Short Term Outcomes of Low Dose Liraglutide in Obese Non Diabetic Indian Subjects-A Real World Experience

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Abstract

Aims: The objective of this study was to investigate whether frequency of not-home prepared (NHP) meals and self-reported diet are associated with depression and metabolic syndrome among U.S. adults.

Methods: Participants (≥20 years) answered depression screening questions (PHQ-9) and completed examination and laboratory test for MetS in National Health and Nutrition Examination Survey (NHANES) 2011-2014. A set of series of weighted logistic regression model was used to investigate the aforementioned relationship. The differentiation among categories of diet and frequency of NHP meals for depression and risk factors of MetS were compared with t-test and Tukey's post hoc test, respectively.

Results: The prevalence of depression among U.S. adults is 11.74%. Participants who eat a poor diet are more likely to have depression and MetS than those who eat a healthier diet with odd ratios (ORs) 2.76(95% CI: 2.01, 3.72) and 1.55(95%CI: 1.25, 1.94), respectively. The individuals with 1-7 NHP meals per week have a smaller likelihood of having depression compared to those who only eat home prepared meals (OR= 0.55, 95%CI: 0.39-0.77).

Conclusion: The results demonstrated that a self-reported diet was associated with depression and MetS. The number of NHP meals is associated with depression rather than MetS. Therefore, the increased attention to quality of NHP food is needed especially for obese adults.

Keywords: Depression; Metabolic Syndrome; Not-Home Prepared Meals; Diet Quality

Abbreviations: MetS: Metabolic syndrome; NHP: Not-Home Prepared; SES: Socio Economic Status

Introduction

Frequency of eating not home-prepared meals (NHP) has risen quickly due to numerous factors, including more females working outside the home, and a faster paced life and work environment. There continues to be an increase in the number of people that choose to eat not home-prepared NHP meals from different locations including restaurants, fast food establishment vs places, food stands, grocery stores or vending machines [1]. NHP meals were reported to have higher density in sugar, fat and sodium but lower amounts of vegetables, fruits fiber and other protective nutrients [2-6]. More evidence indicated that greater NHP consumption is highly associated with low quality of diet and obesity [7-10]. Recent studies indicate that NHP are associated with several biomarkers of chronic disease such as body mass index (BMI) and cholesterol among U.S. Adults [11]. A more recent study found that the frequency of dining out has an impact on the metabolic risk factors in Korean adults [12]. However, there is no current study that focused on the relationship of NPH and the five risk factors of metabolic syndrome (MetS) among U. S. adults.

Depression is one of the most common mental disorders in the U.S. and is caused by a combination of genetic, biological, environmental, and psychological factors. About 6.7% (around 15.7 millions) of all U.S. adults had at least one major depressive episode in the past year [13]. Depression causes morbidity and death in the U.S. which is also associated with quality of life and social functioning and activity [14,15]. Moreover, depression has also brought a large burden of disability among U.S. adults [16]. Evidence from previous studies indicate that depression and MetS are associated with each other and both are precursors to developing type 2 diabetes and cardiovascular disease [17,18]. Individuals who suffered depression at baseline are more likely to develop MetS later (odds ratio=1.52). On the other hand, individuals with MetS have approximately 1.5 fold chance to develop depression later [19]. Unhealthy behaviors including smoking, poor diet and physical inactivity are leading risk factors for MetS and death in U.S. [20,21] Studies indicate that individuals engaging in the aforementioned behaviors have certain psychiatric problems including depression [22,23].

It is widely known that eating home-prepared meals allows individuals to control the ingredients in the food. Individuals may eat food with smaller amounts of salt and trans fats compared to NHP food. Many NHP food, such as from a food producer or restaurants, uses more salt and fat to make the food taste more appetizing [24]. Another well-known advantage is that home-prepared food costs less compared NHP food. However, home-prepared meals consume more time in preparation, cook time, and cleanup. It is a challenge for individuals who need more time for studying, working and commuting. It is reasonable to consider that spending more time on food preparation potentially puts added pressure on these individuals with busy lifestyles.

MetS and depression have received increased attention over the past decades. Diet behaviors, particularly frequency of NHP meals, have long been of interest as factors that contribute to the development of obesity and MetS [12,25]. Only a few studies have focused on the relationship between NHP and the human's well-being [25,26]. To the best of our knowledge, no study has reported NHP to be associated with depression. The aim of this study is two-folds: (1) to assess the relationship of NHP and diet quality with the incidence of MetS and depression and (2) to investigate which risk factor of MetS is associated with depression among US adults using an up-to-date nationwide examination and survey.

