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# Food insecurity and anxiety in the Israel-Gaza War of 2023-2024

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**ABSTRACT**

**Background:** Armed conflict can disrupt food production and distribution, leading to food insecurity. It can also lead to displacement, interfere with typical food preparation, cause psychological stress, and deteriorate diet quality.

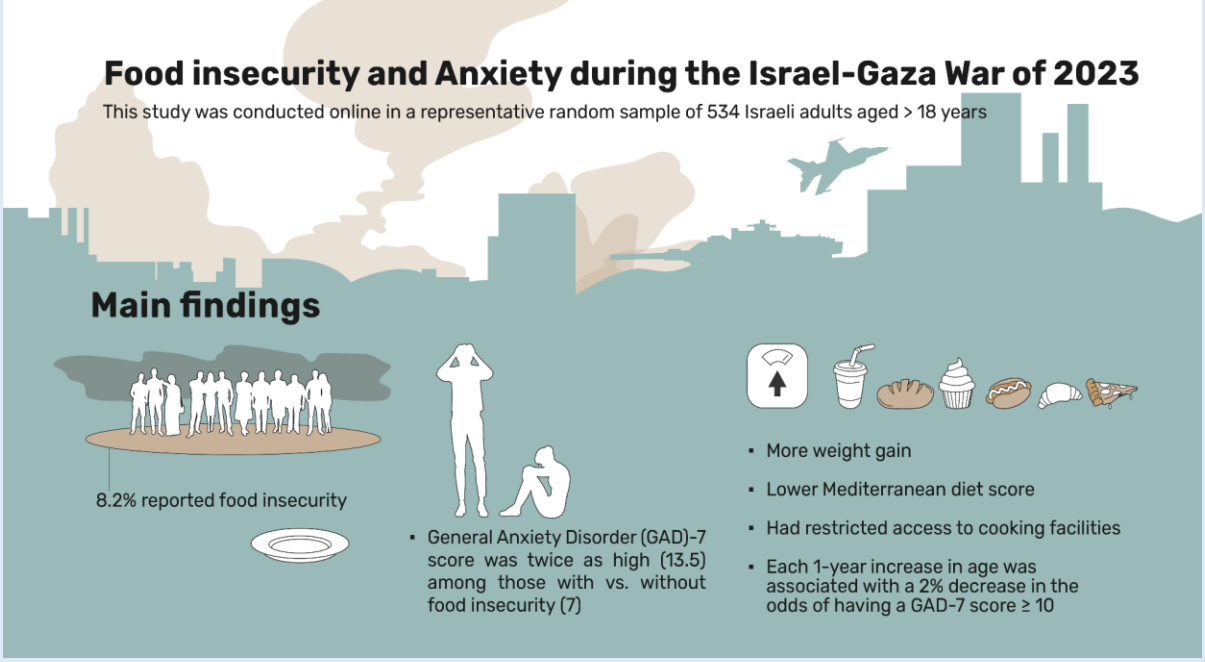
**Objectives**: The present cross-sectional study was designed to estimate food insecurity prevalence and its association with anxiety and diet quality measures during the ongoing Israel-Gaza war.

**Methods**: This study was conducted online in a representative random sample of Israeli adults aged > 18 years. Food insecurity was assessed using the two-question Hunger Vital Sign questionnaire. Anxiety was measured using the General Anxiety Disorder (GAD)-7 screener. Diet quality was measured using the Israel Mediterranean Diet Scale (I-MEDAS).

**Results**: The study population included 534 Israeli adults, of which 44 (8.2%) reported food insecurity. Food-insecure respondents were younger; had fewer years of education; were less likely to be Jewish; were more religious; reported more weight gain and a greater deterioration of diet quality; and had more restricted access to cooking facilities since the war began. The GAD-7 score was 13.5 (10.75) in people with vs. 7 (9) in people without food insecurity, $p<0.001$. Anxiety was a robust predictor of food insecurity even after controlling for age, sex, and religion.

**Discussion**: In this novel examination of food patterns and emotional outcomes during a period of armed conflict, food insecurity was associated with increased anxiety, deteriorating diet quality, and weight gain, suggesting that public health interventions should include both nutrition and mental health components during periods of war.

