ORIGINAL ARTICLE

Ketogenic diet: knowledge, awareness, and perception among university students in Saudi Arabia

Nahla A. Alshaikh

Biomedica - Official Journal of University of Health Sciences, Lahore, Pakistan
Volume 38(2):64-69
https://doi.org/10.51441/BioMedica/5-707

ABSTRACT

Background and Objective: Ketogenic diet (KD) has gained a high popularity recently. It is extensively used for weight reduction besides its therapeutic use in some diseases. The aim of this study was to determine the awareness, knowledge, and perception about KD, its therapeutic uses, and side effects among university students in Saudi Arabia.

Methods: This survey-based study was conducted at Jazan University, Jazan, Saudi Arabia, during the month of December, 2021. A validated and pretested questionnaire was electronically distributed via a Google Drive link to collect data from the students enrolled in the study. Data were computed using correlation statistics.

Results: A total of 701 students completed the questionnaire. Among all students, 64% were females and 64.6% were studying in non-health related specialties. Majority of the students (84.8%) had heard about KD at the time of survey administration and 70.6% knew someone who were using KD. More than half (69.5%) of the students reported weight loss as the purpose of KD use. Most of the participants did not know about the therapeutic use of KD for diabetes and epilepsy (58.9% and 81%, respectively). Majority of the students did not know about most of the adverse effects of KD; however, 87.2%, 79.7%, and 80.9% of the participants had a perception that everyone cannot follow KD, it is not safe to follow KD lifelong, and the diet has to be recommended and supervised by a physician, respectively.

Conclusion: The study shows that students had low knowledge about KD's therapeutic uses and side effects. Weight loss was considered as the main purpose for using KD. Most of the students rightfully perceived the importance of consulting a physician before adopting this diet plan.

Keywords: Ketogenic diet, weight loss, students, university, knowledge, perception.

Received: 11 March 2022 **Revised date:** 19 May 2022 **Accepted:** 02 June 2022
Correspondence to: Nahla A. Alshaikh
*Assistant Professor of Biochemistry, Department of Medical Laboratory Technology, Faculty of Applied Medical Sciences, Jazan University, Jazan, Saudi Arabia.
Email: nalshaikh@jazanu.edu.sa
Full list of author information is available at the end of the article.

Introduction

Obesity is becoming a major health concern due to its incessant prevalence rates globally in the adults and children equally. Obesity is a risk factor for many health complications and chronic diseases.[1-3] Although a trend of gradual decrease in the prevalence of obesity has been reported in Saudi Arabia, a significant association between obesity and a few clinical conditions such as type 2 diabetes mellitus (T2DM), hypercholesterolemia, hypertension, lung diseases, rheumatoid arthritis, sleep apnea, colon diseases, and thyroid disorders has been found which emphasizes the urgent need for its more rigorous control and management.[4] In general, people are aware of the negative impact of obesity on their quality of life and its association with the increased risk of chronic diseases. Therefore, they try many diets and calories restriction regimens to lose weight regardless of knowing their primary purpose or potential risks. One of these dietary regimes is ketogenic diet (KD) in which the body is restricted to low levels of carbohydrates, moderate levels of proteins, and unrestricted levels of fat.[5] This nutritional redistribution induces metabolic changes including induction of gluconeogenesis and ketogenesis as an alternative energy source to glycolysis which is the primary and the most favored energy source for the body under normal physiological conditions.[6]

Clinically, KD is known for its positive therapeutic impact on patients with epilepsy[7] and with other systemic conditions such as cardiovascular diseases[8] and diabetes mellitus.[9] On the other hand, KD is associated with many short-term adverse effects including gastrointestinal problems, dizziness,

headache, dehydration, weakness, and fatigue. Long-term adverse effects of KD include vitamin and mineral deficiencies, acidosis, osteoporosis, and kidney stones.[10-13] Data regarding KD is growing in literature and many unanswered questions concerning clinical impact, efficacy, and safety of the diet have been addressed. However, most conducted studies lack generalizability and validity due to a number of limitations including small sample size and short study duration hence, the effectiveness and recommendation on using KD is still a matter of debate and individuals who are interested in adopting the KD should take precaution and discuss with their physicians before self-administration.

