



**Assessing the impact of food insecurity on the nutritional status of
Lebanese adults during the economic crisis**

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Abstract:

Objective: The study's aim is to determine the impact of food insecurity on the nutritional status of Lebanese adults during the ongoing economic crisis in 2020-2021. **Design:** cross-sectional. **Setting:** random regions from all around Lebanon. **Participants:** 89 Lebanese adults between the ages of 40 and 60. **Methodology:** Diets, personal information, economic status, food insecurity status and nutritional status were all collected via a survey on Google forms. The FFQ was used to assess the diets of the participants, it consisted of 28 food items developed by An et al (2018) and adjusted based on the Lebanese diet. Personal information included age, marital status & educational level. Economic status assessment was done by determining the income level and assets of the participants. Food insecurity was assessed using the Household food insecurity access scale (HFIAS) authenticated by Hawalla et al (2015). The HFIAS included nine questions that can assess food security in households globally. Nutritional status was assessed by the NRS-2002 questionnaire that can pinpoint undernourished individuals and individuals at risk of under nutrition, it includes questions about the BMI, and weight loss, in addition it contains a grading system for the severity of diseases as a reflection of increased nutritional requirements (Kondrup et al, 2002). **Results:** The data was analyzed using SPSS. Approximately one third (38.6%) of the participants had a monthly income between 1 and 3 million LBP they consisted 38.6% and 29.5% of the participants had a monthly income of less than 1000000 LBP. When it comes to food security results were alarming, as the percentage of the participants who worried about food availability was 43.7%, the percentage of the participants who did not have to consume food they disliked was 44.8%, the percentage of the participants of the participants or their family members had to sleep hungry was 33% and the percentage of the participants who couldn't access food at all for 24 hrs at some point was 19.5%. The NRS-2002 score showed that 29.3% of the

participants were moderately malnourished. **Conclusion:** This study showed that there is a high prevalence of food insecurity and malnutrition among the Lebanese population.

Literature review:

In the past few years, access to adequate food has been identified as a fundamental human right (Costa et al, 2017). With the most recent Arab uprisings, affected nations, including Lebanon, have been failing to provide food as a basic fundamental human right to its population thus increasing the risk of food insecurity (Makdisi,2017). As stated by Gunderson & Ziliak (2015), food insecurity is defined as limited access, availability and utilization of appropriate, safe and nutritious food hence the individual fails to meet his dietary needs.

Experience of food insecurity affects the dietary intake of the population both qualitatively and quantitatively leading to macronutrient and micronutrient deficiencies (Gunderson & Ziliak 2018). As such, it has been observed that individuals suffering from food insecurity are more prone to be deficient in macronutrient intake and therefore tend to be undernourished (Gunderson & Ziliak 2015). A study conducted by Mohamadpour et al in 2012 reinforced the evidence showing that food insecurity is associated with poor nutritional status. The study enrolled 169 participants Indian women who are non-pregnant, non-lactating and aged between 19-49 years old. With the purpose of identifying and characterizing the dietary patterns of food insecure participants, food intake information in this study was obtained through two 24-hour dietary recalls and food-frequency questionnaire (FFQ), and The Radimer/Cornell. Hunger and Food Insecurity Instrument (10 items) was used for determining the severity of food insecurity in a household. Their results showed that food insecure individuals had lower nutrient intake, diet diversity or variety and number of servings less than the recommendations of the food guide pyramid for meat/fish/poultry/legumes. Furthermore, it has been observed that participants