**Keywords**: food insecurity; armed conflict; diet quality

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## INTRODUCTION

Food security as defined by the World Food Summit exists "…when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (1). Thus, if any of the abovementioned elements are lacking, the risk of food insecurity can be said to exist.

It has been estimated that approximately two billion people worldwide experience food insecurity annually (2). Food insecurity is associated with such economic precipitators as unemployment, low-income, and single-parent households (3). Social factors associated with food insecurity include race/ethnicity, low education levels, discrimination, and disability (4). Geographical factors including limited access to grocery stores and/or food markets and lack of public transportation can contribute to food insecurity by physically barring access to appropriate foods or by increasing food costs to the point that food becomes difficult (5). Environmental factors such as severe weather events and natural disasters can destroy crops and lead to price fluctuations that prohibit access to healthy foods (6).

Food insecurity impacts human health. It has been proposed that by altering dietary intake, food insecurity can increase the risk for obesity and related chronic

diseases including diabetes and can worsen management of existing chronic diseases (7). Not surprisingly, food insecurity has been associated with psychological stress, depression and anxiety (8, 9). Psychological stress and anxiety can activate the hypothalamus-pituitary-adrenal axis, precipitating the release of cortisol, neuropeptide Y, and other neuropeptides (10), motivating consumption of calorie-dense foods (11). Often, food insecure individuals adopt strategies in which they substitute less expensive processed foods for more expensive foods such as protein sources, fruits, vegetables and dairy products. This practice reduces micronutrient intake and increases intake of saturated and trans fats (12).

Anxiety is characterized by feelings of distress, fear and dread. These negative emotions are future-oriented and do not reflect an immediate trigger. Importantly, anxiety is a relatively common disorder and can culminate in disability (13). Periods of uncertainty, such as pandemics, can increase anxiety in populations. Indeed, the COVID-19 pandemic was associated with a more than 7-fold increase in anxiety in Brazil (14). In an international study, associations between anxiety and worsening diet quality measured using the Mediterranean Diet Score were observed during the COVID pandemic (15).

The Israel-Gaza War (Iron Swords) is a population-level event that, despite its great tragedy, enables an examination of associations between anxiety and other factors during a stressful situation. Thus, the present report examines associations between food insecurity, anxiety and diet quality during the Israel-Gaza War (Iron Swords) that began on October 7, 2023, and is presently ongoing.

## MATERIALS AND METHODS

**Study Design***:* Conducted online in a representative sample of Israeli adults, the present cross-sectional survey simultaneously assessed the degree to which food insecurity was associated with changes in dietary habits compared to pre-war patterns; anxiety measured using the General Anxiety Disorder (GAD) 7 questionnaire; food quality, assessed using the Israel-Mediterranean diet screener (I-MEDAS); and demographic characteristics.

**Ethics:** The study was approved by the Institutional Ethics Board of Ariel University, Israel (approval number AU-HEA-MB-20231105, November 5, 2023).

**Study Location:** The survey was managed on an online Google Survey platform by Sekernet, a company specializing in logistics and technical supervision of survey research.

**Study Population:** The study population was a representative random sample of Israeli adults who indicated their age as 18 years or older and who provided informed consent by clicking the appropriate button.

**Inclusion criteria:** All Israeli adults who indicated their age as 18 years or older, and who provided informed consent by clicking on the appropriate button, were included. Survey recruitment and data collection were halted when > 500 responses were accrued.

**Exclusion criteria***:* Survey respondents who did not provide informed consent by clicking on the appropriate button and those who indicated their age was younger than 18 years could not proceed with the survey and thus were excluded.

**Study Procedures:** Sekernet recruited a representative, random sample of Israeli adults aged 18 years or older. Participant recruitment continued until the final number of >500 participants was reached. Sekernet de-identified all data prior to transferring the survey-generated dataset to investigators.

**Data Acquisition and Survey Characteristics:** Collected in the framework of the survey were the following data: 1) demographic information: age; sex; country of residence; level of education; ethnicity (religion); religiosity; family status; 2) food insecurity (Hunger Vital Sign 2-question food insecurity screening tool) (16); 3) anxiety questionnaire (General Anxiety Disorder (GAD)-7) (17); and 4) nutrition questionnaire (change in the present vs. pre-war diet questions; Israel Mediterranean Diet Screener (I-MEDAS) (18). As stated, the dataset was thoroughly de-identified by Sekernet prior to transferring it to the investigators.

