

# Knowledge, attitudes, and practices of Jordanians towards the relationship between food and immunity during the COVID-19 era

Dima, H, Sweidan

Department of Nutrition, Faculty of Pharmacy and Medical Sciences, University of Petra, Amman, Jordan  
demeswidan.52@gmail.com

Hiba, F, Al-Sayyed\*

Department of Nutrition, University of Petra, Amman, Jordan  
halsayyed@uop.edu.jo

## ABSTRACT

A diet with specific variety of food and drinks enhances physical condition, prevents disease, and assists in keeping an individual mentally and physically healthy. The global pandemic of coronavirus disease -2019 (Sars-Cov-2/Covid-19) has highlighted public awareness of the importance of eating a nutritious diet to boost immune defenses. This study aimed at exploring the awareness of Jordanian population on the relationship between food intake and immunity. A cross-sectional design was used to achieve the aim of this investigation. The study targeted Jordanian population (including 1024 participants residing in all Jordanian governorates). Awareness of Jordanians was tested via a questionnaire that was validated and tested for reliability (internal consistency). The awareness is usually indicated by knowledge, attitudes, and practices. The questionnaire was developed and introduced in the Arabic language to accommodate Jordanian culture. Results of this investigation showed that the survey tool was valid and reliable (Cronbach's-alpha value = 0.842). The mean, median, and mode values for awareness score are ~51, 52, and 56 out of 70 indicating very good awareness of Jordanian population towards the relationship between food intake and immunity. It is recommended to translate the survey tool used in this investigation into other languages and validate it. In addition, it is recommended to consume healthy foods of Jordanian culture to boost immunity. Furthermore, it is recommended to increase awareness regarding the correct and fad information as well as the importance of vaccination role on immunity via educators and family, health care team members, magazines and newspapers, and social media.

## KEYWORDS

Awareness, Jordanian population, Information, Beliefs, Behaviors

### ACM Reference Format:

Dima, H, Sweidan and Hiba, F, Al-Sayyed. 2021. Knowledge, attitudes, and practices of Jordanians towards the relationship between food and immunity during the COVID-19 era. In *2021 International Symposium on Biomedical*

\*Corresponding author

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](https://permissions.acm.org).

*BECB 2021, August 13–15, 2021, Nanchang, China*

© 2021 Association for Computing Machinery.

ACM ISBN 978-1-4503-8411-7/21/08...\$15.00

<https://doi.org/10.1145/3502060.3503641>

*Engineering and Computational Biology (BECB 2021), August 13–15, 2021, Nanchang, China.* ACM, New York, NY, USA, ?? pages. <https://doi.org/10.1145/3502060.3503641>

## 1 INTRODUCTION

Many studies suggest that a balanced diet involves certain food groups in specific amounts and proportions to meet the requirements for energy, proteins, minerals, and vitamins, while a diet is a specific variety of food and drink that is frequently eaten by a person to enhance one's physical condition, prevent or treat a disease, and thus assist in keeping an individual mentally and physically healthy [1]. The global pandemic of coronavirus disease -2019 (Sars-Cov-2/Covid-19) has highlighted public awareness of the importance of eating a nutritious diet to boost immune defence [2]. To the best of the investigators' knowledge, this is the first study that investigated knowledge, attitudes, and practices of Jordanians related to the effect of food on immunity

## 2 SUBJECTS AND METHODS

The study participants were conveniently selected to be adult Jordanians of both genders residing in all Jordanian governorates. The survey tool was developed using the concepts of immunity, food, information, beliefs, and behaviors. In addition, 20 Jordanian adults of both genders (18 females and 2 males) aged 18-88 years were pilot surveyed (17th - 22nd February 2021) about what they know about the foods that affect immunity either positively or negatively. Results of this pilot study, related literature, as well as concepts (information about food and immunity, beliefs, and practices) were used to formulate the questionnaire. The questionnaire was validated by a panel of experts (3 professors in nutrition and food technology as well as a specialist in social science). To finalize the questionnaire, it was pilot tested by a group of adults (14 females and 2 males) to ensure the clarity of questions. All of the notes of the expert panel and pilot study participants were taken into consideration. The questionnaire contains 4 parts i.e., sociodemographic characteristics (gender, age, nationality, education level, specialty, country and governorate of residence, and household income), 4 knowledge questions, 5 attitude questions, and 10 practice questions related to the relationship between food and immunity. All questions were of the closed-ended types to facilitate answering and scoring. Knowledge questions included asking about the effect of certain nutritional factors on immunity including breastfeeding, obesity, underweight, anemia, antioxidants, food additives and preservatives, Zn, vitamins A, C, B12, B6, and D, vitamin C supplements, ingesting vitamins and minerals in amounts higher than the recommendations, and well-balanced diet. Attitude questions