not only had reduced energy and nutrient intakes but also reduced quality of food consumed (Mohamadpour et al, 2012; Jomaa et al, 2017). In fact, households identified as food insecure were found to be consuming low cost foods which are known to be caloric dense. Additionally, food insecure families tend to have higher consumption of refined grains, foods of animal source, sugar, and fat and lower intake of fruits and vegetables (Jomaa et al, 2017). These could be the possible reasons why obesity is shown in food insecure individuals especially among the poorest families. Further studies have revealed that poor diet quality and high obesity rates were prevalent among populations at risk of food insecurity. One of these studies was conducted by Jomaa et al in 2017 to identify the association between food insecurity and prevalence of obesity among Lebanese households with poor dietary intake. A cross-sectional study was conducted among a representative sample of households (n = 378) in Beirut, Lebanon. Surveys were completed with mothers of children aged less than 18 years. High food insecurity access scale (HFIS) was measured using an Arabic-translated Household Food Insecurity Access Scale (HFIAS). Dietary intake was assessed using the multiple pass 24-h recall method. In addition, logistic regression analyses were conducted to explore the association of HFIS with obesity ($BMI \geq 30 \text{ kg/m}^2$) and at-risk waist circumference ($WC \geq 80 \text{ cm}$) among mothers. Their results showed that participants who were food insecure had a high risk of dietary inadequacy and obesity. Lebanese households in this study were not only deficient in macronutrients, but also were deficient in micronutrients including iron, calcium, magnesium, vitamin A, B6, C, E, B folate, and zinc. Knowing that food insecurity holds negative health consequences beyond nutrient deficiencies and obesity, a previous review was conducted by Gunderson & Ziliak in 2015 to assess the effect of food insecurity on mental and physical health in the United States. Their research was based on an extensive explanation of the data collected by the Supplemental Nutrition Assistance Program (2015). Their review showed that food insecurity is associated with negative health outcomes: anemia, lower nutrient intakes, cognitive

problems behavioral problems, depression, increased rates of mental health problems, diabetes, hypertension, and hyperlipidemia.

Several factors may contribute to a greater exposure of a certain population to food insecurity including socioeconomic, demographic and political aspects. Household income per capita is strongly associated with food insecurity where families with low income, especially those with a monthly income lower than the minimum wage, are more prone to developing food insecurity (Gundersen & Ziliak, 2015). Educational level is another variable associated with food security. A study previously stated that people with low levels of education have a higher risk of being food insecure (Jomaa et al, 2017). Less educated people considerably come from a large family which has also been associated with food insecurity. This could be explained by the fact that families with larger number of individuals need more resources to buy food, and family growth is not always accompanied by increased income (Costa et al, 2017). Factors related to food insecurity were further identified by a study conducted in Brazil in 2017 by Costa et al after an increased prevalence of food insecurity in their population. Their research followed the cross-sectional design with a sample size of 3366 families. Food insecurity was identified on the basis of the Brazilian Food Insecurity Measurement. Their results suggested that the prevalence of food insecurity was high among households head by women since they are paid lower wages when compared to men due to workplace inequalities. Other than gender, low assets and decreased mental functioning were strongly associated with food insecurity. Finally, all the previously mentioned factors worsened among populations suffering from an economic and political crisis.

Periods of economic, political, and social instability tend to affect the diet of the population and to promote food insecurity at the household level, especially among the most disadvantaged population groups. A study conducted by Sousa et al in 2019 investigated the effect of an economic crisis and

political instability on food security status of the affected population. This cross-sectional study analyzed data from two different sources: the Brazilian National Household Sample Survey for 2004 (n = 112,479), 2009 (n = 120,910), and 2013 (n = 116,192); and the Gallup World Poll for 2015 (n = 1,004), 2016 (n = 1,002), and 2017 (n = 1,001). Household food security status was measured by a shorter version of the Brazilian Food Insecurity Scale, consisting of the first 8 questions of the original 14-item scale. The authors found that the economic crisis led to the worsening of many social indicators including unemployment, income, and subsequently food insecurity.

In 2017, out of 378 people from the Beirut residents, 42% of the Lebanese participants suffered from moderate to severe food insecurity, and 8% of them suffered from mild food insecurity (Jomaa et al, 2017). In Lebanon, high prevalence of food insecurity is attributed to the insufficient welfare program that addresses the increasing need of these communities, particularly those residing in impoverished suburbs of the city (Jomaa et al, 2017).

In Lebanon, the food basket price increased from 339 084 LBP to 825 722 LBP (July 2019 and July 2020) with an increase of 109% in prices of food products (WFP). Since October 2019, the national currency has lost 80 percent of its value and after the devastating Beirut blast (August 4 2020) grain silos as well as homes and economic activities were destroyed. Consequently, 50% of Lebanese population are worried about food availability and might be at risk of failing to access basic food needs by the end of 2020 (WFP).

