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POST-COVID-19 RECOVERY AND FOOD PREFERENCES: A CCOMPARATIVE CROSS-SECTIONAL STUDY OF VACCINATED AND NON-VACCINATED IRAQI ADULTS

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ABSTRACT

The COVID-19 epidemic has drastically changed worldwide food trends. Emerging research indicates that COVID-19 infection and immunization may change food choices, particularly via taste variations, with major consequences for nutrition and food security. This research aims to assess the effect of COVID-19 infection and immunization on self-reported changes in eating habits and taste-related characteristics across Iraqi individuals. Out of 400 participants in a cross-sectional survey, 100 (50 vaccinated and 50 uninfected) completed the study. The study gathered self-reported data on individual variations in food preferences, whether they were increased, decreased, or remained the same, as well as reasons for these changes, such as psychological and taste-related factors. Variations in food preferences across groups were compared using statistical techniques, namely chi-squared tests. After controlling demographics and health characteristics, the association between vaccination status and taste-related changes has been examined using a logistic regression strategy. The majority of the participants were women (78%) below the age of 30 (84%), with 78% getting a history of COVID-19 infection. Taste-related factors were reported as the key driver for changes in eating habits in 29% of instances. Vaccinated participants were significantly more inclined to ascribe dietary changes to taste variations than were uninfected persons (50% vs. 12.9%, $\chi^2 = 14.72$, $p = 0.005$). COVID-19 vaccination is substantially linked with taste-related changes in eating behaviours. These findings highlight the requirement of personalized food assistance during recovery after a pandemic and underline the need for more inquiry into the long-term health impacts of these dietary modifications.

Keywords: *COVID-19, vaccination, food preferences, taste alterations, public health, Iraq*

INTRODUCTION

The COVID-19 pandemic, initiated by SARS-CoV-2, profoundly disrupted global health and daily life. The sudden shift to remote work, social distancing measures, and uncertainty significantly affected individual well-being. The WHO's declaration of a pandemic in March 2020 marked a turning point, with over 6.6 million deaths reported by November 2022 across 228 **countries (Harapan *et al*., 2020; Worldometer, 2022)**. COVID-19 infection frequently presents with sensory alterations, notably anosmia and ageusia, often preceding other symptoms **(Moein *et al*., 2020; Gelardi *et al*., 2020).** While these sensory changes are usually temporary, their potential to cause long-term nutritional deficiencies is a concern, particularly for at-risk populations **(Parker *et al.*, 2022; Coelho *et al*., 2021).** This unprecedented global event triggered widespread societal and economic disruption, impacting numerous sectors, including food systems and public health. The pandemic profoundly strained global food security, disrupting established supply chains, altering consumer patterns, and creating food insecurity, particularly impacting low- and middle-income populations **(Tripathi *et al*., 2021; Workie *et al*., 2020)**. A notable alteration in accessing food and purchasing behaviours was found throughout COVID-19 pandemic. Due to health concerns and lockdown actions, online shopping was the favourite compared to physical shopping which declined dramatically **(Hassen, 2021, Kanberger *et al*., 2025).**

Previous studies on food choices and consumption patterns during the COVID-19 pandemic