Nowadays, KD is gaining much popularity as one of the most effective diets for weight loss in Saudi society. Therefore, the current study aims to investigate and evaluate the knowledge, awareness, and perception about KD among Saudi students studying at Jazan University.

Methods

A cross-sectional descriptive study was conducted between 1st December, 2021 and 15th December, 2021 among students studying in different disciplines at Jazan University, Saudi Arabia. A well-structured, pretested, and validated questionnaire was used to collect data from the study participants. The survey was composed of 20 questions exploring demographic characteristics of the participants, knowledge about ketogenic-diet, students' awareness regarding the adverse effects and use of KD. The questionnaire was electronically distributed via a Google Drive link. The participants who gave their agreement to participate in the survey and had heard of KD before were considered for inclusion in the study. Ethical approval to conduct research was obtained from the Institutional Review Board at Jazan University, Saudi Arabia.

Statistical analysis

Collected data were reviewed and coded. Analysis was performed by using Statistical Package for the Social Sciences (SPSS) version 25.0 (SPSS for Windows, Chicago, IL). Frequency and percentages were calculated for demographic data, and KD awareness, knowledge, and perception. Pearson's correlation coefficient was used to measure the strength of association between the variables, awareness, and use of KD. The *p*-value of ≤0.05 was considered to be significant.

Results

A total of 845 students responded to the survey, in which 827 (97.9%) continued taking the survey questionnaire, while 18 students refused to participate in the study. Majority of the participant students (529, 64%) were females and the age of most of them (99.3%) ranged between 18 and 25 years. Regarding the weight, 79 (9.6%), 231 (27.9%), 188 (22.7%), 143 (17.3%), and 186 (22.5%) students were <40, 40-50, 51-60, 61-70, and >70 kg respectively. Of the total participants, 534 (64.6%) were from non-health related specialties. Majority of the students 701 (84.8%) answered that they have heard about KD before and continued the survey, while those who were unaware of KD [126 (15.2%)], their responses were automatically terminated. Among those who continued the survey, 116 (16.5%) had used KD before and 495 (70.6%) knew someone who used KD.

While ascertaining the knowledge of KD among students, they were asked about the purpose of using KD and some its therapeutic and adverse effects. The most reported answer was weight loss (487, 69.5%), followed by the general maintenance of health (136, 19.4%), and blood sugar control (48, 6.8%). Of the total, 30 (4.3%) students did not know the purpose for following KD. Only 287 (41.1%) and 133 (19%) participants were aware of the therapeutic role of KD for diabetes, and epilepsy, respectively. Among the study participants, 422 (60.2%) knew that headache, dizziness, vomiting, and constipation are short-term adverse effects, while 509 (72.6%), 311 (44.4%), 471 (67.2%), and 514 (73.3%) students did not know that acidosis, dehydration, vitamins deficiency, osteoporosis, and kidney stone formation are long term adverse effects of KD on health (Table 1).

Analysis of perception regarding KD among the student showed that 611 (87.2%), 559 (79.7%), and 567 (80.9%) students had a perception that not everyone can follow KD, it is not safe to follow KD for lifelong, and the diet has to be recommended and supervised by a physician, respectively (Table 1).

The distribution of KD awareness and use among students by their gender, major subject, and weight is shown in Table 2. To examine awareness of KD, students were asked if they had heard about KD before or not. Most of the female students answered this question (yes) with statistical significance (p = 0.002). Also, a significant relation (p = 0.019) was observed between the students' major (non-health related subjects) and awareness regarding KD. Weight had no statistical association with student's awareness about KD. Regarding use of KD by students, it was found that students' having weight >70 kg was significantly associated (p = 0.000) with the use of KD, while gender and study major had no significant associations.