**Statistical Analysis:** Data was stored on an Excel spreadsheet and analyzed on SPSS Statistical Analysis Software v29. The Kolmogorov-Smirnov test was used to assess the normality of continuous variables. Because none of the continuous variables were normally distributed, they were described as median (interquartile range (IQR)). Nominal variables were presented as n (%). Food insecurity was considered present if the subject answered "yes" to either of the two Hunger Vital Sign questions. Continuous variables were compared by food insecurity using the Mann-Whitney U test. Nominal variables were compared by food insecurity using the chi-square test. Food insecurity was modeled using binary logistic regression analysis. All analyses were intention-to-treat, and all tests were two-sided and considered significant at $p<0.05$.

**Sample Size and Study Power:** The present study was powered to include 500 participants, which provided 95% confidence level and a confidence limit of 4.4% for the survey.

## RESULTS

The study population was comprised of 534 Israeli adults aged 18 years or older. Of these, 44 (8.2%) answered "yes" to one or both food insecurity screening questions on the Hunger Vital Signs questionnaire, defining them as food insecure.

Displayed in Table 1 are characteristics of the study population by food insecurity. Participants without food insecurity were almost a decade older than those with food insecurity. Sex, marital status, number of children and region of residence did not differ by food insecurity. Religion differed by food insecurity such that fewer Jews but more non-Jews, particularly Muslims and Druze, reported food insecurity. Food insecurity was more prevalent among participants who described their religiosity as traditional, religious, or ultra-religious people than among people who described themselves as secular. People with fewer than 12 years of education, high school completion or a professional license reported food insecurity more frequently than people with a bachelor's degree or higher.

**Table 1.** Study population demographic characteristics by food insecurity

| Characteristic | Not food insecure (n=490) | Food insecure (n=44) | p-value |
|---|---|---|---|
| Age (years, median (interquartile range)) | 40 (24) | 31 (14) | 0.001 |
| Sex n (% female) | 254 (51.8) | 25 (56.8) | 0.526 |
| Family status n (%) | | | |
| Married/domestic partnership | 315 (64.3) | 28 (63.6) | 0.855 |
| Single | 128 (26.1) | 13 (29.5) | |

| Characteristic | Not food insecure (n=490) | Food insecure (n=44) | p-value |
|---|---|---|---|
| Divorced | 42 (8.6) | 3 (6.8) | |
| Widowed | 5 (1.0) | 0 (0.0) | |
| Children in the household < 18 years of age (median (interquartile range)) | 0 (2) | 0 (2) | 0.751 |
| The region of your residence on October 7, 2023 (n (%)) | | | |
| Central Region (excluding Tel Aviv) | 119 (24.3) | 5 (11.4) | 0.134 |
| Northern Region | 51 (10.4) | 4 (9.1) | |
| Tel Aviv | 40 (8.2) | 6 (13.6) | |
| Southern Region | 80 (16.3) | 3 (6.8) | |
| Jerusalem | 55 (11.2) | 8 (18.2) | |
| Carmel Region (excluding Haifa) | 29 (5.9) | 2 (4.5) | |
| Judea and Samaria | 86 (17.6) | 10 (22.7) | |
| Mixed city (i.e., Haifa, Lod, Ramleh) | 7 (1.4) | 1 (2.3) | |
| Southern Triangle (i.e., Jaljulia, Taibeh) | 16 (3.3) | 2 (4.5) | |
| Northern Trianle (i.e.,Um al Fahem, Kfar Kara) | 6 (1.2) | 3 (6.8) | |
| Outside of Israel | 1 (0.2) | 0 (0.0) | |
| Religion n (%) | | | |
| Jewish | 406 (82.9) | 27 (61.4) | 0.002 |
| Muslim | 43 (8.8) | 11 (25.0) | |
| Christian | 23 (4.7) | 3 (6.8) | |
| Druze | 11 (2.2) | 3 (6.8) | |
| Other | 7 (1.4) | 0 (0.0) | |
| Religiosity n (%) | | | |
| Secular | 277 (46.3) | 10 (22.7) | 0.025 |
| Traditional | 153 (31.2) | 20 (45.5) | |
| Religious | 73 (14.9) | 10 (22.7) | |
| Ultra-religious | 37 (7.6) | 4 (9.1) | |
| Education n (%) | | | |
| Fewer than 12 years | 2 (0.4) | 2 (4.5) | 0.003 |
| High school diploma/matriculation | 41 (8.4) | 6 (13.6) | |
| Professional license (technician, tradesperson, etc.) | 91 (18.6) | 14 (31.8) | |
| Bachelor’s degree | 133 (27.1) | 10 (22.7) | |
| Master’s degree or higher | 133 (27.1) | 8 (18.2) | |
| Other | 90 (18.4) | 4 (9.1) | |