included asking about beliefs related to the effect of certain foods and/or dietary factors on immunity including dates, garlic, fenugreek, sugar, honey, pickles, nuts (such as almonds, walnuts, and cashews), ginger, soft drinks, split lentils, luncheon meat, fish and tuna, sweetened juices, eggs, potato chips, yogurt, cinnamon, red meat (beef meat/lamb meat), olive oil, onions, pastries, broccoli, fast food, mulberry (*Morus nigra*), black cumin seeds (*Nigella sativa*), cherry, licorice root, dark chocolate, grapes, sausages, bell pepper (red, green, or yellow), apples, energy drinks, apricot, parsley, hot drinks (like anise, green and red tea), losing weight, and healthy food in comparison with vaccination. Practice questions included asking about related behaviors such as reading and seeking the related information to food and immunity, using nutritional supplements (iron, zinc, vitamin D, and B12) to boost immunity, eating main meals at home, eating fruits and vegetables, junk foods, frying foods at home, and eating sweets during the pandemic of COVID-19. The survey tool was introduced into Google Forms® and distributed via social media to a convenient sample of 1024 participants representing the population of Jordan of all Jordanian governorates. Distributing of the survey was in the era of COVID-19 (March, 2021). Respondents were consented prior to participation in this research. The implementation of this research was approved by the institutional review board (IRB) at the University of Petra (Decision number 1Q/4/2021).

To evaluate the awareness, each correct answer of the knowledge and attitude questions was given a score of 1 while correct answers of practice questions were given a score of 2. The total full score of knowledge, attitudes, and practice questions were 15, 39, and 16 respectively. The total full score of the questionnaire was set to be 70. The total scores of 57-70, 43-56, 29-42, 15-28, and 0-14 were considered to indicate excellent, very good, good, fair, and poor awareness, respectively. All answers were coded for statistical analysis by the statistical package system for social sciences® (SPSS) version 26. Reliability was evaluated by internal consistency testing using Cronbach's alpha test [3]. Frequencies, as well as percentages of each answer as well as the score categories, were calculated [4].

### 3 RESULTS AND DISCUSSION

The reliability of the questionnaire was tested by examining internal consistency yielding Cronbach's alpha value of 0.842. Thus, to the best of the investigators' knowledge, the survey tool represents the only validated reliable tool to examine knowledge, attitudes, and practices of Arabic language speakers regarding the relationship between food intake and immunity.

In relation to the demographic characteristics, the study participants were adult (18-24 years) (41.1%) female (81.2%) Jordanians (89%), living in Amman (85%), the capital city of Jordan. Most (70.8%) of the study participants were educated (had bachelor degree). In addition, most of them (38%) had a household income of 200-800 JOD (282-1128 USD) and specialized/work in non-medical sectors (66.2%). Despite the fact that the current study participants were selected conveniently, the sample demographic characteristics represent the population of Jordan in terms of age, educational level, household income, and profession. The population of Jordan is considered a youth [5-7], educated [5, 7], and of low middle income [8]. Our result that the questionnaire was answered more commonly

by females is not surprising. Usually, women respond more to diet and health surveys [9-11]. This is probably because they usually take the leadership role of the household [12] and responsible for the household diet and nutrition accordingly [13, 14].

The knowledge score of the study participants ranged between 0-15 out of 15. About half of Jordan population (42.2%) scored 13-15 in knowledge questions indicating excellent knowledge while 1.8% of the study participants scored 0-3 indicating poor knowledge. Interestingly, 30.6%, 14.7%, and 10.7% of Jordan population showed very good, good, and fair knowledge related to the relationship between food and immunity. These scores are not surprising since most of the study participants were educated and working.