Based on what was previously discussed, food insecurity increases among households that have low assets, are not educated and are headed by women. Families who are subjected to food insecurity are prone to developing deficiencies and having poor nutritional status. Accordingly, these individuals tend to be under/over-nourished, deficient in micronutrients and consume low cost and low-quality foods

items. Furthermore, food insecurity is a condition associated with greater susceptibility to the development of diseases that result from the lack of access to adequate food. Hence, families experiencing food insecurity are at increased risk of developing chronic diseases (diabetes, hypertension, etc..) and mental health issues (depression, anxiety etc..). To our, no studies have yet been conducted to find the correlation between these three factors together, especially among Lebanese adults. Therefore, the aim of the current study is to assess the effect of food insecurity on the Lebanese adults' nutritional status during the ongoing economic crisis in 2020.

Methodology

Study design:

This study had a cross sectional design and the population was randomly chosen from the adult's population aging between 40 and 60 years old. The sample size consisted of 89 participants from across Lebanon with participants having different cultural, religious, educational and economic backgrounds. Inclusion criteria were male and female individuals living in Lebanon aged between 40 and 60. Exclusion criteria included people who suffer from mental disorders, critical illnesses such as cancer and illiterate people because the survey was sent online and they would not be able to read it on their own.

Ethical considerations:

This research was approved by the Lebanese American University's IRB (institutional Review Board). Since the survey was sent via a link on Google forms, an informed consent was added at the beginning of the survey for the participants to read it prior to completion; the participant had to agree to the

terms in order to proceed to the questionnaire. In order to keep all the responses confidential, no questions were asked about the participants' names, phone numbers, or addresses.

Data collection:

Due to the COVID-19 pandemic, data was collected using an online survey on google forms and it was sent to participants via a link. The survey consisted of four parts: a food frequency questionnaire, a demographic background/socioeconomic status questionnaire, household food insecurity access scale and NRS-2002 scale. A validated food frequency questionnaire by Naja et al. (2015) was used to evaluate the nutritional intake of participants. Demographic questions reflected information about the participant's age, gender, marital status, and educational level. Socioeconomic questions included questions asking about the participants' monthly income, assets, and number of children in the family. The household food insecurity access scale validated by Hawalla et al (2015) was used to identify participants who are food insecure and the degree of their insecurity. The NRS-2002 was used to evaluate the nutritional status of participants (Kondrup et al, 2002).

FFQ:

The dietary intake of participants was assessed using a modified version of the food frequency questionnaire from Naja et al (2015). Twenty-eight food items were divided into nine groups (Bread and cereals, dairy products, fruits and fruit juices, vegetables, animal meat and legumes, fats and oils, sweets desserts and beverages, nut and seeds). To further quantify the participants' food intake, food

consumption was estimated by using both the quantity and frequency of consumption to determine clearly the overall dietary patterns. The frequency of intake was assessed by providing the options: (once/2-3/4-5/>6) per day, (once/2-4/5-6) per week, and (1-3) per month; the quantity was assessed by giving the recommended serving size for each item; also a never/less than once a month option was included.

General questionnaire:

The general questionnaire included information about demographics, socioeconomic status and health status. Demographic background was assessed using seven questions about age, gender, height, weight, marital status, the governate in which they live in, and educational level of individuals and their partners. Socioeconomic status was assessed by 11 questions about the monthly income of the household, number of children in the household, assets (houses, cars and appliances) and when was the last time the family went to a vacation. Finally, information regarding the general health status of the participants was collected using five questions about presence of chronic diseases, supplements intake and polypharmacy.

Household food insecurity access scale:

The household food insecurity was measured using the Household food insecurity access scale (HFIAS) validated by Hawalla et al (2015) to be used among the Lebanese population. It consisted of nine questions that have the ability to distinguish food secure from insecure households. The information generated from the HFIAS can be used to assess the prevalence of household food insecurity and to

detect changes when it comes to the food security in a certain population (Coates et al, 2007). The survey is based on qualitative questions that ask about the feeling of uncertainty or anxiety over food, the perception of insufficient food quantity, reduction of food intake, consequences of reduced food intake, and the disgrace of relying on socially unacceptable way to obtain food. The participants were asked to answer the questions by choosing between the following options: most of the times, sometimes, rarely, and no.