Table 2 presents the characteristics of the study population relating to the impact of the war. Almost four times as many people with an immediate family member or close relative wounded at the beginning of the war reported food insecurity. Food insecurity was more frequently reported by people who were displaced by the war and living elsewhere at the time of the survey.

**Table 2.** Study population characteristics regarding October 7, 2023 Attack by food insecurity

| Characteristic | No food insecurity (n=490) | Food insecurity (n=44) | p-value |
|---|---|---|---|
| Were you in an area that was directly attacked by Hamas on October 7, 2023? (percent answering yes, n (%)) | 58 (11.8) | 9 (20.5) | 0.101 |
| Do you have an immediate family member or close relative who was killed on October 7, 2023? (percent answering yes, n (%)) | 29 (5.9) | 6 (13.6) | 0.058 |
| Do you have an immediate family member or close relative who was wounded on October 7, 2023? (percent answering yes, n (%)) | 12 (2.4) | 4 (9.1) | 0.035 |
| Do you have an immediate family member or close relative currently serving in the army? (percent answering yes, n (%)) | 255 (52.0) | 23 (52.3) | 0.976 |
| Residence since October 7, 2023, n (%) | | | |
| Home | 456 (93.1) | 33 (75.0) | <0.001 |
| Relocated by army/government (i.e., hotel, field school) | 4 (0.8) | 4 (9.1) | |
| Staying with relatives/friends | 20 (4.1) | 6 (13.6) | |
| Other | 10 (2.0) | 1 (2.3) | |

Shown in Table 3 are the lifestyle and dietary characteristics of the study population. Compared to people without food insecurity, people with food insecurity engaged in half the minutes per week of physical activity; however, time spent on physical activity was lower than recommendations in both groups. The amount of time spent on physical activity declined in both groups during the war and the difference between groups was no longer significant. The pattern of weight change since the onset of the war differed between people with vs without food insecurity. Stable weight (no gain or loss compared to before the war) was more frequently reported in people without food insecurity, while. weight gain was more frequently reported in people with food insecurity. Moreover, the amount of weight gained was marginally greater in the food insecure group. Though cooking facilities were available for the majority of respondents, more people with food insecurity reported having no access to cooking facilities, likely due to displacement from their homes.

Also shown in Table 3 are changes in food-associated behaviors and habits. More people with food insecurity reported that the quality of their diets had declined since the war began. Consistent with this, more people with food insecurity reported consuming more snacks since the onset of the war. The difference in the I-MEDAS score was not detected between respondents by food insecurity.

