persons With T2DM in Ghana? A Facility Based Cross Sectional Survey

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## Research Article

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## Abstract

**Background:** Psychological distress is a pervasive condition that interacts with other factors to influence adherence to treatment regimens, yet information-gap exists on how psychological-distress interact with Type-2-Diabetes Mellitus (T2DM) patients' perceptions about their disease state and treatment benefits for adherence to dietary-recommendation. This study therefore investigates how T2DM patients' psychological-distress interacts with perception about disease state and treatment benefits for adherence to dietary-recommendation.

**Methods:** Facility-based cross-sectional-study was conducted among 530 T2DM patients at six health-facilities in Ghana. Structured-questionnaires were used to collect socio-demographics data, and Health Belief Model (HBM) questionnaires used to assess perceived-beliefs. Perceived-Dietary-Adherence-Questionnaire (PDAQ) for T2DM patients was used to assess adherence to dietary-recommendation. SPSS version-22 was used in data analysis.

**Results:** Weight, diabetes-duration, total-cholesterol, HbA1c and fasting-blood-sugar were statistically significant for adherence to dietary-recommendation ( $P$ -value  $<0.05$ ). Perceived-Susceptibility, Perceived-Benefit and Perceived-Cue to action were statistically significant for adherence to dietary-recommendations ( $P$ -value  $<0.05$ ). After adjusting for confounders, interaction between low-psychological-distress and moderately-perceive-susceptibility[Adjusted Odd ratio(Adj.OR: 0.21, 95% confidence interval CI:1.18, 9.83); interaction between high-psychological-distress and moderately-perceived-susceptibility (Adj.OR: 4.49, 95% CI: 1.41, 14.28); interaction between low-psychological distress and highly-perceived-benefit (Adj.OR: 3.20, 95% CI: 1.30, 6.62); interaction between low-psychological-distress and moderately-perceived-barriers (Adj. OR: 4.79, 95% CI: 1.82, 12.60) and interaction between moderate-psychological-distress and highly-perceived-cue to action (Adj. OR 1.93, 95% CI: 1.36, 4.50) were statistically significant for adherence to dietary-recommendations.

**Conclusion:** Psychological-distress can interact with patients' perceptions for adherence to dietary recommendation. Therefore, health care workers globally should be mindful of this and offer professional care.

### 1.1.0. Introduction

Dietary recommendations are tailor made eating pattern design to help persons with chronic non-communicable diseases control their conditions and prevent risk of complications [1]. These feeding recommendations are the best and healthiest eating pattern for almost all healthy persons, but are often recommended to persons living with diabetes for glycemic control purposes [2]. Adherence to dietary recommendations support healthy weight gains and reduce metabolic indices that are known to be associated with increased risk of complications among persons with T2DM[3]. Persons put on dietary recommendation are often counseled to intake nutrient-dense foods from fruits and vegetables, whole grains, legumes and nuts, fish, lean meat, and low fat dairy foods[5]. When these dietary recommendations are adequately follow, individuals nutrients requirement are met for healthy living [4]. However, when conditions such as depression, anxiety, psychological distress and some perception about their disease states and treatment benefits exist, they can independently act or act in tandem with one another to influence adherence to dietary recommendation[6]. Persons with Diabetes Mellitus (DM) need to have sound mind in order to adequately adhere to dietary-recommendation for glycemic control purposes. However, most patients with DM also have varying degree of psychological distress and some perceived beliefs about their disease state and treatment benefits that can act independently or in tandem with each another to influence attitude and behavior for adherence to dietary recommendation[7]. Research shows that before patients can be ready to take action for behavior change toward adherence to therapy recommendations, they must first perceive that they are susceptibility to the health problem they are exposed to; they must also perceive that the health problem they are exposed to can be severe if they do not take action to resolve it; furthermore they must perceived that taking action to resolve the health problem is feasible and efficacious enough of which they weighed cost and barriers before considering to take the action; finally they must perceived that environmental trigger(s) (cues to action) are present to prompt them take action for the behavior change[8]. When these perceived beliefs are well conceived without the inference of psychological distress, individuals will be able to take evidence based action for adherence to treatment regimens including dietary recommendation. However, when psychological distress exists, it may independently or act in tandem with these perceived beliefs, to influence patients' adherence to dietary recommendations. In Ghana, due to socio economic differences, cultural diversity and differences in educational achieve, many poor and low class aged tent to live in isolation with different degrees of psychological distresses and diseases and

treatment benefits perception. To investigate this phenomenon in the Ghanaian setting, our study aims to evaluate the extent to which patients' psychological distress interacts with their perceived beliefs for adherence to dietary recommendation among persons' with T2DM in Ghana.

