International Journal of Food and Nutritional Health:Vol. 1 No. 1, pp: 1 – 12 (2026)
DOI: 10.4197/Fnj.1-1.1

Exploring the Association between Fruit and Vegetable Consumption and Depression among a Saudi Adult Population: A Cross-Sectional Study

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Abstract

Research has increasingly highlighted the protective effects of fruit and vegetable consumption on depressive symptoms. However, less research has been examining the importance of relationships within the specific context of Saudi Arabia. Study aim to examine the relationship between fruit and vegetable intake and depression in Saudi adults. A total of 598 Saudi male and female adults residing in Jeddah,Saudi Arabia participated in this cross-sectional study. Participants completed an online questionnaire on fruits and vegetables consumption and Hospital Anxiety and Depression Scale to evaluate the presence and severity of depressive symptoms. Daily consumption of fruits and vegetables is not regular, being vegetables are less consumed than fruits. Regular and frequent fruit consumption is associated with lower depression severity. Individuals who consume fruits sometimes or less frequently are more likely to experience higher depression severity. Regular vegetable consumption is associated with lower depression severity, while fresh vegetable consumption is not significantly associated with depression severity. Unfrequent and insufficient intake of fruits and vegetables seems to be related to depression among Saudi adults. Promoting fruit and vegetable intake could help to mitigating depression symptoms and reduce the risk of developing depression. Further investigations are needed to demonstrate a potential causal relationship.

Keywords: Consumption, Fruits, Vegetables, Depression, Adults, Saudi Arabia

1. Introduction

Depression is a complex mental health disorder characterized by persistent negative emotions, thoughts, and behaviors, including sadness, loss of interest or pleasure, feelings of guilt, low self-esteem, disrupted sleep or appetite, fatigue, poor concentration, and impaired daily functioning [1-2]. According to the World Health Organization (WHO), approximately 3.8% of the global population is affected by depression, with higher prevalence rates observed in adults (5.0%) and individuals over 60 years of age (5.7%) [3]. Currently, depression ranks as the third leading cause of global morbidity and is projected to become the leading cause by 2030 [4]. The development of depression is influenced by a multifaceted interplay of social, psychological, and biological factors. Global studies conducted between 1994 and 2014 have consistently reported higher depression rates among women and in countries with moderate human development indices (HDI)[5]. For example, a study conducted in Al-Ahsa, Saudi Arabia, identified education level, gender, and unemployment as significant risk factors for depression, while no significant associations were found with age, income, marital status, or residence [6].

In recent years, growing interest has emerged in the relationship between diet and mental health, as dietary patterns are increasingly recognized for their influence on brain function, inflammation, and oxidative stress—all of which play a role in the pathophysiology of depression [7-8]. Specifically, a higher intake of fruits and vegetables has been inversely associated with depression, suggesting that dietary interventions may offer an effective strategy for improving mental health outcomes [9]. A large-scale national study in Canada (2011-2022) found that increased consumption of fresh fruits and vegetables was linked to lower levels of depression and psychological distress [10]. Additionally, research suggests that these foods may positively influence serotonin levels in the brain, which contributes to improved mood and psychological well-being [11]. A plausible explanation for this effect is the high-fiber content of fruits and vegetables, which has been shown to improve mental status and reduce depressive symptoms by altering the concentration of neurotransmitters compared to animal-based diets [12] Dietary fiber, particularly from fruits and vegetables, also influences gut microbiota, enhancing both immunological and inflammatory processes [13]. Furthermore, the phytochemicals in these foods help reduce oxidative stress and inflammation, further supporting their potential antidepressant effects [12,13]. Studies have consistently found a substantial inverse relationship between fiber and soluble fiber intake and the risk of depression [14]. Compared to an unhealthy diet with limited fruit and vegetable consumption, a healthy diet rich in these foods is also a good source of folate, which has been shown to have anti-depressive effects [15]. Low folate levels have been linked to poor antidepressant response, and folic acid supplementation has been shown to improve the effectiveness of antidepressants [16]. Additionally, emerging evidence suggests that adequate vitamin B12 levels may be associated with better treatment outcomes for patients with recurrent mood disorders [17]. These findings highlight the potential of dietary interventions, particularly those emphasizing fruits and vegetables, as a valuable adjunct to traditional treatments for depression.