**Table 3.** Lifestyle and dietary characteristics of the study population by food insecurity

| Characteristic | No food insecurity (n=490) | Food insecurity (n=44) | p-value |
|---|---|---|---|
| Minutes of exercise/week prior to war (median (IQR)) | 60 (160) | 30 (55) | <0.001 |
| Minutes of exercise/week in the past week (median (IQR)) | 50 (120) | 17.5 (74) | 0.051 |
| Present smoker (at least one cigarette smoked per day) n (%) | 126 (25.7) | 15 (34.1) | 0.227 |
| Weight change since the start of war n (%) | | | |
| No weight change | 188 (38.4) | 6 (13.6) | 0.004 |
| Yes, weight gain | 156 (31.8) | 24 (54.5) | |
| Yes, weight loss | 62 (12.7) | 7 (15.9) | |
| Don't know | 84 (17.1) | 7 (15.9) | |
| Quantity of weight change among those reporting change (in kg) | | | |
| Weight gained (median (IQR)) | 3 (2) | 4.5 (3.8) | 0.050 |
| Weight lost (median (IQR)) | -3 (1.5) | -3 (2) | 0.314 |
| Has cooking facilities as present location (n (%)) | 473 (96.5) | 36 (81.8) | <0.001 |
| Change in diet quality n (%) | | | |
| No difference | 261 (53.3) | 12 (27.3) | <0.001 |
| Healthier prior to the war | 101 (20.6) | 16 (36.4) | 0.016 |
| Less structure now | 106 (21.6) | 11 (25.0) | 0.605 |
| More snacks now | 91 (18.6) | 14 (31.8) | 0.034 |
| Fewer fruits/vegetables now | 58 (11.8) | 6 (13.6) | 0.725 |
| Healthier now during the war | 24 (4.9) | 3 (6.8) | 0.578 |
| MedDiet Score (median (IQR)) | 8 (3) | 7 (3) | 0.092 |

Table 4 displays the anxiety scores as measured by the GAD-7, by food insecurity. Respondents are asked to refer to the two weeks preceding the GAD-7 administration when answering the questions. Each item on the scale is scored as follows: 0 (not at all), 1 (several days), 2 (more than half of the days) 3 (nearly every day); thus, the total score can receive a value from 0-21, The total GAD-7 score was elevated in the total study population and significantly higher in people with vs. without food insecurity. On each item in the questionnaire, people with food insecurity scored significantly higher than those without food insecurity.

The GAD-7 score can be categorized as follows: 0-4= minimal anxiety; 5-9=mild anxiety; 10-14=moderate anxiety; and ≥ 15 = severe anxiety. The distribution of the categorized GAD-7 scores differed significantly by food insecurity such that minimal and mild anxiety were less frequent, but severe anxiety was more frequent in people with food insecurity.

**Table 4.** Anxiety Measures by food insecurity

| Characteristic | Not food insecure (n=490) | Food insecure (n=44) | p-value |
|---|---|---|---|
| Total GAD-7 Score (median (IQR)) | 7.0 (9.0) | 13.5 (10.8) | <0.001 |
| GAD-7 score (median (IQR))* | | | |
| Feeling nervous, anxious or on edge | 1.0 (1.0) | 2.0 (2.0) | 0.022 |
| Not being able to stop or control worrying | 1.0 (2.0) | 2.0 (2.0) | <0.001 |
| Worrying too much about different things | 1.0 (1.0) | 2.5 (2.0) | <0.001 |
| Trouble relaxing | 2.0 (2.0) | 2.0 (2.0) | <0.001 |
| Being so restless that it is hard to sit still | 1.0 (1.0) | 1.0 (2.0) | <0.001 |
| Becoming easily annoyed or irritable | 1.0 (2.0) | 2.0 (2.0) | <0.001 |
| Feeling afraid as if something terrible might happen | 1.0 (1.0) | 2.0 (2.0) | 0.003 |
| Categorized GAD-7 score n (%) | | | |
| Minimal anxiety (GAD-7 score 0-4) | 149 (30.4) | 6 (13.5) | <0.001 |
| Mild anxiety (GAD-7 score 5-9) | 157 (32.0) | 10 (22.7) | |
| Moderate anxiety (GAD-7 score 10-14) | 95 (19.4) | 9 (20.5) | |
| Severe anxiety (GAD-7 score ≥ 15) | 89 (18.2) | 19 (43.2) | |

**The GAD-7 scale asks the respondent to refer to the two weeks prior to the survey. Each item on the scale can receive is scored as follows: 0 (not at all), 1 (several days), 2 (more than half of the days) 3 (nearly every day); thus, the total score can receive a value from 0-21.*

Shown in Table 5 is the dichotomized I-MEDAS score for each item in the questionnaire. While the total I-MEDAS score did not differ by food insecurity, the adherence with each of the items in the scale was assessed. Adherence with an item was given a score of 1 (adherence) or 0 (no adherence). Thus, the percentage of the study population in each group was compared by food insecurity. Compared to people without food insecurity, a smaller percentage of respondents with food insecurity consumed less than one serving of butter/margarine/cream per day; less than one sugar-sweetened beverage per day; or less than less than two servings of savory baked goods per week. By contrast, a smaller percentage of people without food insecurity consumed fewer than three servings of sweet baked goods per week compared to people with food insecurity.