With reference to Jordanian population knowledge about the relationship between food intake and immunity, the mean, median, and mode score values are 11, 12, and 13 out of 15 indicating very good knowledge. Most of the study participants answered correctly when asked about the effects of breastfeeding (90.7%), extreme body weight changes (whether increasing or decreasing) (84.6% and 70% respectively), anemia (89.6%), Zn (71.5%), vitamins A (71.4%), C (79.8%), B12 (72.1%), B6 (68.4%), and D (77.6%), antioxidants (60.1%), food additives and preservatives (74.8%), foods containing amounts of vitamins and minerals higher than the recommendations (71.4%), and well-balanced diet on immunity (99.1%). Most Jordanians (84.1%) answered the question related to the effect of vitamin C supplements on cold and flu negatively (either incorrectly or didn't know the correct answer). Actually, research doesn't support the belief that vitamin C supplements can treat, relieve, or even prevent common cold [15]. In this regard, our results are similar to those found by Al-Shimmari et al. [16] and opposite to those found by Abida et al. [17], Qidwai et al. [18], and Basheer et al. [19]. It is, thus, recommended to raise the awareness of Jordanians regarding to the fact that vitamin C supplements treat cold and flu.

With relation to the study participants' attitudes towards the relationship between food intake and immunity, the mean, median, and mode score values were ~30, 32, and 35 out of 39 indicating very good attitudes. The study population was asked about their attitudes in terms of the general effect of food, the effect of specific foods on the immunity (dates, garlic, fenugreek, sugar, honey, nuts, ginger, carbonated beverages, lentils, mortadella, fish and tuna, sweetened juices, eggs, chips, yogurt, cinnamon, red meat, olive oil, onion, pastries, broccoli, fast foods, berries, black cumin seeds, cherries, licorice, dark chocolate, grapes, sausages, colorful sweet pepper, apples, energy drinks, apricots, parsley, hot drinks). Most of the study population answered correctly when they were asked about their attitudes in terms of the general effect of food (93.3%), the effect of specific foods on the immunity: dates (93.1%), garlic (96.9%), fenugreek (69.5%), sugar (81.3%), honey (91.8%), nuts (87.3%), ginger (92.2%), carbonated beverages (91.2%), lentils (73.9%), mortadella (68.2%), fish and tuna (93.6%), sweetened juices (82.3%), eggs (89.8%), chips (81.0%), yogurt (82.3%), cinnamon (80.8%), red meat (73%), olive oil (92.4%), onion (94.4%), pastries (45.2%), broccoli (90.3%), fast foods (88.3%), berries (82.7%), black cumin seeds (86.7%), cherries (80%), licorice (46%), dark chocolate (62.1%), grapes (79%), sausages (66.4%), colorful sweet pepper (92.2%), apples (94.1%) energy drinks (5.4%), apricots (83.5%), parsley (84.1%), and hot drinks (79.9%). In addition, when Jordanians were asked about their attitudes in relation to reducing their body weight and immunity,

84% answered that immunity will not be affected if they reduce their body weight. Surprisingly, most (83.2%) of the study participants' attitudes towards vaccination were negative. Only 16.8% of Jordanians believe that vaccination affects immunity better than healthy food intake while about double of the former percentage (38.5%) believe that healthy diet has better effect on immunity. In addition, 3.9% of Jordanians didn't believe anything in relation to better effect (whether healthy food or vaccination) on immunity. Our results are consistent with those found by Al-Elimat et al. [20] who found fairly low public acceptability of COVID-19 vaccines among Jordanian population. Jordanian population needs, thus, much more awareness regarding to the importance of vaccination on immunity.

On the other hand, when asked about their attitudes towards the effect of pickles on immunity, 48.8% answered incorrectly (i. e. pickles affect immunity negatively). Indeed, moderate intake of pickles enhances immunity due to the stimulation of beneficial bacteria and natural killer cells [21]. It should be emphasized that moderate intake of pickles is recommended to enhance immunity only in people who are not prohibited from eating high salt foods such as people with hypertension and cardiovascular diseases [22]. Within the same context, it is recommended to increase the awareness of Jordanians about the positive effect of pickles in enhancing immunity.

Within the same line, Jordanians mentioned that the trustable sources of having information about the relationship between food and immunity are the health care team members (physician, nurse, pharmacists, and dietitians), internet webpages such as google® and yahoo®, social media, books and scientific articles, family members, television programs, neighbors and friends, folks medicine, magazines and newspapers. These trustable sources should be utilized by policymakers, educators, and legislatives to increase awareness of Jordanians in terms of the relationship between food intake and immunity. Knowledge affects attitudes [23]. This is reflected by the result that about half (40.4%) of the study participants showed very good attitudes (score 25-32).