Methods

Study Population

The data used in the current study was from the 2011-2014 NHANES survey, which are the only cycles to include an oversample of Asian Americans among all released NHANES surveys. Individuals aged 20 and over who had completed a health examination, mental health-depression screening questionnaire and a diet behavior and nutrition survey were included in this study.

Depression Assessment

Depression was assessed using a reliable tool PHQ-9, which contains nine symptom questions. A 4-point ascending Liker scale (0 to 3) scored each symptom. Zero means the individual has not suffered the symptom at all over the past two weeks and 3 indicated that the individual suffered the symptom "nearly every day". The sum range of the total score was from 0 to 27. The sum of score that was greater than 10 was used to indicate depression in this study since a previous study showed this cut-off point was validated and there is high sensitivity (88%) and specificity (88%) as a total score ≥10 [11].

Metabolic Risk Factors

MetS contains a set of five risk factors and the American Heart Association gave the following thresholds [27]: (1) waist circumference: at least 88 cm for women and at least 102cm for men. (2) Fasting blood glucose at least 100 mg/dL. (3) Serum triglycerides at least 150 mg/dL. (4) Blood pressure at least 135/85mmHg. (5) HDL ("good") cholesterol lower than 40 mg/dL for men or 50 mg/dL for women.

Diet behavior and Nutrition

We were interested in the two items regarding self-reported overall diet quality and behavior in this study. First, the weekly frequency of NHP meals includes breakfast, lunch and dinner. NHP meals refers to the food was prepared in places such as restaurants, fast food establishments, food stands, grocery stores or from vending machines. Second, the answer to "How healthy is the overall diet" is a 5-point Likert scale and dichotomized into a good and poor diet.

Demographics and Socioeconomics

Age, gender and race were examined as demographic control variables. Age was categorized into "20-39 years old", "40-59 years old" and "60 and older". Race included Mexican American, other Hispanic, Black, Caucasian, Asian and other race. Two indicators of socioeconomic status included education and family poverty level. Education reflects the completion of the highest grade or degree with three categories: <12 years, 12 years (equivalent to high school diploma) and >12 years. Family poverty income ratio (PIR), a ratio of income to the federal poverty threshold taking into account family size, age of members, measured the poverty status and was categorized into three groups: poor (PIR<100%), near poor (100%≤PIR≤300%) and non-poor (PIR>300%).

Statistical Analysis

First, we examined weighted prevalence of each symptom of depression. The prevalence of depression and MetS, poor diet and NHP meals within each explanatory variable was also assessed. Proportional tests were used to compare prevalence difference of depression, MetS and poor diet within each demographic and socioeconomic status (SES). The differences of depression score and the five risk factors of metabolic syndrome due to diet quality and frequency of NHP meals were also compared. More specifically, a two group t-test was used to compare the difference between a good diet and a poor diet. A Tukey post-hoc test followed overall ANOVA significance was used to keep nominal type I error rate. Two weighted logistic regression models were employed to investigate the relationship between two outcome variables (metabolic syndrome and depression) and two explanatory variables considered in this study. Model 1 only contained diet quality and NHP meals. Model 2 adjusted for demographics (age, gender and ethnicity) and poverty status and education level. The odds ratio (OR) with 95% confidence interval (CI) were estimated. A 4-year sample weight variable was created by combining two biennial national surveys in the analysis. All statistical analyses were carried out with the Statistical Analysis System (SAS, version 9.3, Cary NC). A p-value<0.05 was considered statistically significant.

Results

In the present study, a total of 2,849 American adults, aged 20 and over answered all mental health-depression screening questions and health examination related metabolic risk factors in NHANES 2011-2014. The overall weighted prevalence of depression and MetS among U.S. adults was 11.74% and 32.36%. The average of NHP meals among U.S. adults was 3.78 (s.e=0.1). Seventeen percent of U.S. adults only consumed home-prepared meals and more than 21% of adults ate more than once a day in the past week.

(Table1) presents the weighted frequency and weighted percent for each item used to construct mental health-related quality of life (MHRQoL) for this study, representing more than 61 million adults. The two most often reported MHRQoL concerns were "Trouble sleeping or sleeping too much" and "Feeling tired or having little energy", each more than 11% of this population. The least often reported MHRQoL concerns were "Thought you would be better off dead" (0.69%) and "Moving or speaking slowly or too fast" (2.75%).