**Table 5.** Adherence to I-MEDAS items by food insecurity

| | % receiving a point for the item | | |
|---|---|---|---|
| I-MEDAS items | Not food insecure (n=490) | Food insecure (n=44) | p-value |
| Uses Olive Oil as Main Culinary Fat | 302 (61.6) | 26 (59.1) | 0.740 |
| Eats poultry/white meat more than red meat | 359 (73.3) | 29 (65.9) | 0.294 |
| At least two vegetable servings/day | 220 (46.0) | 18 (40.9) | 0.514 |
| Three or more fruit servings/day | 62 (12.7) | 6 (13.6) | 0.851 |

| | % receiving a point for the item | | |
|---|---|---|---|
| Less than one butter/margarine/cream servings/day | 289 (59.0) | 17 (38.6) | 0.009 |
| Less than one sugar-sweetened beverages/day | 290 (59.2) | 13 (29.5) | <0.001 |
| Three or more whole grain servings/day | 99 (20.2) | 11 (25.0) | 0.451 |
| Two or more unsweetened dairy servings/day | 257 (53.2) | 22 (50.0) | 0.683 |
| Fewer than seven red/processed meat servings/week | 468 (95.5) | 41 (93.2) | 0.484 |
| Seven or more alcoholic beverages/week | 11 (2.2) | 1 (2.3) | 0.990 |
| Three or more legume servings/week | 134 (27.4) | 12 (27.3) | 0.985 |
| Three or more fish servings/week | 61 (12.5) | 6 (13.6) | 0.824 |
| Three or more nut servings/week | 142 (29.0) | 13 (29.5) | 0.937 |
| Three or more hummus/tahina servings/week | 182 (37.1) | 16 (36.4) | 0.918 |
| Fewer than three sweet baked goods servings/week | 201 (41.0) | 25 (56.8) | 0.042 |
| Fewer than two savory baked goods servings/week | 402 82.0) | 30 (68.2) | 0.025 |
| Three or fewer salty snacks servings/week | 412 (84.1) | 33 (75.0) | 0.122 |

*Variables are presented as median (interquartile range)*

Food insecurity was modeled using logistic regression in Table 6. Each 1-year increase in age was associated with a 3% (95% confidence interval (95% CI 0.6%-5.2%) reduction in the odds of food insecurity. Jewish religion (as opposed to any other religion) was associated with a 61.7% (95% CI 25%-80.5%) reduction in odds of food insecurity. Each one-point increase in the GAD-7 score was associated with a 12.6% increase in the odds of food insecurity, 95% CI 6.2%-19.3%). Consuming less than one serving per day of butter/margarine/cream (receiving a point on the I-MEDAS for this item) was associated with 52.6% (95% CI 8.2%-75.5%) relative reduction in odds of food insecurity. While sex was not significantly associated with the odds of food insecurity, it was retained in the model to control for its potential influence as a universal confounder. The model was significant (p<0.001) and correctly categorized 91.9% of study participants for food insecurity.

**Table 6.** Multivariable Logistic Regression Model of Food Insecurity

| Variable | Odds Ratio | 95% Confidence Interval | p-value |
|---|---|---|---|
| Age (years) | 0.973 | 0.948-0.994 | 0.040 |
| Sex (Male=1) | 1.662 | 0.818-3.375 | 0.160 |
| Religion (Jewish=1 vs. all other religions) | 0.383 | 0.195-0.753 | 0.005 |
| Total GAD-7 score | 1.126 | 1.062-1.193 | <0.001 |
| Consumes < 1 serving butter/margarine/cream per day (1=yes) | 0.474 | 0.245-0.918 | 0.027 |
| Constant | -1.776 | | 0.013 |

Generalized Anxiety Disorder score, GAD-7. Indicators for variables received a value of 1. Indicators were: male sex (vs. female); Jewish (vs. any other religion); consumes < 1 serving per day of butter/margarine/cream. The model was significant (p<0.001) and correctly classified 91.9% of study participants for food insecurity as measured by the two-question Hunger Vital Sign screener.