## **2.1.0. Methods**

### **2.1.1. Study design and Method**

Facility-based cross-sectional study was conducted among 530 persons living with T2DM in Brong Ahafo Region (BAR), Ghana. Individuals 18 years and above who were diagnosed with T2DM by physicians, using the American Diabetes Association (ADA) Diagnostic and Classification Guideline[9], and counseled to follow dietary recommendations for at least three months and over, were recruited into the study. Persons aged 70 years and above who could not answer interview questions; mentally incapacitated; severely ill; and pregnant and lactating women were excluded. Simple random sampling was used to select 6 hospitals in BAR, and the eligible participants consecutively recruited from patients' registers.

### **2.1.2. Patients Demographic Characteristics, Clinical and Anthropometry Measurements**

Age, diabetes-duration, medications intake and other demographic characteristics were collected using questionnaires. Weight (kg) and height (m) were measured and recorded to the nearest 0.5kg and 0.5m using adult weighing scale and stadiometer respectively. Weight and height measurements were done when participants were asked to wear light clothes without shoes, and were in standing position. Body mass index (BMI, kg/m<sup>2</sup>) was calculated by dividing weight in kilograms with height in square meters. Systolic and diastolic blood pressures were measured using manual sphygmomanometer and stethoscope, and the reading recorded to the nearest 0.5mmHg, after participants were asked to relax for 5 or more minutes.

### **2.1.3. Assessing T2DM Persons' Perception about their disease state and treatment benefits**

Health Belief Model (HBM) construct was used to assess T2DM persons' perceptions about their disease state and treatment benefits in this study. This model is used in our study because it has been previously validated in other studies describing preventive health and sick role in behaviors among patients[10, 11]. The HBM construct has five domains with 24 items. The responses to the items in the domains are in liker's scale. Before using this model in our study we contacted experts in behavior sciences to examine the face and content validity of the questionnaires during the pre-test phase. The responses of the items in the HBM construct in our study were summed up to form a global score, and this represented patients' total perception about their illness and treatment benefit.

### **2.1.4. Assessing Patients Psychological Distress**

Patients psychological distress was assessed using Kessler 10-items (K-10) psychological distress scale [12]. This scale is also a 10 independent items with five likert's scale response ranging from none of the time to all of the time. Patients', who responded 'none of the time' to all the items in the questionnaire, were said to have no psychological distress, and those who responded 'all of the time' to all 10 items in the questionnaire, were said to have very high psychological distress. The items under the Kessler psychological distress scale were also summed up to form global score which represented patients' total psychological distress.

### **2.1.5. Assessing Patients Adherence to Dietary Recommendation**

Perceived Dietary Adherence Questionnaire (PDAQ) for Persons living with T2DM was used to assess adherence to dietary recommendation[13]. This questionnaire is also a 9 items and 7 point likert's scale questionnaire designed to elicit information about adherence to dietary recommendation among persons with DM. This likert's scale questionnaire has points ranging from 0 to 7. Zero point on the scale mean non-adherence to any item in the scale, and 7 point means highest adherence to items on the scale. The 9 items in the questionnaire were also summed up to form global score which represented patients' total adherence to dietary recommendations. Patients' total adherence on the global score was 63. This score was categorized into low, moderate and high adherence. Based on the patients' scores on the scale, those who scored 0 points were considered to have non-adherence to dietary recommendation. Those who scored between 1-21 points were considered to have low adherence, those who scored in

the range of 22-42 were said to have moderate adherence and those who score 43-63 points were said to have high adherence to dietary recommendation. This questionnaire was pretested among 20 participants (chronbach alpha of 0.95).

#### 2.1.6. Statistical analysis

IBM SPSS version 22.0 (SPSS, Chicago, IL, USA) was used to ran all statistical analysis in this study. Data normal distributions were checked using Kolmogorov-Smirnov test. Descriptive statistics were used to describe all demographic characteristics, while One-way ANOVA with Post Hoc multiple comparison tests used to demonstrate statistically significant mean differences between the groups of adherence to dietary recommendation (low, moderate and high). Multinomial logistic regression models were used to assess the statistical significant results in the interaction between patients' psychological distress and their perception about their disease state and treatment benefits for adherence to dietary recommendations. All variables significant were set at 0.05 alpha level.