As presented in (Table 2), more than 50% of U.S. adults ate 1 to 7 not home-prepared meals in the past seven days regardless of demographics and SES status. There were significant age group differences in frequency of NHP meals and diet quality. Older adults had the smallest proportion of eating more than seven not home-prepared meals (9.86%) and poor diet (19.45%) compared to young adults ((>7NHP meals/week: 31.53%, and poor diet: 32.56%). Non-poor individuals are more likely to have consumed NHP meals at more than 7 times (24.38%) and less likely to report poor diet (18.81%) compared to the poor individuals (>7 NHP meals: 18.81% and poor diet: 39.17%). A higher proportion of eating >7 NHP meals was found among individuals with a college education (23.20%) or high school diploma (21.18%)

than those with less than 12 years education (14.59%). On the other hand, the less educated (<12 yrs) education individuals (39.54%) were the most likely to have overall poor diet compared to individuals with more than 12 years education (23.78%).

Middle-aged adults have higher depression prevalence (13.73%) than young adults (9.38%). The proportion of depression for females (13.96%) was significantly higher than that of their male peers (10.28%). Individuals with lower SES status were more likely to suffer from depression than those with higher SES status. Poor individuals (18.20%) were more likely to suffer from depression than their non-poor peers (5.80%).

Individuals who did not finish high school education (18.46%) were the most likely to have depression compared to individuals that had a high school diploma (12.94%) and college education (9.5%). There was a substantial age group difference in prevalence of MetS. The prevalence of MetS in middle aged (37.90%) and older adults (44.43%) were significantly higher than young adults (17.46%). The prevalence of MetS among adults with college education (30.81%) is significantly lower than those whose did not finish high school education (36.23%). It is worth noting that Asian people had the lowest prevalence of depression (4.04%) and MetS (19.06%).

Table 1: The US adults from NHANES 2011-14 data to each PHQ-9 question (n=2849).

Mental health-related quality of life questions	Weighted frequency	Weighted Percent % (s.e.)
Q1 Have little interest in doing things		
0=Not at all	39581389.5	64.79(1.16)
1=Several days	14535746.5	23.80(1.04)
2=More than half the days	3899694	6.38(0.58)
3=Nearly every day	3070525.5	5.03(0.50)
Q2 Feeling down, depressed, or hopeless		
0=Not at all	40269742	65.92(1.15)
1=Several days	15127335	24.76(1.06)
2=More than half the days	3040889	5.0(0.51)
3=Nearly every day	2649389.5	4.34(0.47)
Q3 Trouble sleeping or sleeping too much		
0=Not at all	27216814	44.55(1.22)
1=Several days	20114322.5	32.93(1.16)
2=More than half the days	6567818.5	10.75(0.78)
3=Nearly every day	7188401	11.77(0.77)
Q4 Feeling tired or having little energy		
0=Not at all	14909135.5	24.41(1.04)
1=Several days	32039257	52.45(1.22)
2=More than half the days	7230148	11.84(0.80)
3=Nearly every day	6908815.5	11.31(0.75)
Q5 Poor appetite or overeating		
0=Not at all	40228363	68.85(1.15)
1=Several days	13121149	21.48(0.99)
2=More than half the days	4102578.5	6.72(0.60)
3=Nearly every day	3635265	5.95(0.58)
Q6 Feeling bad about yourself		
0=Not at all	45463853.5	74.42(1.07)
1=Several days	10694674	17.51(0.93)
2=More than half the days	2732353	4.47(0.52)
3=Nearly every day	2196475.5	3.60(0.45)
Q7 Troubling concentrating on things		
0=Not at all	46516074	76.15(1.04)

1=Several days	9191242	15.05(0.88)
2=More than half the days	2846971	4.66(0.51)
3=Nearly every day	2533069	4.15(0.47)
Q8 Moving or speaking slowly or too fast		
0=Not at all	52644527.5	86.18(0.83)
1=Several days	5356725	8.77(0.68)
2=More than half the days	1408865	2.31(0.32)
3=Nearly every day	1677239	2.75(0.42)
Q9 Thought you would be better off dead		
0=Not at all	58271984.5	95.39(0.50)
1=Several days	1933269	3.16(0.42)
2=More than half the days	462485.5	0.76(0.19)
3=Nearly every day	419617	0.69(0.21)

Table 2: Percentage of categories of NHP, poor diet, depression and MetS within groups of demographics and SES status.