## DISCUSSION

Armed conflict can contribute to food insecurity by damaging food production and distribution, leading to increased scarcity and elevated food prices (19). In its most severe form, food scarcity can lead to starvation, which has been weaponized historically, leading to political suppression and even genocide of populations (20). A recent example of this occurred in the Artsakh region (Nagorno-Karabakh) in the armed conflict between Azerbaijan and the Republic of Artsakh, during which time Azerbaijan blockaded Artsakh, thus cutting off this area from access to vital resources, including food and medicine (21). In addition to the direct catastrophic effects of food deprivation, food insecurity and scarcity can adversely impact human immune function, leading to increased susceptibility to infectious diseases, as was observed in the Artsakh region during the COVID-19 pandemic (22).

Armed conflict has been shown to contribute to food insecurity in other regions as well. For example, a study from war-torn Tigray, Ethiopia, found that food insecurity access and experience had each increased by more than 40% and hunger had increased by more than 30% from pre-war levels (23). Armed conflict in one part of the world can disrupt food security in other parts of the world. For example, the war between the Ukraine and Russia has adversely impacted food security in Lebanon by increasing food prices, leading to less diverse dietary patterns, reducing food purchases and consuming fewer meals each day. Food insecurity was reported by 74% of Lebanese households, even prior to the present armed conflict there (24).

By contrast, the estimated prevalence of food insecurity in the present study was 44 out of 534 participants (8.2%), measured in a representative random sample of Israeli adults during a time of war. This is almost half the rate estimated by the Israeli National Insurance Institute (INII), which last measured food insecurity in 2021, during the COVID-19 pandemic, and reported a 16.2% prevalence rate nationally (25). The large disparity in prevalence estimates between the present study and the INII estimates may be attributable to differences in the method used to measure food insecurity; specifically, the present study used a self-administered, two-question Hunger Vital Signs questionnaire, while the INII study used a longer and more complex questionnaire based on the USDA method but adapted for Israel (26). This questionnaire included items on consuming a balanced diet and not buying special foods due to financial constraints. By including subjective concepts such as “balanced diet” and “special foods,” the longer questionnaire may capture elements of food insecurity not included in the Hunger Vital Sign questionnaire. Nevertheless, the characteristics of study participants with food insecurity in the present survey were consistent with previous reports of food insecurity in Israel. The present study identified increased food insecurity prevalence in non-Jewish respondents, those who described themselves as more religious, and younger respondents (27). Another possible influence on food insecurity prevalence estimates may be the data acquisition method used. The current study was conducted online, perhaps excluding individuals at greater socioeconomic disadvantage, leading to an underestimate of food insecurity. The INII study data was acquired through in-person interviews. This method may introduce social desirability bias but may also permit access to participants excluded by an online method. On the other hand, it has been estimated that more than 90% of Israeli households have access to the internet (28).

Anxiety was a frequent finding in the study population (71% had GAD-7 scores consistent with mild anxiety or worse), perhaps not surprising during a war. Anxiety was measured in Israeli adults using GAD-7 during the 2020 COVID-19 lockdowns, another period of

population-wide stress (29). At that time, the median GAD-7 score was 5 (8), significantly lower than the GAD-7 scores measured in the current study in people with (13.5 (10.75), p<0.001) or without (7 (9), p<0.001) food insecurity I-MEDAS scores were also measured during COVID-19 lockdowns The median score at that time was 9 (3), significantly greater than scores in the present study in people with (7 (3), p<0.001) or without (8 (3), p<0.001) food insecurity. This suggests that food insecurity exacerbated an already stressful event and was associated with reduced diet quality.

Associations between anxiety and food insecurity have been investigated previously, most recently during the COVID-19 pandemic. For example, a study in Brazil identified a positive association between food insecurity measured using the Brazilian Food Insecurity Scale, and anxiety measured using the GAD-7, during the COVID-19 pandemic. Associations were stronger among women, racial minorities and low-income individuals (9). In a study including more than 8000 participants conducted in the US during the post-lockdown period of the COVID-19 pandemic, food insecurity was measured using the six-item US Household Food Security Screener Module Short Form and anxiety was measured using a dichotomized version of the Patient Health Questionnaire-4 anxiety subscale. People with food insecurity were significantly more likely to report anxiety than people without food insecurity (30). Food insecurity was positively associated with anxiety among mothers in Iran in the post-COVID era. Food insecurity was measured using the Household Food Insecurity Access Scale, and anxiety was measured using the Depression Anxiety Stress Scale. Approximately half of the study population was food insecure, and in this group, 91.4% of participants reported anxiety, compared to 61.3% in the group without food insecurity (31).