### 3.1.0. Results

General characteristics of participants are shown in Table 1. Mean (SD) for: Total Adherence to dietary recommendation was 32.56(9.61); Perceived Susceptibility was 13.49 (1.71); Perceived Severity was 11.44(2.25); Perceived Benefit was 12.92(1.97); Perceived Barriers was 8.58(3.85) and Perceived Cue to Action was 10.19(1.55). Mean (SD) for: Psychological distress was 5.33(5.21), age; weight and BMI were 58.10(9.70); 61.70(9.30) and 23.14(2.92) respectively. Majority of participants (70.9%) were females; married (64.2%); and live in small towns (76.2%). More than 38% of participants have no formal education; about 13% has senior high education; and 8.4% have tertiary level education.

Participants' general characteristics, anthropometry, clinical and HBM associations across the levels of adherence to dietary recommendation are shown in Table 2. Weight, diabetes duration, total cholesterol, HbA1c and fasting blood glucose were statistically significant for adherence to dietary recommendation ( $P$ -value <0.05). Perceived Susceptibility, Perceived Benefit and Perceived Cue to action were statistically significant for adherence to dietary recommendations ( $P$ -value <0.05).

The interaction between patients' psychological distress and perception about their state and treatment benefits for adherence to dietary recommendation are shown in table 3. After adjusting for potential confounders (age, education level, and diabetes duration), interaction between low psychological distress and moderately perceived susceptibility [Adjusted Odd ratio; 95% confidence interval (Adj.OR 0.21 95%CI: 1.18, 9.83) was statistically significant for low adherence to dietary recommendation. Interaction between low psychological distress and moderately perceived susceptibility (Adj.OR 2.44, 95%CI: 1.88, 6.74) was statistically significant for moderate adherence to dietary recommendations, while interaction between high psychological distress and moderately perceived susceptibility (Adj.OR 4.49, 95%CI: 1.41, 14.28) was statistically significant for low adherence to dietary recommendation. Furthermore interaction between high psychological distress and moderately perceived susceptibility (Adj.OR 0.15, 95%CI: 1.35, 12.20) was statistically significant for moderate adherence to dietary recommendation while, interaction between low psychological distress and highly perceived susceptibility (Adj.OR: 1.39, 95%CI: 1.51, 3.83) was statistically significant for moderate adherence to dietary recommendation. Again interaction between low psychological distress and moderately perceived severity (Adj.OR 1.50, 95%CI: 2.94, 6.65) was statistically significant for moderate adherence to dietary recommendation whereas interaction between low psychological distress and highly perceived benefit (Adj.OR 3.20, 95%CI: 1.30, 6.62) was statistically significant for moderate adherence to dietary recommendation. Also interaction between moderate psychological distress and lowly perceived barriers (Adj.OR 5.29, 95%CI: 2.18, 12.79) was statistically significant for moderate adherence to dietary recommendation, whereas, interaction between low psychological distress and moderately perceived barriers (Adj.OR 4.79, 95%CI: 1.82, 12.60) was statistically significant for moderate adherence to dietary recommendations. On the other hand, interaction between moderate psychological distress and moderately perceive barriers (Adj.OR 0.80, 95%CI: 2.26, 14.90) was statistically significant for moderate adherence to dietary recommendation, while interaction between moderate psychological distress and low perceived cue to action (Adj.OR 0.95, 95%CI: 1.36, 2.48) was statistically significant for moderate adherence to dietary recommendation. Finally interaction between moderate psychological distress and highly perceived cue to action (Adj.OR 1.93, 95%CI: 1.35, 4.50) was statistically significant for moderate adherence to dietary recommendation.

### 4.1.0. Discussion

In this study we evaluated the extent to which Psychological distress can interacts with patients' perception about their diseases state and treatment benefits for adherence to dietary recommendation among persons with T2DM in Ghana. Many studies conducted concerning psychological distress and adherence to dietary recommendations always focus on the direct associations between these variables. However, since psychological distress can exist in tandem with other factors such as patients' illness and treatment benefits perceptions to affect adherence to therapy regiments, it is important that we look at how these factors can act interact with each another influence adherence to dietary recommendation. Generally speaking, we found that participants in our study reported low means psychological distress, moderate means adherence to dietary recommendation and a relatively higher means illness and treatment benefits perceptions. We also found that interaction between low psychological distress and moderately perceived susceptibility was statistically significant for moderate adherence to dietary recommendation, while interaction between high psychological distress and moderately perceived susceptibility was statistically significant for moderate adherence to dietary recommendations. These findings could possibly be true because when individuals perceived that they are susceptible or vulnerable to disease consequences, and have low psychological distress, they may be able to take action toward adherence to therapy recommendation given to them[14, 15]. However, when they have high psychological distress, it may mask their perceived vulnerability and put patients at increased risk of non-adherence to therapy regimens. We also found that interaction between low psychological distress and highly perceived susceptibility was statistically significant for adherence to dietary recommendation. These findings too could also be true because when patients perceived that they are at increased risk of disease consequences, and have little or no psychological distress they may adhere to dietary recommendation given them. However, if they perceived that they are susceptible to the disease consequences but have higher psychological distress; this too could also compromise their adherence to dietary recommendation. Although our study evaluated how psychological distress interacts with patients illness and treatment benefit perception for adherence to dietary recommendation, study from Ethiopia partly supported our finding by showing that psychological distress could independently predicted treatment non-adherence among TB patients[16]. Although this study in Ethiopian did not investigate how psychological distress interaction with other variables for adherence to treatment regimens, its findings supported our results by concluding that psychological distress are strong determinants for therapy non-adherence among patients.