Variable(n)	Weekly frequency of NHP meals mean (%)			Poor diet %(s.e.)	Depression % (s.e.)	MetS %(s.e.)
	0	1-7 meals	>7 meals			
Overall	17.00(0.84)	61.68(1.18)	21.32(1.02)	28.27(1.08)	11.74(0.77)	32.36(1.15)
Age						
20-39yrs (984) (reference)	10.75(1.09)	57.75(1.89)	31.53(1.81)	32.56(1.74)	9.38(1.14)	17.46(1.41)
40-59yrs (925)	16.58(1.47)**	63.22(2.10)*	20.20(1.83)***	30.89(2.02)	13.73(1.47)*	37.90(2.14)***
60 and over (940)	25.47(1.82)***	64.66(2.08)**	9.86(1.39)***	19.45(1.72)***	12.16(1.36)*	44.43(2.21)***
Gender						
Male (1270) (reference)	15.27(1.26)	56.28(1.85)	28.44(1.70)	30.76(1.71)	10.28(1.13)	32.30(1.77)
Female (1579)	18.44(1.13)*	66.20(1.49)***	15.36(1.20)*	26.18(1.38)*	13.96(1.06)*	32.42(1.50)
Race						
Caucasian (1275) (Reference)	14.25(1.09)	64.48(1.57)	21.27(1.37)	24.83(1.43)	11.63(1.04)	33.40(1.55)
Mexican American (322)	22.37(2.42)*	57.32(3.02)*	20.31(2.57)	48.88(3.06)***	10.20(1.71)	31.70(2.77)
Other Hispanic (282)	25.90(2.76)***	56.61(3.29)*	18.49(2.77)	29.31(3.01)*	15.81(2.34)	31.72(2.097)
Black (586)	23.18(1.85)***	55.41(2.20)**	21.42(1.82)	38.78(2.17)***	12.90(1.49)	29.26(1.98)
Asian (306)	25.18(2.56)***	51.13(3.00)***	23.69(2.00)	14.43(2.13)***	4.04(1.66)***	19.06(2.26)***
Other race (78)	16.73(5.15)	55.32(7.20)	27.94(6.63)	40.49(6.74)**	19.29(4.82)*	26.70(6.70)
Family PIR						
Poor(587) (Reference)	28.10(1.95)	53.09(2.19)	18.81(1.89)	39.17(2.13)	18.20(1.59)	31.96(2.05)
Near poor(1091)	17.92(1.34)***	62.81(1.88)***	19.27(1.62)	32.56(1.87)*	14.68(1.48)	34.59(1.86)
Non-poor(901)	10.29(1.22)***	65.32(1.96)***	24.38(1.78)*	18.81(1.60)***	5.80(1.01)***	30.71(1.95)
Education						
<12(629) (Reference)	31.84(2.94)	53.57(2.57)	14.59(2.05)	39.54(2.55)	18.46(1.94)	36.23(2.42)
12(635)	18.07(1.84)***	60.75(2.54)*	21.18(2.22)***	32.43(2.38)*	12.94(1.74)***	33.84(2.47)
>12(1585)	12.59(1.01)***	64.21(1.53)***	23.20(1.36)***	23.78(1.36)***	9.50(0.95)***	30.81(1.51)*

*P<0.05, **P<0.001, ***P<0.0001.

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As presented in (Table 3), individuals who ate a poor diet (mean=6.0) had a larger depression score than those who ate a good diet (mean=4.19). Except for triglycerides, individuals that consumed a good diet have healthier measures on the other four risk factors of MetS than those that consumed a poor diet (Table 3).The individuals only eating home-prepared meals had higher depression scores (5.46) than those eating 1-7 meals (4.53) and greater than seven meals (4.56). The participants who only consumed home-prepared meals had significantly higher fasting glucose (mean=114.77mg/dL) than those eating not home-prepared meals/week (>7) (mean=105.23mg/dL).

Table 3: Mean depression score and five risk factors of MetS for categories of diet quality and weekly frequency of NHP meals.