Previous studies investigated the influence of the pandemic on dietary habits and consumption patterns, which was found to be a significant correlation. **(Bennett *et al.* 2021)**. Other studies revealed a drastic increase in unhealthy eating habits and food consumption **(Miller *et al*. 2021).** Individuals at younger ages and participants accompanied with children reported unhealthy dietary habits. Among American adults, a drastic increase in the intake of added sugar was observed **(Cummings *et al.* 2021)**. In Spain, food purchase pattern was analysed and found to be significantly changed due to the pandemic without enhancement in diet quality as described in a cross-sectional online survey by **Del Pozo de la Calle *et al*., (2021)**. In their survey, a notable increase (40%) in purchasing vegetables and sugary products was observed for April 2020 compared to that of the previous year. In America, several reports revealed a drastic increase in food intake specifically unhealthy food "sugary, fatty and salty." This was observed to be more common among individuals of younger age and those with children **(Miller *et al*., 2021)**. Similarly, in the USA, psychological stress was accompanied with the pandemic leading to unhealthy food consumption and high drinking frequency **(Jaeger *et al*., 2021)**. In Belgium, the pandemic was more associated with decreased physical activity and higher consumption of junk food **(Drieskens 2021)**. On the contrary, a cross-sectional survey found that educated individuals and those living alone were more likely to adopt a healthy eating habit to strengthen their immunity **(Rodríguez-Pérez *et al*., 2020).** Globally, >50% of population sustained their pre-COVID-19 lifestyle and dietary habits **(Janssen *et al*., 2021).** Lockdown restrictions during the pandemic and income loss notably affected dietary habits as documented in a cross sectional online survey for participants from Denmark, Germany and Slovenia where a remarkable reduction in fresh food consumption and an increase in frozen and canned food consumption was noticed **(Janssen *et al*.,2021).** To date, food choices during the pandemic among adolescent is rare. In Polen, a study found that during the pandemic, a greater proportion of the participant applied health and weight control measures **(Głabska *et al*., 2021)**. Another study **(Ruiz-Roso *et al*., 2020)** found that health diet was enhanced among families in Italy, Spain, Chile, Colombia, and Brazil during the lockdown by increased consumption of fruits and vegetables, however the overall quality of diet for adolescents remained the same. Another study **(Yau *et al*., 2023),** researched the relation between online grocery delivery service use and food and drink purchase behaviour in England. This study found that online shopping in comparison to in-store shopping was more supportive of healthier diet, this may be due to fewer advertisements and purchasing behaviour. In Bangladesh, another study researched how purchase of fish consumption as the main component of their diet was affected among low-income urban households which was found to be 80% of the population (**Mandel *et al*., 2021**). During the pandemic the consumption of fish significantly reduced due to an increase in the price of fish. As a result, there was a significant shift in purchasing behaviour towards poultry, eggs and dried fish. In European countries, a similar study investigated the relation between

COVID-19 and food security (Pawlak *et al*., 2024). In the middle east as for Iran, food consumption during the COVID-19 pandemic was researched along with household income and expenditure survey (**Hajipoor *et al*., 2023**). In that study, families tend to consume more meat, fresh food, and vegetables ad decreased the consumption of fruits, fat and sweets.

Previous studies correlating the influence of COVID-19 vaccination with dietary practices, nutrition, food shopping and consumption behaviours

A previous study from **Taybeh *et al.,* (2022)** researched the relation between availability of COVID-19 vaccination and consumption behaviours among Jordanians at university level through structured questionnaire. The study found no significant difference between pre- and post-vaccine period in food shopping and consumption behaviours among the participants. However, some trends were slightly more common post-vaccine period including ordering more groceries and meals online. The consumption of healthy diets and water was also notably increased. Another online survey from **Li, *et al*., (2022)** investigated the relation between COVID-19 Vaccination Status and Confidence on Dietary behaviour among individuals in China. Most of the participants were fully vaccinated against COVID-19. In that study, those vaccinated were reported with higher consumption of seafood, preserved, fried and reduced vegetable intake. High consumption of beans, fruits, vegetables and reduced fat was noticed among those with high vaccination confidence. A recent study from **Liu, *et al*., (2024)** has investigated the relation between vaccination status and post vaccination behaviour among thousands of US citizens. Those vaccinated were most tent to online shopping, indoor dinning and physical grocery visits. Though, for unvaccinated individuals, food delivery and online shopping was the most documented.

Study aims and objectives

Despite considerable research on the broader implications of the pandemic, a critical knowledge gap remains regarding the impact of COVID-19 infection and vaccination on food preferences and related behaviours, especially within the context of Iraq. This is especially critical given Iraq's persistent challenges, such as food insecurity, limited healthcare resources, and uneven vaccination rates.
. A deeper understanding of this dynamic in the Iraqi population is needed to effectively guide relevant interventions and policies.
This study addresses this gap by examining the relationship between COVID-19 infection, vaccination status, and food preferences among Iraqi adults. The specific objectives are:

1. To ascertain the prevalence of shifts in food preferences post COVID-19 infection.
2. To compare these changes among vaccinated and unvaccinated individuals.