We also found that interaction between low psychological distress and moderately perceived disease severity was statistically significant for moderate adherence to dietary recommendations while interaction between moderate psychological distress and highly perceived disease severity was statistically significant for low adherence to dietary recommendation. This finding again could also be true, because as individuals have low psychological distress and perceived that diabetes and its complication can be severe, they would take appropriate steps to adherence to dietary recommendation given to them. Perceived severity could be a strong motivator to therapy adherence and psychological distress could be a strong antagonist, thus compromising, optimum adherence to therapy regimens. In our study, we looked at the complex ways through which individuals' psychological distress can interact with patients' disease and treatment benefits perceptions for adherence to dietary recommendation. Although other studies did not investigate these interactions, however, their results still pointed to the fact that perceived disease severity and psychological distress among patients could independently affect adherence dietary recommendation [17-19] which are consistent with our findings. Furthermore we found that interaction between low psychological distress and highly perceived treatment benefit was statistically significant for moderate adherence to dietary recommendation while interaction between moderate psychological distress and moderately perceived barriers to treatment was statistically significant for moderate adherence to dietary recommendations. These findings are interesting because perceived treatment benefits are strong motivators for therapy adherence while psychological distress is a major predictor for therapy non-adherence. In this regard if patients have psychological distress and also perceived that some physical barriers exist on their ways to achieving adherence to dietary recommendation, they will certainly unable to adhere to the treatment recommendation given to them. In line with this Lee S et al., noted that DM patients aged 65 years and above who have psychological distress and also reported that they faced physical barriers such as luck of financial resource were found to have higher non-adherence to medication regimens [20]. Although Lee S et al., did not investigate how psychological distress interacts with patients' perceived treatment barriers for adherence to dietary recommendation, their study however pointed to the fact that physical barriers are strong predictors for therapy non-adherence in DM management. Non-adherence to medication intake and dietary recommendation could adversely affect DM management, and this could be as a result of many factors interrelating with one another.

In our study we further found that interaction between moderate psychological distress and lowly perceived cue to action was statistically significant for moderate adherence to dietary recommendation, while interaction between moderate psychological distress and highly perceived cue to action was statistically significant for moderate adherence to dietary recommendation. Cue to actions are intrinsic and extrinsic factors that serves as reminders to prompt individuals' take action for behavior change. Person's desire to take action for behavior change depends on these intrinsic and extrinsic factors. If these factors are lacking, the individuals' motivation to take action for behavior change could be altered. Venkatachalam J.et al noted that perceived cue to action was significantly associated with adherence to therapy recommendation [21] which is consistent with our finding. Despite the fact that Venkatachalam J.et al did not investigate interaction between psychological distress and cue to action for adherence to dietary recommendation, their findings also supported our results by concluding that psychological disturbances are strong variables that can act independently or in complex with other variables to affect treatment outcomes. Most persons with DM also have some form of psychological distress. Therefore, health care workers should be mindful of how psychological distress could acts in complex with other variables in patients' lives to influence adherence to treatment protocols.

Although our study have found significant interactions between patients psychological distress and their illness and treatment benefits perception for adherence to dietary recommendation, we cannot conclude based on our finding by saying that causal association exist for the interaction between psychological distress and patients illness and treatment benefit perception for adherence to dietary recommendation. This is because of some methodological weakness in this study. We used facility based cross sectional study to arrive at our result, and since cross sectional study cannot detect causal association between variables, we cannot conclude on causality. We recommend that subsequent study should consider adopting more powerful study designs such as prospective cohort study or randomize clinical trial to evaluate this problem. Despite the methodological weakness in our study, we strongly recommend that based on our findings, patients with chronic non-communicable disease most particularly aged persons with DM reporting to health facilities in Ghana and elsewhere in the world, should be periodically screened to identify and correct the many factors that can precipitate psychosocial distress.