The mean, median, and mode score values Jordanians' practice scores towards food and immunity are ~10, 10, and 10 out of 16, respectively, indicating very good practices. Within the practice context, Jordanians increased reading about immunity (67.1%), ingestion of dietary supplements (such as vitamin C, omega-3, fish oil, the vitamins B12 and D) to increase their immunity (72.9%), periodically checked their blood levels of Fe, Zn, the vitamins B12 and D (53.1%), choose fresh instead of canned foods (67.7%), increased their intake of fruits and vegetables (62.7%), ate their main meals at home, stopped eating fast foods to a certain extent, frying foods at home (64.1%), stopped eating fast foods to a certain extent (37.5%), frying foods at home (73.7%), and reduced their intake of sweets (such as biscuits, doughnuts, and the Arabic sweet Knafeh) (29.6) during the pandemic of COVID-19.

Behaviors are practices that are usually based on humans' knowledge as well as attitudes [23]. About 1/5th of Jordan population (18.7%) scored between 13-16 in the practice questions while most (36.8%) of the study participants showed very good practices (score of 10-12). In addition, about 1/3rd (30.4%) of Jordan population exhibited good practices (score of 7-9). Furthermore, only 2.4% of the study sample showed poor practices related to the relationship

between food intake and immunity. All-in-all, the mean, median, and mode values for total score are ~51, 52, and 56 out of 70 indicating very good awareness of Jordanian population towards the relationship between food intake and immunity.

## 4 CONCLUSION

In conclusion, Jordanians exhibited very good awareness towards the relationship between food intake and immunity. The awareness is indicated by knowledge, attitudes, and practices.

## 5 RECOMMENDATIONS

It is recommended to translate the survey tool used in this investigation into other languages and to validate it. In addition, it is recommended to consume healthy foods of Jordanian culture to boost immunity and to increase awareness regarding food intake and immunity and the related fads. Furthermore, the importance of vaccination should be emphasized. Suggested education tools are educators and family health care team members, magazines and newspapers, and social media.

## ACKNOWLEDGMENTS

The investigators would like to thank Dr. Refat Al-Kurd, Dr. Seham Abu-Jadayil, Mrs. Dalal Tom, Mrs. Maisa Mustafa, Dt. Lana Rizeq, Ph. Dt. Natasha Baj, Ph. Dua'a Sabbah, Dt. Zeina Naser, Jana Al-Awaideh, Eng. Sondos Al-Kiswani, and Ph. Abdullah Al-Atia for their valuable help in revising the questionnaire.

## REFERENCES

- [1] Sabiha Alam, Farhana Rumzum Bhuiyan, Tanvir Hossain Emon, and Mahmudul Hasan. 2021. Prospects of nutritional interventions in the care of COVID-19 patients. *Heliyon*, 7(2): 1–11. Doi: <https://doi.org/10.1016/j.heliyon.2021.e06285>
- [2] Haya Aljadani. 2021. Impact of Different Dietary Patterns and Micronutrients on the Immune System and COVID-19 Infection. *Current Research in Nutrition and Food Science*, 9(1): 127–138. Doi: <https://doi.org/10.12944/CRNFSJ.9.1.13>
- [3] Laerd statistics. 2021. Cronbach's alpha: SPSS statistics. 2021, 1–10. Retrieved from <https://statistics.laerd.com/premium/spss/ca/cronbachs-alpha-in-spss-3.php>
- [4] Adam Lund. 2021. Laerd Statistics. University of Bath, UK. Retrieved from <https://statistics.laerd.com/statistical-guides/spearmans-rank-order-correlation-statistical-guide.php>
- [5] Khlaif Gharaybeh. 2014. General Socio-Demographic Characteristics of the Jordanian Society: A Study in Social Geography. *Research on Humanities and Social Sciences*, 4(1): 1–10.
- [6] Youth | UNICEF Jordan. Retrieved June 28, 2021 from <https://www.unicef.org/jordan/youth>
- [7] Jordan | UNESCO UIS. Retrieved June 27, 2021 from <http://uis.unesco.org/en/country/jo>
- [8] 2021. Household Expenditures & Income Survey – Department of Statistics. Retrieved May 19, 2021 from <http://dosweb.dos.gov.jo/economic/expenditures-income/>
- [9] Nihaya Al-shehab, Mahmoud Alomari, Audai Hayajneh, and Smita Shah. 2019. Attitudes and perceived barriers toward healthy lifestyle behaviors in Jordanian adolescents: a developing country perspective. *Adolescent Health, Medicine and Therapeutics*, 10: 39–47. Doi: <https://doi.org/10.2147/ahmt.s181001>
- [10] Ali A. Ammouri, Geri Neuberger, Abdulqadir J. Nashwan, and Ahmad M. Al-Haj. 2007. Determinants of Self-Reported Physical Activity Among Jordanian Adults. *Journal of Nursing Scholarship*, 39(4): 342–348. Doi: <https://doi.org/10.1111/j.1547-5069.2007.00191.x>
- [11] International Food Information Council Foundation. 2015. The 2015 Food & Health Survey: Consumer Attitudes toward Food Safety, Nutrition & Health. *Food Insight*, 1–98. Doi: <https://doi.org/10.2307/j.ctt1t8957r.13>
- [12] Department of Statistics [Jordan] and ICF. 2019. Jordan Population and Family Health Survey 2017-18: Key Findings. Amman, Jordan, and Rockville, Maryland, USA.
- [13] The World Bank. 2018. Hashemite Kingdom of Jordan – Understanding How Gender Norms in MNA Impact Female Employment Outcomes. 1–18. Retrieved June 30, 2021 from <https://documents.worldbank.org/en/publication/documents->