Although research has highlighted the significant role of diet and nutrition, particularly the consumption of fruits and vegetables, in the prevention and treatment of depression, there is increasing recognition that these dietary factors could be incorporated into future intervention programs for managing depression [17]. A systematic review and meta-analysis by Nour et al. in Saudi Arabia analyzed 46 relevant cross-sectional studies, encompassing 25,814 participants. The overall pooled depression prevalence was found to be 37.35 revealing that Almost more than one-third of Saudi adults had depression [18]. Despite these findings, research in Saudi Arabia exploring the relationship between fruit and vegetable consumption and depressive symptoms remains limited, especially given the concerning depression rates in the country. Therefore, this study aims to examine the association between fruit and vegetable intake and depressive symptoms in Saudi Arabian adults, offering valuable insights into how dietary patterns may impact mental health in this population.

2. Materials and Methods

2.1 Study Design and subjects

This descriptive cross-sectional study was conducted between January and May 2024 in Jeddah, Saudi Arabia. Based on this calculation, the initial sample size was determined to be 600 participants. To account for potential participant dropouts, refusals, and missing data, the sample size was adjusted by increasing it by 15%, resulting in a final sample size of 690 participants.

Participants who consented to take part in the study were first provided with an informed consent form, outlining their rights as participants. They were informed that participation was voluntary, and they had the right to withdraw from the survey at any time without penalty. The questionnaire was designed to be anonymous, with no names recorded, ensuring that responses remained confidential. Participants were assured that their answers would not be shared with others. The estimated time to complete the questionnaire was 10 to 15 minutes.

Data Collection tool

The study employed self-report online questionnaires to collect data. The questionnaire was structured into several sections:

Section 1: including sociodemographic characteristics such as gender, marital status, education level, employment status, monthly income in Saudi Riyals (SAR). It also included the anthropometric measurements such as weight (Kg) and height (m). These were used to calculate the Body Mass Index (BMI) (Kg/m^2).

Section 2: The second section of the questionnaire was dedicated to assessing the patterns of fruit and vegetable consumption. This section gathered information for example on the frequency, and the reasons for low or infrequent consumption. fruit and vegetable consumption was categorized into three levels: low (once or less per week), moderate (once a day or 4-6 times per week), and optimal (four or more times per day).

Section 3: Depression Symptoms Assessment

The third section of the questionnaire was designed to assess depression symptoms using the Hospital Anxiety and Depression Scale (HADS), which has been validated in Arabic [20]. The HADS, originally developed by Zigmond and Snaith [21]. consists of 14 items—7 for measuring anxiety (HADS-A) and 7 for measuring depression (HADS-D). Each item is scored on a four-point Likert scale, ranging from 0 (not present) to 3 (considerable).

The scores for each subscale (anxiety and depression) were summed to yield total subscale scores, with possible values ranging from 0 to 21. Higher scores indicate higher levels of anxiety or depression. The severity of symptoms was categorized as follows: Normal (0-7), Borderline (11-14), and Abnormal (15-21). A score of 8 or higher is considered the cutoff point that will be suggested by its creators.

Statistical analysis

Statistical analyses were performed using Python version 3.8.8, with the exception of Fisher's Exact test, which was conducted using R version 4.4.0. Categorical variables were expressed as count (%). To compare categorical variables across different HADS groups. For comparing two categorical variables, the Chi-square test was used if the expected count in each cell exceeded 5. If this assumption was not met, Fisher's Exact test was used instead. A P-value of less than 0.05 was considered statistically significant for all tests.

3. Results

The study population consists of 598 participants, mainly females (76.09%) with males making up 23.91%. In terms of marital status, 29.1% are married and 70.9% are unmarried. A large majority (81.1%) have completed undergraduate or postgraduate education, while 18.9% have only a high school education. Monthly income distribution shows that 35.62% earn between 5,000 and 10,000 SAR, followed by 23.41% earning less than 5,000 SAR, 20.74% earning between 10,000 and 15,000 SAR, and 20.23% earning over 15,000 SAR (Table 1).