## 5.1.0. Conclusion

Our study found that significant interactions exist between low-psychological distress and moderately-perceive-susceptibility, high-psychological distress and moderately-perceived-susceptibility, low-psychological distress and highly-perceived-benefit, low-psychological distress and moderately-perceived-barriers and moderate-psychological distress and highly-perceived-cue to action for adherence to dietary-recommendations. In this regard we noticed that although adherence to dietary recommendation is important in of chronic diseases management, when psychosocial distress exist it could act independently or in tandem with other factor to affect adherence. Therefore, patients and health care workers in the world should be mindful of this and seek professional care.

## Declarations

### Ethics approval and consent to participate

Ethical approval was obtained from Ghana Health Service Ethics Review Committee (GHS-ERC008/08/18) and Tehran University of Medical Sciences Ethics Review board (IR.TUMS.VCR.REC.1397.409). All participants were also asked to sign a written informed consent form before participating.

### Consent for publication

Not Applicable

### Availability of data and material

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

### Competing interests

All authors have read and approved the manuscript, and declared no conflict of interest.

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This study was funded by Tehran University of Medical Sciences.

### Authors' contribution

BDD collected and analyzed the data and wrote the manuscript.

AA obtained ethical clearance in Ghana for this study, supervised the data collection, and proofread the final version of the manuscript before submission.

YM supervised the data analysis and proofread the final version before submission.

SE proofread the final version of the manuscript before submission.

AD acquired funding for the study, supervised the data collection process, and proofread the final version of the manuscript before submission.

MK supervised, coordinated the study, took part in the data collection took part in the data analysis and wrote the manuscript.

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## Tables

**Table 1: Participants General Characteristics, Anthropometrics, Clinical and Illness and Treatment Benefits Perception**

<b>Variable</b>	<b>Means(SD)</b>	<b>Number (%)</b>
Age(years)	58.10(9.70)	
Wight(Kg)	61.70(9.30)	
Height(m)	1.63(0.09)	
BMI(Kg/m <sup>2</sup> )	23.14(2.92)	
HbA1c	8.13(3.2)	
FBS	10.05(4.55)	
Total Cholesterol(mg/dL)	7.19(3.49)	
HDL-cholesterol(mg/dL)	1.74(0.90)	
LDL-cholesterol(mg/dL)	5.15(3.42)	
Triglycerides(mg/dL)	4.64(14.14)	
Systolic (BP)mmHg	135.67(7.79)	
Diastolic (BP)mmHg	77.79(12.79)	
Diabetes duration (years)	4.90(5.40)	
Duration lived with diabetes(years)	4.90(5.40)	
Total Compliance to Feeding Recomd.	52.82(0.57)	
Psychological distress	5.33(5.21)	
<b>Participants' Illness and Treatment Perceptions</b>		
Perceived Susceptibility	13.49(1.71)	
Perceived Severity	11.44(2.25)	
Perceived Benefit	12.92(1.97)	
Perceived Barriers	8.58(3.85)	
Perceived Cue to Action	10.19(1.55)	
<b>Sex</b>		
Male	154(29.1)	
Female	376(70.9)	
<b>Marital Status</b>		
Married	340(64.2)	
Single	20(3.8)	
Widow	107(20.2)	
Divorce	63(11.9)	
<b>Place of Residence</b>		
Village	39(7.4)	
Town	404(76.2)	
City	87(16.4)	
<b>Educational Level</b>		

No education	202(38.1)
Primary	85(16.0)
Junior High	132(24.9)
Senior High	67(12.6)
Tertiary	44(8.4)

*HbA1c- Glycosylated hemoglobin; FBS- Fasting Blood Sugar; HDL-cholesterol- High density lipoprotein cholesterol; LDL-cholesterol- Low density lipoprotein cholesterol*

**Table 2: Participants General Characteristics, Clinical measures and Illness, treatment benefits Perceptions on Adherence to Diabetics Feeding Recommendation**