Variable (mean/std.err)	Diet quality		Weekly frequency of NHP meals /week		
	Good (Reference)	Poor	0 (reference)	1-7 meals	>7 meals
Depression_score (mean/std.err)	4.19(0.09)	6.00(0.18)***	5.46(0.20)	4.53(0.10)***	4.56(0.19)***
BMI(kg/m2)	28.39(0.15)	31.70(0.29)***	29.33(0.29)	29.65(0.18)	28.69(0.31)
Waist Circumference (cm)					
male	99.53(0.52)	104.73(0.95)***	101.89(1.10)	102.19(0.62)	98.41(0.95)*
female	95.77(0.49)	104.29(0.87)***	98.91(0.88)	98.53(56)	96.33(1.29)
Fasting glucose mg/dL)	106.95(0.76)	111.48(1.28)*	114.77(1.72)	106.87(0.79)***	105.23(1.34)***
HDL C (mg/dL)					
Male	48.38(0.48)	45.97(0.62)**	48.36(0.98)	46.79(0.49)	48.83(0.76)
Female	59.67(0.48)	53.70(0.66)***	57.50(0.89)	57.58(0.46)	59.99(1.78)
Trigs(mg/dL)	125.60(3.01)	138.29(4.14)	134.95(4.53)	130.31(3.56)	120.38(4.05)*
SBP(mm/Hg)	122.42(0.41)	123.20(0.64)	125.49(0.80)	122.59(0.45)***	119.47(0.68)***
DBP(mm/Hg)	68.60(0.28)	70.06(0.45)**	68.02(0.53)	69.24(0.31)*	69.65(0.55)*

*P<0.05, **P<0.001, ***P<0.0001.

(Table 4) indicated that individuals consuming a poor diet are more likely to have depression and MetS than those eating a good diet, with odds ratio 2.76(95%CI: 2.01, 3.72) and 1.55 (95%CI: 1.25, 1.94), respectively. This relationship remained significant after adjusting for demographics and SES status. Adults eating 1-7 NHP meals per week have smaller odds to suffer depression than those who only consumed home-prepared food (OR=0.55, 95%CI: 0.39, 0.77), and this relationship was still significant after adjustment with demographics and SES. Participants consuming more than seven NHP meals had a smaller likelihood of having depression and MetS with odds ratio 0.62 (95%CI: 0.40, 0.97) and 0.64 (95%CI: 0.46, 0.89), respectively. However, these two relationships lost significance after the adjustment for demographics and SES.

Table 4: Relation of diet quality and weekly frequency of NHP meals with depression and MetS.

Depression (probability=YES)	Model I OR (95% CI)	Model II OR (95% CI)
Diet		
Excellent/very good/good (Reference)		
Fair/poor	2.76(2.01, 3.72)***	2.39(1.76, 3.27)***
Number of not home prepared meals		
0 (reference)		
1-7 meals	0.55(0.39, 0.77)***	0.67(0.46, 0.96)*
>7 meals	0.62(0.40, 0.97)*	0.82(0.51, 1.31)
Metabolic syndrome (probability=MetS)		
Diet		

Excellent/very good/good (Reference)		
Fair/poor	1.55(1.25, 1.94)***	1.70(1.33, 2.17)***
Number of not home prepared meals		
0 (reference)		
1-7 meals	0.86(0.67, 1.11)	1.01(0.76, 1.35)
>7 meals	0.64(0.46, 0.89)**	0.97 (0.67, 1.10)

*P<0.05, **P<0.001, ***P<0.0001.
Model 1: Only included diet quality and weekly frequency of NHP meals.
Model 2: ContainedModel 1 and additionally adjusted for demographics and SES status.

Discussion

The present study found that diet quality is significantly associated with depression and MetS. The significant differences of depression score and all five risk factors of MetS were found between a good and poor diet. More specifically, individuals eating a poor diet have a higher depression score, BMI, waist circumference, fasting glucose, and lower HDL cholesterol compared to those eating a good diet. It is worth noting that individuals who had higher frequency of weekly NPH meals had lower depression scores and better measures related to MetS such as lower fasting glucose and blood pressure than those that always ate home-prepared meals.