In addition to anxiety, food insecurity was associated with a deterioration in diet quality. A greater percentage of people with vs. without food insecurity reported worse diet quality at present compared to before the war. A greater percentage of individuals with food insecurity also reported consuming more snacks currently compared to the pre-war diet. Weight gain was reported by a greater percentage of people with food insecurity, and the amount of weight gained since the beginning of the war was marginally greater in people with food insecurity. Total I-MEDAS scores did not significantly differ by food insecurity; however, specific I-MEDAS items did. A smaller percentage of people with food insecurity reported consuming less than one serving per day of butter/margarine/cream; less than one serving per day of sugar-sweetened beverages; or fewer than two servings per week of savory baked goods.

A striking difference between those with vs. without food insecurity was the location of their residence since the beginning of the war. A significantly greater percentage of people with food insecurity had been relocated from their homes to other localities, including hotels and field schools, and had no cooking facilities at their disposal. Lack of cooking facilities has been cited previously as a factor associated with food insecurity, for example among Norwegian university students (32), migrant farm workers in the US (33), and Australian adults (34). Lack of cooking facilities has been associated with greater consumption of convenience and takeaway foods, and these foods are of poorer nutrition quality than home-prepared meals (35).

The findings of this study must be considered in light of its limitations. While the study population was a representative random sample of Israeli adults, the study population may underrepresent soldiers. In addition to younger people currently completing their mandatory military service, people called up to military reserve duty may be underrepresented in the sample. It is difficult to predict the influence of this potentiality, but it must be noted that individuals serving in the war in any combat capacity have little control over their food intake. While

the food served may not be their preferred food items, it would certainly be nutritionally adequate.

The anonymity of the survey method undoubtedly reduced social desirability bias; nevertheless, it may have been present, influencing responses to the two-question Hunger Vital Sign food insecurity questionnaire, likely leading to an underestimation of food insecurity in the study population. Indeed, food insecurity prevalence was considerably lower in the present study than national estimates. Similarly, this bias may have led to an underestimation of weight change and other diet-associated behaviors. Taken together, these underestimations may have led to an underestimation of the association between food insecurity and anxiety during armed conflict.

Only 44 individuals reported food insecurity. This precluded by-ethnicity, by-region, and other subgroup analyses within the group with food insecurity. Based on prior reports, it had been assumed that the percentage of participants with food insecurity would be almost twice the observed prevalence.

Another limitation is the cross-sectional study design. Because exposure and outcome are measured simultaneously, the assignment of causality cannot be made. In this case, it is not clear whether food insecurity increased anxiety, or whether anxiety, by impairing cognitive executive functions and leading to poorer food decisions (36), led to food insecurity.

## CONCLUSIONS

The novelty of this research lies in its focus on the interrelationships between armed conflict, diet quality, food insecurity and anxiety. This study identified a robust association between anxiety and food insecurity, that persisted after controlling several potential confounders. Consuming more than the recommended less than one serving per day of butter/margarine/cream, which can be viewed as a marker of poor diet quality, was also significantly associated with increased risk of food insecurity. Despite these findings, causality cannot be assigned due to the cross-sectional study design. During periods of armed conflict, public health interventions should be particularly attentive to populations with food insecurity and/or anxiety, due to the persistent association between them.

**Abbreviations:** General Anxiety Disorder – 7; GAD-7, Israel Mediterranean Diet Scale; I-MEDAS, Interquartile Range ; IQR, Confidence Interval; CI, Israeli National Insurance Institute; INII, United States Department of Agriculture; USDA

**Ethics Statement:** The study was approved by the Institutional Ethics Board of Ariel University, Israel (approval number AU-HEA-MB-20231105, November 5, 2023). No survey respondent participated in the study without providing informed consent. Informed consent was indicated by clicking on the appropriate button at the start of the survey, and individuals who did not do so could not proceed with the survey.

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