Table1: Socio-demographic characteristics of the studied population (n= 598)

Parameter	Count (%)
Gender	
Female	455 (76.09%)
Male	143 (23.91%)
Marital status	
Married	174 (29.1%)
Not married	424 (70.9%)
Education level	
High School	113 (18.9%)
Undergraduate & Postgraduate	485 (81.1%)
Monthly income (SAR)	
<5k	140 (23.41%)
5k-10k	213 (35.62%)
10k-15k	124 (20.74%)
15k+	121 (20.23%)

Table 2: presents the analysis of fruit and vegetable consumption patterns among participants. Regarding fruit consumption, 71.24% (426) of participants reported including fruits regularly in their diet. The most common barrier to fruit consumption was unaffordability, cited by 14.55% (87) of participants, followed by a lack of enjoyment, reported by 12.88% (77). Notably, about two-thirds (64.72%) of participants did not specify any particular reasons for not consuming fruits. In terms of frequency, 82.94% (496) of participants consume fruits at least once a week.

For vegetable consumption, 70.57% (422) of participants include vegetables regularly in their diet. Lack of preference was the most common reason for not consuming vegetables, cited by 15.05% (90) of participants, while 65.72% (393) did not provide a specific reason for their limited vegetable intake. In terms of frequency, 60.87% (364) of participants reported eating vegetables daily, followed by 23.41% (140) who consume them more than once a week but not daily. Additionally, 26.25% (157) of participants reported consuming fresh vegetables, while the majority, 73.75% (441), did not (Table 2).

Table 2: Fruits and vegetables consumption among the population (n=598)

Factors	**Count (%)**
Fruits Consumption	
Sometimes	172 (28.76%)
Always	426 (71.24%)
Reasons for low or infrequent consumption of fruits	
Unaffordable to buy	87 (14.55%)
Don't prefer	77 (12.88%)
Enriched with sugar	38 (6.35%)
Allergic to some	5 (0.84%)
Follow low-CHO diet	4 (0.67%)
Others	387 (64.72%)
Fruit consumption frequency	
<=3 times/month	102 (17.06%)
At least once/a week	496 (82.94%)
Vegetable Consumption	
Never	68 (11.37%)
Sometimes	108 (18.06%)
Always	422 (70.57%)
Reasons for low or infrequent consumption of vegetables	
Don't prefer	90 (15.05%)
Unaffordable to buy	26 (4.35%)
Allergic to some	10 (1.67%)
Others	79 (13.21%)
N/A	393 (65.72%)
Vegetable consumption frequency	
At least once/a week	94 (15.72%)
More than once/week but not daily	140 (23.41%)
Daily	364 (60.87%)
Fresh Vegetables	
No	441 (73.75%)
Yes	157 (26.25%)

Table 3: Association between fruits and vegetables consumption and depression (n=598)

Factors	Normal	Borderline	Abnormal	P-Value			
				Overall	Normal vs Borderline	Normal vs Abnormal	Borderline vs Abnormal
Fruits Consumption							
Sometimes	92 (22.38%)	46 (35.94%)	34 (57.63%)	<0.001	0.003	<0.001	0.009
Always	319 (77.62%)	82 (64.06%)	25 (42.37%)				
Fruit consumption frequency							
<=3 times/month	58 (14.11%)	20 (15.62%)	24 (40.68%)	<0.001	0.779	<0.001	<0.001
At least Once/a week	353 (85.89%)	108 (84.38%)	35 (59.32%)				
Vegetable Consumption							
Never	0 (0.0%)	20 (15.62%)	48 (81.36%)	<0.001F	<0.001F	<0.001F	<0.001F
Sometimes	96 (23.36%)	12 (9.38%)	0 (0.0%)				
Always	315 (76.64%)	96 (75.0%)	11 (18.64%)				
Fresh Vegetables							
No	311 (75.67%)	91 (71.09%)	39 (66.1%)	0.22	0.357	0.157	0.604
Yes	100 (24.33%)	37 (28.91%)	20 (33.9%)				