NRS-2002:

The NRS-2002 questionnaire was used to identify the prevalence of under nutrition as well as the likelihood of developing it. This questionnaire contains asks about the BMI, nutrient intake and recent weight loss of the participants, in addition it contains a grading system for the severity of diseases as a reflection of increased nutritional requirements (Kondrup et al, 2002). The survey includes a pre-screening questionnaire for participants to determine who qualifies for the final screening, it consists of the following questions: is the participant BMI is less than 20.5, if he/she lost weight in the last 3 months, if he/she reduced their food intake in the last week and if he/she is severely ill. According to the severity of their disease the participants are then divided according to their scores: a score equal to 1 indicates mild nutritional impairment, a score equal to 2 indicates moderate nutritional impairment, and a score equal to 3 indicates severe nutritional impairment.

Data analysis:

Data was analyzed using the IBM SPSS software, significance level was set at $p=0.05$. Descriptive analysis was done to characterize our sample. The ANOVA test was performed to determine the association between the nutritional status and food insecurity status of the participant and to assess the relationship between the participants' nutritional status and economic status.

Results:

Sociodemographic results (Table 1):

Basic socioeconomic, demographic and population characteristics are shown in the table 1 below. The sample consisted of 89 participants of which 51.2% females. The mean sample age was 41 years. Males had an average weight of 86 kg \pm SD and, an average BMI of 27.4 kg/m², \pm SD while females had an average weight of 64.32 kg \pm SD, and an average BMI of 27.4 kg/m² \pm SD. The majority of the participants (47.7%) was married, had less than 3 family members (51.7%), 2 children in the family (52.1%), and less or equal to 2 members in one room (63.2%). The majority of the participants were university graduates (52.3%), 44.3% of them were living in Mount Lebanon, where the majority owned their own house (62.9%) and had more than 5 home appliances (51.7%), more than 1 vehicle, 79.8% of the participants didn't go on a vacation since 5 month before taking the survey

Finally, 57.9% of participants took food supplements and 1.8% took more than 5 medications hence belonging to the polypharmacy category.

	Mean \pm SD	Count	Percentage

Age		41		
Gender	male		42	48.8%
	female		44	51.2%
Marital status	married		41	47.7%
	divorced		10	11.6%
	single		31	36.0%
	widowed		4	4.7%
Income	<1000 000		26	29.5%
	1000 000 - 3000 000		34	38.6%
	>3000 000		28	31.8%
Family members	<3		45	51.7%
	4-6		41	47.1%
	7-8		1	1.2%
	>9		0	0%
Number of children	1		15	31.2%
	2		25	52.1%
	3		4	8.3%

	4		3	6.25%
	>=5		1	2.1%
Family members in one room	=<2		55	63.2%
	>2		32	36.8%
Educational level	brevet		16	18.6%
	terminal		13	15.1%
	university		45	52.3%
	technique		12	14.0%
Educational level of partner	brevet		12	14.0%
	terminal		10	11.6%
	university		15	17.4%
	technique		5	5.8%
	doesn't have a partner		44	51.2%
Governorate	Beirut		9	10.2%
	Bekaa		2	2.3%
	Mount lebanon		39	44.3%
	North		3	3.4%

	South		6	6.8%
	Nabatieh		14	15.9%
	Baalbak		6	6.8%
	Aakar		9	10.2%
Work type	full time		37	42.5%
	part time		15	17.2%
	looking for a job		7	8.0%
	retired		3	3.4%
	freelancer		20	23.0%
	can't work		4	4.6%
Partner work type	full time		16	18.6%
	part time		3	3.5%
	looking for a job		1	1.2%
	retired		1	1.2%
	freelancer		20	23.3%
	can't work		3	3.5%
	doesn't have a partner		42	48.8%

Home condition	owns his/her house		56	62.9%
	rented		15	16.9%
	doesn't pay rent		0	0.0%
	lives with friends		2	2.2%
	lives with family		15	16.9%
	doesn't have a residence		1	1.1%
Healthcare	daman		44	49.4%
	private insurance		18	20.2%
	from his/her pocket		8	9.0%
	on the ministry		19	21.3%
Vehicles	0		19	21.3%
	1		25	28.1%
	>1		45	50.6%
Appliances	1-2		17	19.1%
	3-4		26	29.2%
	>=5		46	51.7%

Vacation	yes		18	20.2%
	no		71	79.8%
Height (meters)	male		1.77	
	female		1.66	
Weight (Kg)	male		86.00	
	female		64.32	
BMI (Kg/m ²)	male		27.4	
	female		23.3	