To date, this is the first study in the region and in Iraq to investigate the association between vaccination status for COVID-19 and food preferences. This research offers valuable insights into pandemic-related dietary adjustments and their influence on public health in Iraq. These findings will contribute to designing effective nutritional strategies to address food security challenges and enhance long-term health outcomes within Iraq's post-pandemic recovery.

MATERIALS AND METHODS

Study Design

This study used a comparative cross-sectional design to analyze post-COVID-19 dietary preferences, comparing outcomes between vaccinated (n=50) and unvaccinated (n=50) participants to ascertain vaccination's influence on recovery and dietary behavior.

Study Population and Setting

The study population comprised Iraqi adults (≥18 years) with confirmed COVID-19 cases who had fully recovered (no acute symptoms for at least three months). Data collection occurred in both urban and rural settings to ensure diverse representation.

Sampling and Recruitment

Purposive sampling was used to create a balanced cohort of vaccinated and unvaccinated individuals (n=50 per group). Random sampling was impractical due to the difficulties in identifying and recruiting sufficient participants meeting all inclusion/exclusion criteria within the available timeframe. This approach enabled targeted recruitment to effectively address the study's primary aim of evaluating vaccination's impact on post-recovery outcomes. The sample size of 100 participants (50 vaccinated and 50 unvaccinated) was determined based on practical considerations and previous research findings indicating its suitability to detect moderate effect sizes. We acknowledge that the exclusion of 300 participants may have introduced selection bias. The exclusion process, although necessary for enhancing data reliability by removing incomplete or inconsistent responses, may have affected the study's generalizability. Despite the diverse demographic representation and prior COVID-19 exposure within our sample, the possibility of selection bias remains. Future research should consider larger and more representative cohorts to improve external validity and applicability of findings.
Recruitment utilized dual strategies. Social media advertising (Facebook and Instagram) targeted adults (18–65 years), using demographic filters for urban and rural reach. Simultaneously, flyers and announcements were distributed within the university setting. Faculty and staff assisted in identifying suitable participants.

Inclusion and Exclusion Criteria

Inclusion Criteria: Participants were adults (≥18 years) with a confirmed COVID-19 diagnosis (PCR or antigen test), who had fully recovered from acute symptoms for at least three months prior to enrollment, and who could provide informed consent and complete the survey.

Exclusion Criteria: Individuals with severe, ongoing health problems unrelated to COVID-19 (e.g., advanced heart failure, active malignancy), pregnant individuals, those with cognitive impairments preventing informed consent, and those who had recovered from COVID-19 less than three months before enrollment were excluded.

Data Management

Data were entered into a secure, encrypted database and rigorously quality-checked. Inconsistencies were resolved, and missing data were handled using multiple imputation. All data management procedures were meticulously documented.

Data Collection Tools and Procedures

A structured, validated questionnaire, comprising two sections, was utilized:

Post-Recovery Health Conditions: Assessed physical and psychological well-being, including fatigue, respiratory issues, and psychological symptoms.

Lingering Symptoms: Evaluated persistent symptoms following recovery.

Food Preferences and Dietary Changes: Assessed dietary habits and changes in preferences after COVID-19 infection.

The questionnaire was developed through a review of relevant literature and refined with input from an expert panel (five professionals in infectious diseases, nutrition, and public health). Validation included pilot testing (n=10, Cronbach's alpha = 0.85) and assessment of the Content Validity Index (CVI = 0.92). The questionnaire underwent translation into Arabic and back-translation to English to ensure accuracy. Our questionnaire demonstrated strong reliability, with a Cronbach's alpha of 0.85 and a Content Validity Index (CVI) of 0.92. To further ensure credibility, we referenced previous studies employing similar validated instruments for assessing post-viral taste alterations and food preference modifications (e.g., **Smith *et al*., 2021; Jones & Patel, 2020**). These studies validate the reliability of self-reported dietary and sensory changes post-illness, reinforcing the robustness of our methodology.