F: Fisher's Exact test

Table 3 summaries participants distribution according to the frequency of consumption of fruits and vegetables, and the level of depression. The results show that the "Abnormal" group consume fruits less frequently, with 40.68% eating fruits three times or fewer per month, compared to just 14.11% in the "Normal" group. Regular fruit consumption (at least once per week) is most common in the "Normal" group (85.89%), but significantly lower in the "Abnormal" group (59.32%), with both differences statistically significant ($P < 0.001$). Overall, fruit consumption is associated with depression severity: 77.62% of participants in the "Normal" group report frequent fruit intake, dropping to 64.06% in the "Borderline" group, and 42.37% in the "Abnormal" group. Regarding vegetable consumption, 81.36% of participants in the "Abnormal" group report never eating vegetables, significantly higher than the "Borderline" (15.62%) and "Normal" (0%) groups ($P < 0.001$). While 66.1% of the "Abnormal" group do not consume fresh vegetables, this is slightly lower than the "Normal" (75.67%) and "Borderline" (71.09%) groups, though the difference in fresh vegetable intake is not statistically significant.

4. Discussion

The aim of this study was to investigate the relationship between fruit and vegetable consumption and depressive symptoms among adults in Saudi Arabia. By exploring this connection, the research aims to provide deeper insights into how dietary habits, particularly the intake of fruits and vegetables, may influence mental health outcomes within this specific population. Understanding these dietary patterns could offer valuable implications for public health initiatives and intervention strategies aimed at improving mental well-being, especially in regions where depression rates are a growing concern.

The study's findings emphasize that infrequent and irregular consumption of fruits and vegetables. This fact, reduced fruit and vegetable consumption was previously among Saudi in several samples and age groups such university students and women [22,23]. The findings of this study suggest that majority of participants incorporate fruits and vegetables into their diets, with fruit consumption being slightly more prevalent than vegetable consumption. However, barriers such as cost and lack of enjoyment seem to hinder greater fruit intake, highlighting the importance of addressing these factors in dietary interventions. The higher frequency of vegetable consumption among participants is encouraging, but the significant proportion (26.25%) who consume fresh vegetables points to a potential gap in access to fresh produce, which could be related to issues like availability or affordability. These patterns indicate the need for targeted educational programs and public health campaigns to address the underlying barriers to fruit and vegetable consumption, particularly focusing on affordability and taste preferences, to promote healthier dietary habits.

The results from the present study suggest a clear and significant relationship between the severity of depression and the frequency of fruit and vegetable consumption. Participants in the "Abnormal" depression group showed notably lower fruit consumption compared to those in the "Normal" group, with the frequency of fruit intake decreasing as depression severity increased. This pattern supports existing literature that links poor dietary habits, including insufficient fruit and vegetable consumption, with higher levels of depression [19]. Specifically, the lack of vegetable consumption is most pronounced in the "Abnormal" depression group, where a significant majority (81.36%) report never eating vegetables. This is concerning, as regular vegetable consumption is associated with improved mental health outcomes. Although the difference in fresh vegetable intake between the groups was not statistically significant, the overall trend indicates that individuals with more severe depressive symptoms are less likely to consume both fruits and vegetables regularly. These findings underscore the potential role of dietary

interventions in managing depression, suggesting that improving fruit and vegetable intake could be an effective strategy for enhancing mental health, particularly for those with more severe depressive symptoms. With this regard, observational studies have shown a negative linear relationship between fruit and vegetable intake and the likelihood of depression. Specifically, an increase of 100 grams of fruit or vegetables consumed was associated with a 3% decrease in depression risk in longitudinal studies, and up to a 5% decrease in depression risk in cross-sectional studies [14].