Variables	Adherence to Diabetic Feeding Recommendation			*P-value
	Low	Moderate	High	
Height(m)	1.63(.082) <sup>1</sup>	1.634(.079)	1.63(0.09) <sup>1</sup>	0.636
Weight(Kg)	<b>60.01(9.467)<sup>ab</sup></b>	<b>62.52(9.299)<sup>b</sup></b>	<b>62.59(8.805)<sup>a</sup></b>	<b>0.011</b>
BMI (Kg/m <sup>2</sup> )	22.58(2.811)	23.47(2.959)	23.39(2.921)	<b>0.006</b>
Systolic blood pressure (mmHg)	134.31(21.681)	137.41(19.587)	135.33(19.960)	0.348
Diastolic blood pressure(mmHg)	77.32(12.360)	78.87(12.441)	77.20(13.570)	0.393
<b>Diabetes duration(yeas)</b>	<b>3.40(3.010)<sup>ab</sup></b>	<b>4.99(6.187)<sup>b</sup></b>	<b>5.34(6.370)<sup>a</sup></b>	<b>0.005</b>
Age (years)	58.63(10.06)	57.11(10.009)	58.40(8.777)	0.282
<b>Total cholesterol (mg/dL)</b>	<b>5.56(3.792)<sup>ab</sup></b>	<b>7.04(3.450)<sup>b</sup></b>	<b>6.96(3.171)<sup>a</sup></b>	<b>0.001</b>
HDL cholesterol (mg/dL)	1.81(0.980)	1.71(0.898)	1.69(0.823)	0.374
LDL cholesterol (mg/dL)	5.43(3.451)	5.08(3.838)	4.94(2.856)	0.371
Triglyceride(mg/dL)	4.11(11.706)	5.42(16.750)	4.40(13.632)	0.659
<b>HbA1c (%)</b>	<b>9.58(3.798)<sup>ab</sup></b>	<b>7.69(2.508)<sup>b</sup></b>	<b>7.07(2.611)<sup>a</sup></b>	<b>0.001</b>
<b>Fasting Blood Sugar (mmol/L)</b>	<b>11.59(5.277)<sup>ab</sup></b>	<b>9.69(4.136)<sup>b</sup></b>	<b>8.81(3.603)<sup>a</sup></b>	<b>0.001</b>
<b>Perceived Susceptibility</b>	<b>1.88(0.760)<sup>a</sup></b>	1.97(0.745)	<b>2.09(0.733)<sup>a</sup></b>	<b>0.025</b>
Perceived Severity	1.89(0.780)	2.08(0.760)	2.03(0.770)	<b>0.063</b>
<b>Perceived Benefit</b>	<b>1.82(0.900)<sup>a</sup></b>	1.91(0.880)	<b>2.12(0.910)<sup>a</sup></b>	<b>0.006</b>
Perceived Barriers	2.08(0.800)	1.98(0.840)	1.96(0.860)	<b>0.363</b>
<b>Perceived Cue to action</b>	<b>2.01(0.830)<sup>a</sup></b>	1.74(0.790)	<b>1.90(0.770)<sup>a</sup></b>	<b>0.008</b>

<sup>1</sup>Results presented in Mean±standard deviation; \*P-value results from ANOVA (Analysis of variance)<sup>a</sup> significant mean difference between low and high compliance in post hoc analysis <sup>b</sup>significant mean difference between low and moderate compliance in

*post hoc analysis; BMI: - Body Mass Index; HDL: - High density lipoprotein cholesterol; LDL:- Low density lipoprotein cholesterol; HbA1c:-Glycosylated hemoglobin N=530*