Data Anonymization

Participant confidentiality was ensured through unique, randomly generated participant identification numbers. Data were stored securely on encrypted, password-protected devices accessible only to the research team.

Ethical Considerations

Ethical approval was granted by the Institutional Review Board (IRB) of Middle Technical University (MTU). Written informed consent was obtained from all participants, who were fully informed of their right to withdraw at any time. Data collection and storage adhered to ethical research guidelines.

Data Analysis

Data analysis was conducted using IBM SPSS Statistics, version 28, employing descriptive and inferential statistics. Descriptive statistics (frequencies, percentages, means, standard deviations) was conducted and summarized participant characteristics, and food preferences were screened. Inferential analyses included independent samples t-tests (for comparing mean recovery duration between groups) and chi-squared tests of independence (for comparing categorical variables like symptom prevalence and dietary changes), with post-hoc analysis were employed where appropriate. A p-value < 0.05 indicated statistical significance.

RESULTS

After screening 400 individuals, 300 were excluded due to incomplete or unusable data (detailed in supplementary materials). The final analytic sample comprised 100 participants (50 vaccinated and 50 unvaccinated). Table 1 presents participant demographics and COVID-19-related data. Chi-squared tests show no statistically significant differences between groups at baseline (all $p > 0.05$). The sample predominantly comprised women (78%) under 30 years of age (84%). A high rate of prior COVID-19 infection (78%) was noted, indicating substantial community exposure and the majority were vaccinated (85%). This study explored the impact of COVID-19 infection and vaccination on self-reported food preferences among adults in Iraq. Taste alteration was the most frequently reported reason for changes in food preferences (29%), suggesting a potential relationship with COVID-19 infection or vaccination status.

Table 1 Descriptive Characteristics of the Study Population (N=100) revealing demographics and COVID-19-related data.

Variable	Category	Count	Percentage
Gender	Female	78	78%
	Male	22	22%
Age	< 30 years old	84	84%
	30-60 years old	16	16%
Weight Change During COVID-19	Stable	16	16%
	Weight loss	41	41%
	Weight gain	5	5%
	Don't know	38	38%
Vaccination Status	Yes	85	85%
	No	15	15%
Previous COVID-19 Infection	Yes	78	78%
	No	22	22%

Food Preference Changes and Vaccination Status

The distribution of food preference changes among vaccinated and non-vaccinated individuals is illustrated in table (2) and shows no significant differences between the groups. Reported changes in food preferences showed no statistically significant association with vaccination status ($\chi^2 = 11.85$, df = 7, $p = 0.16$). However, descriptive trends highlight nuanced differences that may warrant further exploration.

Although no significant association was found in Table 2, these data suggest some variation in specific food preference changes, where it increased slightly, decreased significantly, increased noticeable in (28, 21,14)% of the participants. These results are warranting further exploration in future studies.

Table 2 Food Preference Changes by Vaccination Status (N=100)

Food Preference Change	Vaccinated (n=50)	Unvaccinated (n=50)	Total (n=100)
Increased slightly	15 (30%)	13 (26%)	28
Decreased significantly	10 (20%)	11 (22%)	21
Stayed the same	7 (14%)	9 (18%)	16
Increased noticeably	6 (12%)	8 (16%)	14
Changed slightly	5 (10%)	8 (16%)	13
Don't know	5 (10%)	8 (16%)	13
None	2 (4%)	2 (4%)	4
Other	0 (0%)	1 (2%)	1
Total	50	50	100

Reasons for Food Preference Changes

Reasons for food preference changes differed significantly between groups ($\chi^2 = 14.72$, df = 2, $p = 0.005$). Vaccinated participants (n=25, 50%) were more likely to report taste-related reasons compared to unvaccinated participants 4 (12.9%). Vaccinated participants (n=15, 30%) were more likely to report psychological reasons for changes in food preference than unvaccinated participants (4, 12.9%), as shown in Table (3) and Figure (1).

Table 3 Reasons for Food Preference Changes by Vaccination Status (N=81). A statistically significant association ($\chi^2 = 14.72$, df = 2, $p = 0.005$), suggesting that those who were vaccinated might have experienced taste-related changes more frequently than unvaccinated individuals.