Meals eaten outside the home have increased from 2% in 1900 to 50% in 2010, and breakfasts from McDonald's accounted for 20% of all breakfasts NHP [28]. In this study, the American adult reported a mean of 3.78 (95%CI: 3.68, 3.88) NHP which is similar to the NHANES 2005-2010 with a mean of 3.9 (95%CI: 3.7-4.0) [11]. The estimated prevalence of 51% of U.S. adults reporting ≥3NHP meals/week is higher than in NHANES 1999-2000 (41%) (1) and similar to NHANES 2005-2010 (>50%) [11]. However, due to no concrete prevalence in 2005-2010 and discontinuity of survey questions in 1999-2000 (1), it is not plausible to comment on real change of prevalence of ≥3NHP meals/week. Two potential reasons that contribute to explaining the high prevalence of NHP meals are (i) women have consistently been entering the workforce overtime which may lead to an increase in the demand for commercially prepared meals because they no longer have the time to prepare meals seven days a week [29]. In 2014, 57% of women participated in the labor force compared with only 21% of women in the workforce in 1900 [30,31]. It was reported that in 1965 a married woman who did not work would spend at least two hours per day making meals whereas by 1995 the same tasks would take less than half that amount of time due to technological innovations [32]. (ii) The expansion of the food industry has allowed people to have many food choices since it encompasses the entire collection of enterprises involved in the production and consumption of food and beverages [33]. Furthermore, the industrialization of the food industry has led to low-cost foods that are affordable to most consumers, which creates the possibility of a shift from home-prepared meals to NHP meals. Overall, the frequency of weekly NHP meals was not significantly associated with MetS after adjusting for demographics and SES status. A more interesting phenomena was found that individuals who consumed NHP meals more once a day had better health measures including blood pressure and fasting glucose and triglycerides. The lack of the expected relationship between NHP and MetS is not well known in this study, but it can be explained with several potential reasons: (a) MetS increases in prevalence through aging, (b) individuals that ate more than 7 times a week were younger people (c) more nutrition labeling can be seen in many restaurants and ready-to-eat food, which is essential to help people manage the energy and fat intake, and (d) there is a greater proportion of individuals that have a higher frequency of eating outside home who were considered non-poor people and have higher education and thus they possibly can afford higher quality food outside home.

As obesity has become a major of public issue in the U.S, NHP meals were widely blamed because recent reports showed consumption of NHP meals is associated with poorer diet and higher energy intake and faster weight gain [34], especially burger-and-fries from fast food establishments. The NHP meals actually contain a variety of food choices from full service restaurants to vending machines. The quality of NHP meals may range from poor to quite healthy. An obese condition is likely due to the food choices that people have been making over time. On the other hand, advantages of NHP meals should not be completely neglected or underestimated. Going out for meals is more than just for nourishment, as it serves as a form of entertainment [35]. NHP meals were acknowledged as a time saving method and allowed individuals to spend more time on physical activity. Eating outside the home is also a type of social connection

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where people consume food with their friends, family or they may even make new friends [36]. The above functions were considered as effective ways of reducing depression and achieving pleasure [36]. Therefore, not surprisingly, this study found frequency of NHP meals inversely related with depression.

The inverse relation between NHP meals and depression carried high importance among U.S. adults who have chronic disease such as Type 2 diabetes and cardiovascular disease. Individuals with depression are less likely to follow directions and cooperate with their physician for treatment [14]. For example, there is a lower treatment adherence rate of HIV-infected patients with depression disorder compared to those do not have depression [37]. Therefore, we can speculate that treatment of depressive disorder among U.S. adults may help improve the life quality and span. The present study indicated taking advantages of positive function of NHP in addition with choices of balanced meals is a potential way to prevent or reduce depression before it is recognized.

To the best of our knowledge, this study provides the first estimates of the prevalence of depression in the category of NHP meals. The findings in this present study (NHP meals is significantly associated with depression instead of MetS) provided some implications for future interventions on body weight management and depression treatment. As cardiovascular disease and other risks of health have been a public health concern, a series of nutrition guidelines were proposed by the USDA such as USDA Food Guide Pyramid (1992), My Pyramid (2005) and My Plate (2011) in recent decades [38]. Meanwhile, food industries have been producing thousands of new products including fat-free cookies, fat-free or low fat cheese as the consumers have changed their needs and expectations for food following the nutrition guidelines [39,40]. Therefore, it is plausible to expect that correct choices of NPH meals would not increase the likelihood of MetS and would liberate people from the pressure of cooking and then reduce the odds of depression.

The nature of a cross-sectional study allowed us to investigate the correlation relationship instead of casual relationship. The two explanatory variables are self-reported and there is no information of their validation. Overall diet quality may be subjective which possibly reflects participants' perception of nutrition and culture and may have a variety of bias.

Conclusion

Given the findings in this study, increased attention to the diet quality of NHP meals is needed to reduce the odds of MetS and depressive disorders especially for the people with overweight/obesity.

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