Table 1: Socioeconomic & demographic characteristics of participants

The mean weekly intake of participants for starch was: 5 slices of white bread, 3.14 slices of whole bread, 4.3 cups of breakfast cereals, 7.8 cups of pasta and rice; for dairy: 5.1 cups of whole fat milk, 7.34 cups of whole fat yogurt, 180 grams of cheese, 14 spoons of labneh, 6.3 servings of fruits, 6.6 cups of fruits juices, 5 cups of non-starchy vegetables, 5 cups of starchy vegetables, 7 cups of legumes, 747.15 grams of red meat, 415.6 grams of fish, 7 eggs, 4.7 cups of nuts and seeds. Results are presented in table 2.

	Mean weekly intake \pm SD
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Bread	8.14
Breakfast Cereal	4.3
Pasta	7.8
Milk & Dairy	25.44
Fresh fruits & Fruit drinks	12.9
Vegetables	10
legumes	7
Red meat	8.79
Fish	4.89
Eggs	7.18
Olives & oils	11.3
Processed food	8.7
Soft drinks	6.5
Coffee	8
Alcohol	10.79
Nuts	4.7

Table 2: Dietary habits among the sampled adult Lebanese population (n=89)

In the last four weeks, 43.7% of our participants did not worry about food, 46% did not worry about not having their favorite food, 70% had enough food to eat, 44.8% did not have to consume a food they disliked, 76.7% did not eat less than the recommended daily portions of all food groups, 67% did not

sleep hungry and 80.5% did not get to a point where they cannot access food at all. Results are presented in table 3.

In addition, 65.2% of the participants were food secure, 14.6% had mild food insecurity, 7.9% had mild food insecurity, 12.4% had mild food insecurity. Results are presented in table 5.

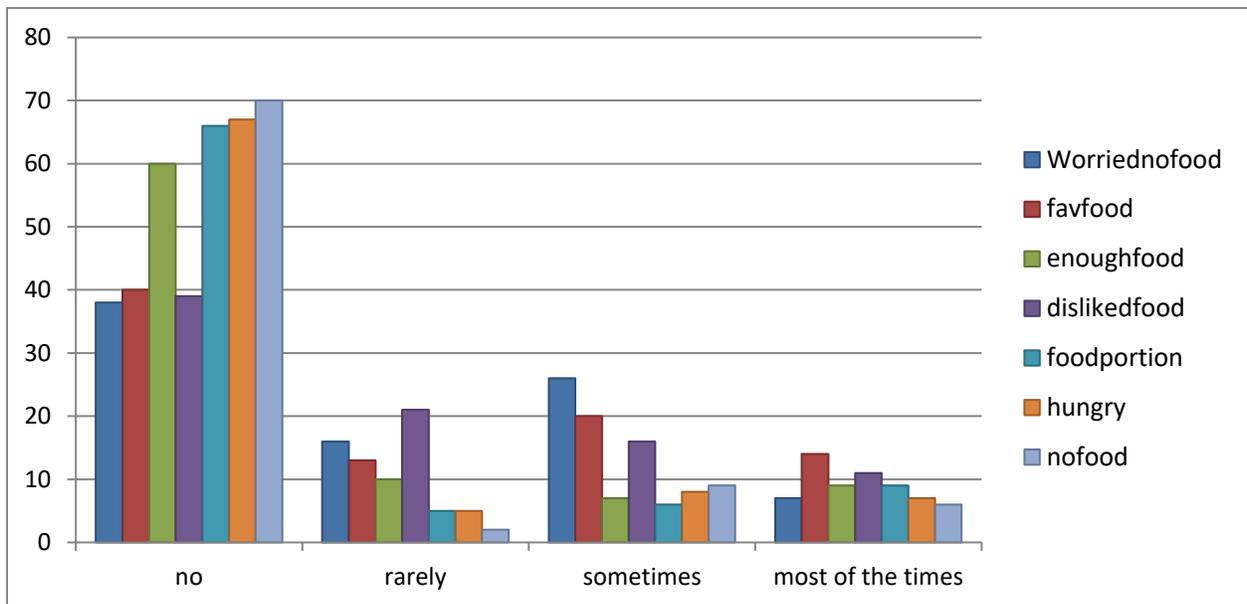


Table 3: HFIS results

				Count	Percentage
Worried about food	no	Gender	Male	20	54.1%
			Female	17	45.9%
	rarely	Gender	Male	7	43.8%