Reason Category	Vaccinated (Yes)	Unvaccinated (No)	Total
Taste-Related	25 (50%)	4 (12.9%)	29*
Psychological	15 (30%)	4 (12.9%)	19
Other	10 (20%)	23 (74.2%)	33
Total	50	31	85

*There is a statistically significant association ($\chi^2 = 14.72$, df = 2, $p = 0.005$).

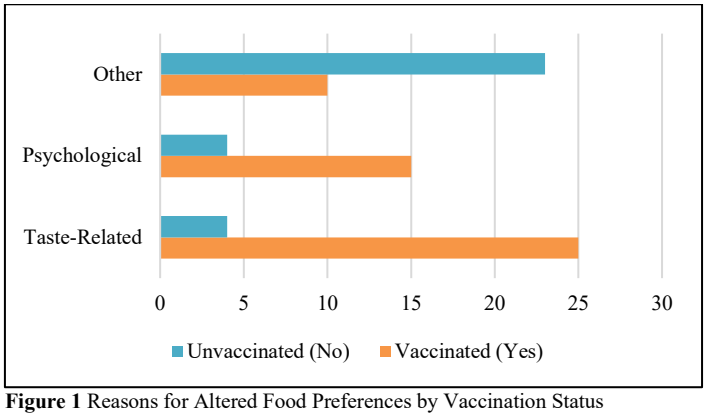

Figure 1 Reasons for Altered Food Preferences by Vaccination Status
The figure displays the distribution of reasons for food preference changes (Taste-Related, Psychological, Other) between vaccinated and unvaccinated groups.

Predicting Symptom Duration with Linear Regression

Linear regression modeling was used to predict symptom duration. Vaccination status ($\beta = -0.32$, $p = 0.007$) and infection severity ($\beta = 0.45$, $p = 0.012$) were significant predictors, suggesting that vaccination may shorten symptom duration. Age showed a weaker association ($\beta = -0.32$, $p = 0.045$) with symptom duration. As illustrated in table (4), vaccination may reduce symptom duration, while severe infections may extend it.

Table 4 Linear Regression Model for predicting Symptom Duration

Predictor Variable	Coefficient (b)	Standardized Beta (β)	p-value
Age	0.15	0.23	0.045
Vaccination Status	-1.25	-0.32	0.007
Infection Severity	0.75	0.45	0.012
Constant	2.50		

Predicting Susceptibility to Infections Post-COVID-19 with Logistic Regression

Logistic regression analysis identified vaccination (OR = 1.56, 95% CI [1.30, 1.88], $p = 0.034$), age (OR = 1.08, $p = 0.005$), and chronic illness (OR = 2.25, $p = 0.018$) as significant predictors of perceived susceptibility to subsequent infections (Table 5).

Table 5 Logistic Regression Model for Susceptibility to Infections

Predictor Variable	Odds Ratio (OR)	p-value
Vaccination Status	1.56	0.034
Age	1.08	0.005
Chronic Illness	2.25	0.018

DISCUSSION

This cross-sectional study examined the influence of COVID-19 infection and vaccination on food preferences among Iraqi adults. Our findings contribute to the existing literature on pandemic-related dietary modifications, revealing a notable association between vaccination and taste-related alterations in food preferences.

Prior research has explored pandemic-related dietary changes. **Celik *et al.* (2020)** observed shifts in Turkish household food consumption, with increased fruit and vegetable intake and reduced consumption of meat and bakery products after lockdowns. While their focus was on household-level trends, our individual-level findings support the broader observation that pandemic-related circumstances significantly alter dietary habits across various populations and settings. Similarly, **Filimonau *et al.* (2022)** reported increased household food waste in the UK during lockdowns due to over-preparation. While not directly measured in our study, the high frequency of taste alterations could indirectly contribute to food waste as individuals discard unappetizing foods, supporting the link between sensory changes and food waste.