**Table 3:** Interaction between Psychological Distress and Perceived beliefs for Adherence to Feeding Recommendation

Variable	Ref	1	1	1	1	1	1	1
High Psych*High Perc. Suscept.								
Low Psych *Low Perc. Suscept.		3.00(1.05, 8.62)	.0040	2.19(0.79, 6.05)	0.130	3.31(1.12, 9.77)	<b>0.030</b>	2.27(0.80, 6.42)
Mod Psych*Low Perc. Suscept		3.07(1.09, 8.61)	0.033	2.25(0.83, 6.07)	0.110	1.78(0.69, 4.59)	0.232	.96(0.38, 2.42)
High Psych*Low Perc. Suscept		2.38(0.87, 6.52)	0.093	1.37(0.51, 3.71)	0.536	1.75(0.61, 5.06)	0.299	1.99(0.76, 5.25)
Low Psych*Mod Perc. Suscept		1.78(0.71, 4.45)	0.220	0.99(0.40, 2.43)	0.983	0.21(1.18, 9.83)	<b>0.023</b>	<b>2.44(1.88, 6.74)</b>
Mod Psych*Mod Perc. Suscept		2.03(0.81, 5.05)	0.130	1.27(0.53, 3.05)	0.598	2.08(0.81, 5.32)	0.129	1.30(0.53, 3.23)
High Psych*Mod Perc. Suscept		1.20(0.45, 3.18)	0.719	1.03(0.41, 2.58)	0.952	4.49(1.41, 14.28)	<b>0.011</b>	<b>0.15(1.35, 12.20)</b>
Low Psych*High Perc.Suscept		1.58(0.57, 4.42)	0.381	1.87(0.73, 4.77)	0.191	2.51(0.89, 7.04)	0.080	<b>1.39(1.51, 3.83)</b>
Mod Psych*High Perc.Suscept		4.03(1.29, 12.59)	0.016	3.65(1.24,10.78)	0.019	1.13(0.42, 3.07)	0.809	0.94(0.37, 2.40)
High Psych*High Perc. Severity	Ref	1	1	1	1	1	1	1
Low Psych.*Low Perc. Severity		.602(0.24, 1.50)	0.274	1.50(0.61, 3.70)	0.382	0.66(0.26, 1.67)	0.380	1.62(0.64, 4.08)
Mod Psych*Low Perc. Severity		1.53(0.60, 3.91)	0.370	1.73(0.63, 4.70)	0.285	1.59(0.61, 4.13)	0.344	1.69(0.61, 4.68)
High Psych*Low Perc. Severity		2.17(0.81, 5.81)	0.122	1.55(0.51, 4.65)	0.439	2.29(0.84, 6.29)	0.107	1.58(0.52, 4.85)
Low Psych*Mod Perc. Severity		1.23(0.43, 3.50)	0.701	1.93(0.66, 5.65)	0.229	1.27(0.44, 3.69)	0.060	<b>1.50(2.94, 6.65)</b>
Mod Psych*ModPerc. Severity		1.91(0.78, 4.68)	0.158	2.28(0.88, 5.93)	0.092	2.10(0.84, 5.29)	0.115	1.00(0.67, 5.93)
High Psych*Mod Perc. Severity		1.42(0.57, 3.52)	0.453	1.78(0.68, 4.67)	0.244	1.49(0.59, 3.78)	0.397	1.91(0.72, 5.10)
Low Psych*High Perc. Severity		1.04(0.36, 3.04)	0.944	1.80(0.61, 5.32)	0.285	1.21(0.40, 3.62)	0.738	1.91(0.63, 5.76)
Mod Psych*High Perc. Severity		0.72(0.30, 1.75)	0.469	1.03(0.41, 2.61)	0.950	2.66 (1.27, 6.63)	<b>0.002</b>	0.95(0.37, 2.45)
High Psych High*Perc. Benefit	Ref	1	1	1	1	1	1	1