			Female	9	56.3%
	sometimes	Gender	Male	10	41.7%
			Female	14	58.3%
	most of the times	Gender	Male	5	71.4%
			Female	2	28.6%
Able to consume favorite food	no	Gender	Male	19	50.0%
			Female	19	50.0%
	rarely	Gender	Male	5	38.5%
			Female	8	61.5%
	sometimes	Gender	Male	10	50.0%
			Female	10	50.0%
most of the times	Gender	Male	8	61.5%	
		Female	5	38.5%	
Enough food consumption	no	Gender	Male	29	50.9%
			Female	28	49.1%
	rarely	Gender	Male	2	20.0%
			Female	8	80.0%
	sometimes	Gender	Male	4	57.1%
			Female	3	42.9%
most of the times	Gender	Male	7	77.8%	
		Female	2	22.2%	
Had to consume	no	Gender	Male	20	54.1%
			Female	17	45.9%

disliked food	rarely	Gender	Male	6	30.0%	
			Female	14	70.0%	
	sometimes	Gender	Male	8	50.0%	
			Female	8	50.0%	
	most of the times	Gender	Male	8	72.7%	
			Female	3	27.3%	
Food portion	no	Gender	Male	29	46.0%	
			Female	34	54.0%	
	rarely	Gender	Male	3	60.0%	
			Female	2	40.0%	
	sometimes	Gender	Male	3	50.0%	
			Female	3	50.0%	
	most of the times	Gender	Male	7	77.8%	
			Female	2	22.2%	
	hungry	no	Gender	Male	30	46.9%
				Female	34	53.1%
rarely		Gender	Male	3	60.0%	
			Female	2	40.0%	
sometimes		Gender	Male	4	50.0%	
			Female	4	50.0%	
most of the times		Gender	Male	5	71.4%	
			Female	2	28.6%	
Available food		no	Gender	Male	33	49.3%

			Female	34	50.7%
	rarely	Gender	Male	0	0.0%
			Female	2	100.0%
	sometimes	Gender	Male	5	55.6%
			Female	4	44.4%
	most of the times	Gender	Male	4	66.7%
			Female	2	33.3%

Table 4: HFIS gender results

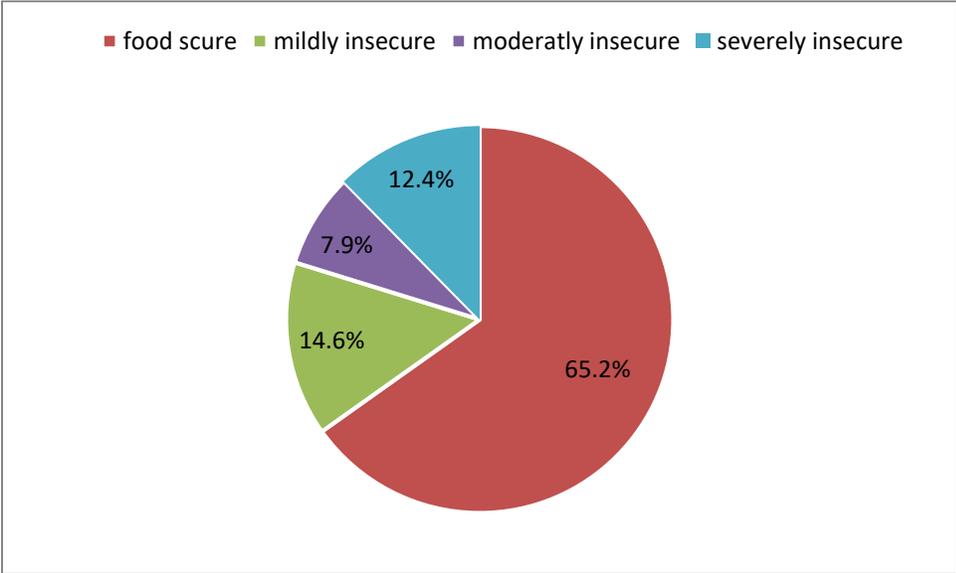


Table 5: HIFIS results

According to the NRS-2002, only 29.3% of participants had a BMI less than 20.5, 45.5% have lost weight in the last three weeks, 48.8% reduced their dietary intake, 10.7% suffered from severe illness and 84% aged more less than 70 years old. According to the NRS-2002 scores 18% of the participants were mildly malnourished, 15.7% moderately malnourished, 5.6% severely malnourished. Results are presented in table 6.