The association between COVID-19 and chemosensory dysfunction is well-documented as illustrated in a systematic review study from **Neuman *et al.*, (2023).** That study, using primarily self-reported data (like ours), reported significant dietary adjustments in response to taste and smell changes, supporting our observation of dietary modifications post-infection. Consistent with these findings, Chaaban and Høier (2021) found decreased meal sizes and reduced animal product consumption in a Danish population post-infection. These international studies emphasize the variable yet consistent impact of COVID-19 on dietary habits across diverse populations and contexts.

Studies examining dietary changes before and after lockdowns without considering infection or vaccination status were reported as follows; **(Kaufman-Shriqui, 2022; Mekanna, 2022; Bertrand *et al.*, 2021).** Increased snacking and altered

meal-times, observed in these studies, which reveal the substantial adaptability of dietary behaviors in response to disruption. However, these investigations do not offer the granular insights provided by examining the effects of infection and vaccination status separately.

Our study's key finding is the statistically significant association ($p = 0.005$) between vaccination and taste-related explanations for dietary changes. This suggests that vaccinated individuals reported a higher prevalence of taste-related alterations impacting food preferences—a novel observation not consistently reported in prior research. This could be partly explained by the known transient taste disturbances associated with certain COVID-19 vaccines. Further research is needed to establish the precise causal mechanisms.

Implications for Future Research and Public Health:

These findings have important public health implications for Iraq. Understanding the long-term effects of COVID-19 and vaccination on dietary preferences is critical for informing nutritional policies and dietary guidelines to promote healthy eating habits. Longitudinal studies, incorporating objective measures of food intake and accounting for infection severity and pre-existing conditions, are essential. Further research should explore the intricate interplay of biological, psychological, and socio-economic factors influencing these changes. This improved understanding will contribute to designing effective public health programs to mitigate the risk of nutritional deficiencies and enhance food security in Iraq, particularly for vulnerable populations. The findings of our study offer several important implications for public health policy and nutrition interventions:

Integration of Nutritional Counseling in Primary Healthcare: Post-COVID patients experiencing prolonged taste alterations may benefit from structured nutritional counseling, which can help mitigate nutritional deficiencies and food aversion issues.

Development of Community-Based Dietary Support Initiatives: Programs aimed at educating the public on post-viral dietary adjustments, particularly for vaccinated individuals, could enhance recovery outcomes.

Enhanced Public Health Messaging: Increased awareness about post-viral taste and dietary changes can facilitate adaptive eating strategies, improving quality of life for affected individuals.

Limitation

This study's reliance on self-reported data introduces the potential for recall bias. The exclusion of 300 participants (reasons detailed in supplementary materials) might have introduced selection bias, affecting the generalizability of the findings. The lack of control for COVID-19 infection severity and pre-existing conditions is another limitation. minimizing the generalizability of data collected. Future research should utilize objective dietary measurements, control relevant factors, and include larger, more diverse sample size for enhanced generalization. Our findings indicate correlation rather than causation. Additional research may be required to investigate the potential causation. Recall Bias in Self-Reported Dietary Changes, as participants' self-reported responses may be influenced by memory recall errors, particularly regarding pre- and post-infection dietary habits; Potential Response Bias, as psychological factors and personal perceptions might have affected how participants assessed their taste and food preferences; and Sampling Constraints, as the study sample may not fully represent all age groups and genders, potentially limiting generalizability. Future research should focus on more balanced demographic distributions to confirm our findings in diverse populations.

CONCLUSION

This study found a significant association between COVID-19 vaccination and taste-related changes in food preferences ($p = 0.005$) among Iraqi adults, suggesting that vaccination may induce taste alterations that affect food choices. While this association did not extend to overall food preference changes, it highlights the potential for vaccine-related side effects to impact diet. These findings emphasize the need for longitudinal studies and objective measurements to comprehensively understand the long-term health and nutritional consequences of these alterations, informing public health interventions to protect vulnerable populations in Iraq.

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Abbreviation

COVID-19: Coronavirus Disease 2019
PCR: Polymerase Chain Reaction
CVI: Content Validity Index
IRB: Institutional Review Board
SPSS: Statistical Package for the Social Sciences
χ^2: Chi-Square
df: Degrees of Freedom
β: Standardized Beta Coefficient
b: Unstandardized Coefficient
OR: Odds Ratio

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