- reports/documentdetail/859411541448063088/hashemite-kingdom-of-jordan-understanding-how-gender-norms-in-mna-impact-female-employment-outcomes
- [14] United Nations. 1990. Women and Nutrition – Nutrition policy discussion paper No. 6.
- [15] Ellie Whitney and Sharon Rady Rolfes. 2016. Understanding Nutrition. Cengage Learning, Stamford.
- [16] Sulaiman Abdullah Alshammari, Leena Sami Alwakeel, Jumana Abdullah Algh-tani, and Laila Mahmoud Alsabbagh. 2021. Effect of COVID-19 on Awareness and Consumption of Dietary Supplements in Saudi Arabia. *Journal of Nature and Science of Medicine*, 4(2): 190–196. Doi: <https://doi.org/10.4103/JNSM.JNSM>
- [17] Abida, Jawzaa Menis Al-Shammari, Mona Balbki, Mohd Imran, and Vijay Chidrawar. 2015. Knowledge, attitude and practice of vitamin supplementation among people of the northern border region of Saudi Arabia. *Der Pharmacia Lettre*, 7(9): 233–238.
- [18] Waris Qidwai, Zahra Aziz Samani, Iqbal Azam, and Saima Lalani. 2012. Knowledge, Attitude and Practice of Vitamin Supplementation among Patients visiting Out-Patient Physicians in a Teaching Hospital in Karachi. *Oman Medical Journal*, 27(2): 116–120. Doi: <https://doi.org/10.5001/omj.2012.24>
- [19] Haneen A. Basheer, Lina Elsalem, Deema Jaber, Shorouk M. Ibraheem, Hamza Alhamad, and Ahmad A. Jum'ah. 2021. Knowledge, awareness and practices regarding dietary supplements in Jordan. *Tropical Journal of Pharmaceutical Research*, 20(3): 649–659. Doi: <https://doi.org/10.4314/tjpr.v20i3.30>
- [20] Tamam El-Elimat, Mahmoud M. AbuAlSamen, Basima A. Almomani, Nour A. Al-Sawalha, and Feras Q. Alali. 2021. Acceptance and attitudes toward COVID-19 vaccines: A cross-sectional study from Jordan. *PLoS ONE*, 16(4): 1–15. Doi: <https://doi.org/10.1371/journal.pone.0250555>
- [21] Sudhanshu S. Behera, Aly Farag El Sheikha, Riadh Hammami, and Awanish Kumar. 2020. Traditionally fermented pickles: How the microbial diversity associated with their nutritional and health benefits? *Journal of Functional Foods*, 70: 1–21. Doi: <https://doi.org/10.1016/j.jff.2020.103971>
- [22] Baris Afsar, Masanari Kuwabara, Alberto Ortiz, Aslihan Yerlikaya, Dimitrie Siroopol, Adrian Covic, Bernardo Rodriguez-Iturbe, Richard J. Johnson, and Mehmet Kanbay. 2018. Salt intake and immunity. *Hypertension*, 72: 19–23. Doi: <https://doi.org/10.1161/HYPERTENSIONAHA.118.11128>
- [23] Chittaranjan Andrade, Vikas Menon, Shahul Ameen, and Samir Kumar Praharaj. 2020. Designing and Conducting Knowledge, Attitude, and Practice Surveys in Psychiatry: Practical Guidance. *Indian Journal of Psychological Medicine*, 42(5): 478–481. Doi: <https://doi.org/10.1177/0253717620946111>