Low Psych.*Low Perc. Benefit	2.26(0.99, 5.16)	0.054	1.54(0.71, 3.35)	0.278	<b>2.24(1.96, 5.24)</b>	<b>0.04</b>	1.48(0.67, 3.29)	0.337
Mod Psych*Low Perc. Benefit	1.71(0.67, 4.34)	0.262	0.85(0.33, 2.18)	0.740	1.58(0.61, 4.11)	0.344	.80(0.31, 2.10)	0.654
High Psych*Low Perc. Benefit	1.93(0.80, 4.66)	0.142	1.52(0.67, 3.43)	0.318	1.93(0.78, 4.76)	0.153	1.60(0.69, 3.70)	0.274
Low Psych*Mod Perc. Benefit	3.16(1.40, 7.17)	0.006	1.62(0.73, 3.56)	0.233	<b>3.16(1.37, 7.27)</b>	<b>0.007</b>	1.65(0.74, 3.70)	0.221
Mod Psych*Mod Perc. Benefit	1.93(0.63, 5.89)	0.246	1.32(0.45, 3.87)	0.615	1.94(0.63, 6.01)	0.251	1.37(0.46, 4.10)	0.571
High Psych*Mod Perc. Benefit	2.42(1.03, 5.69)	0.044	1.98(0.89, 4.37)	0.092	2.32(0.97, 5.55)	0.059	2.04(0.91, 4.58)	0.083
Low Psych*High Perc.Benefit	1.58(0.68, 3.65)	0.289	0.78(0.34, 1.79)	0.560	1.35(0.57, 3.18)	0.491	<b>3.20(1.30, 6.62)</b>	<b>0.001</b>
Mod Psych*High Perc.Benefit	3.22(0.98, 10.58)	0.054	1.98(0.61, 6.39)	0.254	2.82(0.84, 9.52)	0.094	1.73(0.53, 5.71)	0.367
<b>High Psych *High Perc.Barriers</b>	<b>Ref 1</b>		<b>1</b>		<b>1</b>		<b>1</b>	
Low Psych.*Low Perc. Barriers	2.92(1.33, 6.43)	0.008	1.83(0.83, 4.01)	0.133	<b>3.22(1.43, 7.25)</b>	<b>0.005</b>	2.01(0.90, 4.48)	0.090
Mod Psych*Low Perc. Barriers	3.04(1.18, 7.82)	0.021	4.90(2.08,11.56)	0.000	<b>3.42(1.30, 9.04)</b>	<b>0.013</b>	<b>5.29(2.18, 12.79)</b>	<b>0.000</b>
High Psych*Low Perc. Barriers	1.76(0.721, 4.31)	0.214	0.69(0.25, 1.91)	0.469	1.82(0.73, 4.55)	0.198	.66(0.23, 1.88)	0.437
Low Psych*Mod Perc. Barriers	6.41(2.49, 16.49)	0.000	4.11(1.59,10.58)	0.003	<b>7.28(2.76, 19.22)</b>	<b>0.000</b>	<b>4.79(1.82, 12.60)</b>	<b>0.001</b>
Mod Psych*Mod Perc. Barriers	5.67(2.18, 14.73)	0.000	5.34(2.13,13.43)	0.000	<b>6.28(2.36, 16.73)</b>	<b>0.000</b>	<b>0.80(2.26, 14.90)</b>	<b>0.001</b>
High Psych*Mod Perc. Barriers	1.67(0.74, 3.78)	0.218	1.33(0.60, 2.94)	0.487	1.79(0.78, 4.12)	0.171	1.45(0.64, 3.26)	0.370
Low Psych*High Perc. Barriers	2.47(0.91, 6.71)	0.077	3.26(1.30, 8.14)	0.012	2.62(0.94, 7.27)	0.065	3.44(1.35, 8.74)	0.010
ModPsych*High Perc. Barriers	3.80(1.51, 9.53)	0.005	1.58(0.58, 4.29)	0.368	3.77(1.46, 9.76)	0.006	1.45(0.52, 4.04)	0.475
<b>High Psych*High Perc. Cue</b>	<b>Ref 1</b>		<b>1</b>		<b>1</b>		<b>1</b>	
Low Psych.*Low Perc. Cue	2.93(1.08, 7.89)	0.034	2.34(0.91, 6.01)	0.078	<b>2.87(1.04, 7.89)</b>	<b>0.041</b>	2.29(0.88, 5.99)	0.090
Mod Psych*Low Perc. Cue	1.43(0.54, 3.80)	0.479	0.98(0.38, 2.53)	0.968	1.34(0.49, 3.65)	0.565	<b>0.95(1.36, 2.48)</b>	<b>0.008</b>
High Psych *Low Perc. Cue	1.54(0.57, 4.18)	0.394	1.19(0.46, 3.07)	0.724	<b>3.00(1.01, 8.94)</b>	<b>0.048</b>	1.32(0.50, 3.51)	0.578

Low Psych*Mod Perc. Cue	2.66(1.03, 6.88)	0.044	1.58(0.63, 3.98)	0.330	2.57(1.98, 6.77)	0.006	1.62(0.63, 4.13)	0.317
Mod Psych*Mod Perc. Cue	1.90(0.70, 5.13)	0.208	1.53(0.51, 3.93)	0.378	2.08(0.75, 5.74)	0.159	1.73(0.66, 4.54)	0.265
High Psych*Mod Perc. Cue	3.11(1.06, 9.08)	0.038	2.64(0.95, 7.33)	0.062	1.70(0.61, 4.75)	0.312	0.70(0.96, 7.64)	0.061
Low Psych*High Perc. Cue	1.80(0.68, 4.76)	0.236	1.20(0.47, 3.07)	0.710	1.60(0.59, 4.30)	0.353	1.11(0.43, 2.87)	0.836
Mod Psych*High Perc. Cue	1.23(0.45, 3.38)	0.692	0.94(0.36, 2.49)	0.738	1.19(0.43, 3.34)	0.070	1.93(1.35, 4.50)	0.020

*COR (95%CI)-Crude Odd ratio and 95% confident interval; AOR (95%CI)-Adjusted Odd ratio and 95% confidence interval;  
 Psych\*Perc. Suscept - interaction between Psychological distress and perceived susceptibility; Ref-reference; Mod Perc.Suscept-moderate perceived susceptibility; Psych\*Perc.Severity -interaction between psychological distress and perceived severity; Mod Perc. Severity-moderate perceived severity; Psych\*Perc. Benefit -interaction between psychological distress and perceived benefit; Mod Perc. Benefit-moderate perceived benefit; Psych\*Perc.Barriers -interaction between perceived barriers and psychological distress;Mod Perc. Barriers-moderate perceived barriers; Psych\*Cue -interaction between psychological distress and cue to action -Mod Perc. Cue-moderate perceived cue to action.*