		Count	Percentage
BMI25	yes	22	29.3%
	no	53	70.7%
Lost weight	yes	40	45.5%
	no	48	54.5%
Reduced intake	yes	42	48.8%
	no	44	51.2%
Severely ill	yes	9	10.7%
	no	75	89.3%
Aged less than70	yes	84	97.7%
	no	2	2.3%
NRS score	not malnourished	54	60.6%
	mild	16	18.0%

	moderate	14	15.7%
	severe	5	5.6%

Table 6: NRS-2002 questionnaire results

The association between food insecurity scores and NRS scores was analyzed using the one way Anova test. The association between food insecurity and nutritional status was only statistically significant when it comes to the decreased consumption of the participants’ favorite food with a p value equal to 0.002 which is less than 0.05. This shows that as people dropped the consumption of their favorite food (which is a sign of food insecurity), they were more likely to be malnourished.

	P-value
BMI25	.000
Lost weight	.000
Reduced intake	.000
Severely ill	<u>.004</u>

Table 7: Association between food insecurity and NRS score.

Since the nutritional status is affected by the economic status, the following table (table 9) shows the correlation between economic variables and malnutrition of participants by using the Pearson Chi-

square test. The association between economic status and nutritional status was not statistically significant in any of the economic status variables and the NRS score. Results are presented in table 8.

		NRS score				
		not malnourished	mild	moderate	severe	P value
Income	<1000 000	9	4	8	5	0.000
	3000 000	20	9	5	0	
	>3000 000	25	2	1	0	
Member in one room	=<2	35	8	10	2	.666
	>2	18	7	4	3	
Home Condition	you own your house	37	12	7	0	.000
	rented	10	2	1	2	
	lives with friends	0	0	2	0	
	lives with family	7	2	4	2	
	don't have a residence	0	0	0	1	
Healthcare	daman	30	9	4	1	.000
	private insurance	17	1	0	0	

	from your pocket	4	3	1	0	
	on the ministry	3	3	9	4	
Vehicles	0	0	5	9	5	.000
	1	18	5	2	0	
	>1	36	6	3	0	
Appliances	1-2	17	3	6	4	.000
	3-4	15	10	4	1	
	>=5	39	3	4	0	

Table 8: Association between economic status and NRS score.

Discussion:

The aim of the present study was to assess the effect of food insecurity on the Lebanese adults' population nutritional status during the ongoing economic crisis in 2020-2021 in Lebanon. Lebanon is currently facing an economic crisis, a devaluation of its currency (L.L.) and a disrupted political situation. According to our findings, the percentage of adult Lebanese who are malnourished was 39.4% and the percentage of those who are food insecure turned out 34.8%.

In order to assess the dietary intake of participants, the results of the food frequency questionnaire is compared to the Cedar diet guidelines. Our participants daily consumption was 6.8 servings of grains, 1.8 servings of fruits, 1.4 servings of vegetables, 11.4 servings of lean meats, eggs, legumes, unsalted nuts and seeds combined, 2.5 milk & dairy; while the Cedar recommendations are 6 servings of grains, 2

servings of fruits, 3 servings of vegetables, 6.5 servings of lean meat eggs legumes unsalted nuts and seeds, 3 servings of milk & dairy. This shows that the consumption of fruits, vegetables, milk and dairy was inadequate in our sample, and although when it comes to the lean meat eggs legumes unsalted nuts and seeds group the consumption was 168% of the recommendation however almost half of it was legumes, this shows that legumes that are relatively cheap compared to animal products, fruits and vegetables was used as a source of protein and fibers, this shows that people are compensating for the nutrients found in expensive food items, with their cheap equivalent.

According to the world food program 49% of the Lebanese population is worried about access to food compared to 34.8% in our sample. Food insecurity is associated with decreased nutrient intakes, diabetes, hypertension, hyperlipidemia, increased rates of mental health problems, increased depression, worse outcomes on health exams, poor or fair health, and poor sleep outcomes, in addition, mothers who are food insecure are over twice as likely to report mental health problems, and over three times as likely to report oral health problems (Gundersen & Ziliak, 2015).