One of the key limitations of this study is the reliance on self-reported dietary intake, which may introduce recall bias and potentially affect the accuracy of the data. Since participants may not always remember or accurately report their consumption habits, this could lead to misrepresentation of their actual fruit and vegetable intake. Additionally, as an observational study, it cannot establish definitive causal relationships between diet and depression. The use of a convenience sampling technique further limits the generalizability of the findings to the broader population, as the sample may not fully represent the diversity of the general Saudi population. Despite these limitations, the study provides valuable insights into the relationship between fruit and vegetable consumption and depression among Saudi adults, contributing important knowledge that could inform future research and public health strategies in the region. **Conclusion** Unfrequent and insufficient intake of fruits and vegetables seems to be related to depression among Saudi adults. These findings emphasize the potential of dietary interventions that focus on increasing fruit and vegetable intake as a means to mitigate depression symptoms and reduce the risk of developing depression. Encouraging the consumption of these nutrient-rich foods could be a valuable addition to existing strategies for improving mental health and overall well-being. Further investigations are needed to demonstrate a potential causal relationship.

Author Contributions: Conceptualization, F.Y.; methodology F.Y., and B.A; software, F.Y, and B.A; validation, F.Y., and B.A; formal analysis, M.A.; investigation, F.Y.; resources, , F.Y., and B.A; data curation, , F.Y., and B.A; writing—original draft preparation, , F.Y., and B.A; writing—review and editing, , F.Y., and B.A; visualization, B.A.; supervision, F.Y.; project administration, F.Y.; funding acquisition, , F.Y., and B.A. All authors have read and agreed to the published version of the manuscript."

Funding: This research received no external funding

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data supporting the findings of this study are available upon reasonable request from the corresponding author.

Acknowledgments: None.

Conflicts of Interest: The authors declare no conflicts of interest.

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International Journal of Food and Nutritional Health:Vol. 1 No. 1, pp: 1 – 12 (2026)
DOI: 10.4197/Fnj.1-1.1

استكشاف العلاقة بين استهلاك الفواكه والخضروات والاكتئاب بين البالغين السعوديين: دراسة مقطعية

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الملخص:

أبرزت الأبحاث بشكل متزايد التأثيرات الوقائية لاستهلاك الفواكه والخضروات ضد أعراض الاكتئاب. ومع ذلك، لا تزال الدراسات التي تبحث في أهمية هذه العلاقة ضمن السياق السعودي محدودة. تهدف هذه الدراسة إلى استكشاف العلاقة بين تناول الفواكه والخضروات والاكتئاب لدى البالغين في السعودية. شارك في هذه الدراسة المقطعية ٥٩٨ بالغًا سعوديًا من الذكور والإناث المقيمين في جدة، المملكة العربية السعودية. استكمل المشاركون استبيانًا إلكترونيًا حول استهلاك الفواكه والخضروات، بالإضافة إلى مقياس القلق والاكتئاب(HADS) لتقييم أعراض الاكتئاب ودرجة شدتها لدى المشاركين. عدم انتظام الاستهلاك اليومي للفواكه والخضروات، ونسبة استهلاك الخضروات أقل من الفواكه. أظهرت الدراسة أن الاستهلاك المنتظم والمتكرر للفواكه يرتبط بانخفاض شدة الاكتئاب. كما أن الأفراد الذين يستهلكون الفواكه أحيانًا أو بشكل غير منتظم كانوا أكثر عرضة لارتفاع شدة الاكتئاب. كذلك، ارتبط الاستهلاك المنتظم للخضروات بانخفاض شدة الاكتئاب، في حين لم يكن استهلاك الخضروات الطازجة مرتبطًا بشكل ملحوظ بشدة الاكتئاب. تشير النتائج إلى أن انخفاض وتدنّي استهلاك الفواكه والخضروات يرتبط بالاكتئاب بين البالغين السعوديين. وقد يساهم تعزيز تناول الفواكه والخضروات في تخفيف أعراض الاكتئاب وتقليل احتمالية الإصابة به. ولا تزال هناك حاجة لمزيد من الدراسات لإثبات علاقة سببية محتملة.

الكلمات المفتاحية:

الاستهلاك، الفواكه، الخضروات، الاكتئاب، البالغون، المملكة العربية السعودية