The results from this study show the relationship between the degree of adherence to specific food groups and food insecurity. In our study there was low adherence when it comes to fruits, vegetables, milk and dairy which may be indicative of insecurity. However, a significant association was only found between food insecurity and the intake of favorite food. This could be due to the small sample size which wasn't large enough to bring about significant correlations among all food items, or to the fact that our sample doesn't actually represent the Lebanese population. These results duplicate the findings of a cross-sectional study conducted in Malaysia by Mei et al (2020) among the adult migrant workers. The study involved a convenience sample of 125 migrant workers. A researcher-administered questionnaire consisting of socio-demographic questions, three-day 24-hour dietary recall (we used an FFQ), and nine-item Household Food Insecurity Access Scale was used. Their results revealed that food

insecurity affected nutrient intake among Malaysian workers and subsequently worsened their nutritional status.

The prevalence of food insecurity was high our population that is from an economic crisis 34.8%. Food inaccessibility is considered to peak during economic crisis due to increased food prices, low wages and high unemployment rates. Also, during an economic crisis funding for food programs stop and the money invested in the program are used for other economic purposes (Costa et al, 2017) , this shows that food insecurity is a result of economic crisis and political instability (Sousa et al, 2019). Knowing that, Sousa et al (2019) conducted a cross sectional study that analyzed data from two different sources: the Brazilian National Household Sample Survey for 2004 (n = 112,479), 2009 (n = 120,910), and 2013 (n = 116,192); and the Gallup World Poll for 2015 (n = 1,004), 2016 (n = 1,002), and 2017 (n = 1,001). Household food security status was measured by a short version of the Brazilian Food Insecurity Scale, consisting of the first 8 questions of the original 14-item scale. Their results showed that during its economic crisis, food insecurity purged in Brazil as 51% of the population was food insecure by 2017. Our sample just like the Brazilians the prevalence of food insecurity was high. The fact that the prevalence was higher in Brazil may be a result of the NGOs and foreign countries sending aids to the Lebanese population especially after the port explosion and this may be also due to the subsidies on essential goods in Lebanon.

According to Jomaa et al (2017) increased risk of food insecurity is associated with low socio-economic status, similarly in this study food insecurity increased with lower monthly income, lower assets and unemployment. Low assets are also a risk factor for malnutrition (Gundersen & Ziliak, 2018), in our study there wasn't statistical significance found between food insecurity and economic status.

The strengths of our study include, the fact that it is among the first studies to assess the nutritional status and food insecurity in 2020-2021 during COVID-19 in Lebanon. In addition, dietary intake, food insecurity, nutritional status and economic status were assessed using the HFIS and NRS-2002 and the food frequency questionnaire which are all reliable, validated. However just like any other study, this study had its limitations. The lockdowns and social distancing due to the COVID-19 pandemic, forced the data to be collected online via Google forms, this meant that all data was self-reported this could lead to inaccurate results due to under or over reporting of data and people filling the survey could misinterpret questions; illiterate people couldn't participate in addition to people that don't have internet access. Also, the population included 89 participants which is a small sample size and could not lead to significant results and proper associations between variables. Finally, our study followed a cross-sectional design and could not reflect the causal relationships between the variables of the study.

Conclusion

This is one of the first cross-sectional analyses in Lebanon on the relationship between food insecurity and nutritional status in adults aged 40 to 60 yrs during the current economic crisis. Our participants' food intake reflected an inadequate food intake when it comes to fruits, vegetables, milk and dairy. According to our research, 39.4% of adult Lebanese are malnourished, while 34.8% percent have food insecurity, these already high might increase as the economic situation is worsening and because of the fact that the subsidies from the government will be reduced or removed soon.

Our results showed that better nutritional status was associated with higher prevalence of food security and people belonging to higher socio-economic status were at lower risk of developing food insecurity. The cross-sectional design did not permit us to control the causality of our associations, but

our results suggest that favorite food intake and assets were the major determinants of food security. Finally, results from this study should be duplicated on a larger sample size, in person data collection and a different design in order to establish the recommended daily nutrient allowances for adults to remain food secure and find possible solutions for the inaccessibility of food during an ongoing economic crisis to avoid an increased prevalence in malnutrition.

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