Discussion

With the dramatic increase in the prevalence of obesity among adults and children all over the world, KD has gained popularity in the past few years mainly as a dietary approach for weight loss.[14] Although, the positive role of KD in treatment of overweight and obesity and in improving some

Table 1. *Knowledge and perception regarding KD among students.*

Student's knowledge and perception regarding KD	*n*	%
What do you think the purpose of following KD?		
Weight loss	487	69.5
Control blood sugar	48	6.8
Control general health	136	19.4
Don't know	30	4.3
Do you know the therapeutic effect of keto diet on diabetes?		
Yes	287	41.1
No	412	58.9
Do you know the therapeutic effect of KD on epilepsy?		
Yes	133	19
No	568	81
Do you know that fatigue, headache, dizziness, nausea, vomiting, and constipation are common short-term side effects of KD?		
Yes	422	60.2
No	279	39.8
Do you know that acidosis is one of the adverse effects of KD on health?		
Yes	192	27.4
No	509	72.6
Do you know that dehydration and vitamins deficiency is one of the adverse effects of KD on health?		
Yes	390	55.6
No	311	44.4
Do you know that osteoporosis is one of the adverse effects of KD on health?		
Yes	230	32.8
No	471	67.2
Do you know that kidney stone is one of the adverse effects of KD on health?		
Yes	187	26.7
No	514	73.3
Do you think KD is safe to follow lifelong?		
Yes	142	20.3
No	559	79.7
Do you think KD should only be recommended to individuals by a physician under supervision?		
Yes	567	68.6
No	134	16.2
Do you think anyone can follow KD?		
Yes	90	12.8
No	611	87.2

neurological diseases has been reported in literature,[15,16] adopting KD is not recommended to the general population. The present study aimed at evaluating the knowledge, awareness, and perception of KD among Jazan University students as a sample of the Saudi population.

More than half (64%) of the participants in our study were females; considering their consciousness about weight management and interest in having ideal body shape, females were found to be the major respondents in many previous studies that investigated the knowledge and perception about KD.[17,18] Majority (84.8%) of the students who responded to the survey already knew and had heard about KD before and 70.6% of them knew someone who used KD. This finding indicates the popularity of KD among people in Saudi society.

In general, weight loss is a common reason to adopt a diet, and people are more prone to follow any diet to reach their goal in weight loss without focusing on the possible side

Table 2. *Distribution of KD awareness and use among students by their gender, major subject, and weight.*

Awareness and use of KD	Variable	*p*-value	Correlation
Have you heard of keto diet before?	Male	0.002	0.109
	Female		
	Health related major subject	0.019	0.082*
	Non-health related major subject		
	Weight < 40 kg	0.053	0.067
	Weight 40-50 kg		
	Weight 51-60 kg		
	Weight 61-70 kg		
	Weight >70 kg		
Have you ever followed a keto diet?	Male	0.305	0.039
	Female		
	Health related major	0.291	0.040
	Non-health related major		
	Weight <40 kg	0.000	0.212
	Weight 40-50 kg		
	Weight 51-60 kg		
	Weight 61-70 kg		
	Weight >70 kg		

effects or the possible negative health impact. According to our results more than half of the students answered that the weight loss is the main purpose of using KD among people. This finding is similar to the outcome of a previous cross-sectional study conducted among medical students at College of Medicine and Dentistry, Lahore, Pakistan.[19] The study has shown weight loss to be the main aim and important factor for adapting KD. This indicates the wide use of KD and its efficacy in rapid weight loss; another study conducted on obese adults reports the superior effects of low-carbohydrate KD in comparison to low caloric low-fat diets for weight reduction.[20]

When assessing students' knowledge about KD, it was found to be low since more than half of the students did not know the therapeutic effects of KD on diabetes and epilepsy. The association between KD and the development of many long-term adverse effects such as acidosis, nutrients deficiency, osteoporosis, and kidney stone are well established in the literature.[10,11,13] In the present study, more than half of the participants had low knowledge about long-term adverse effects of KD on health. In a previous study aimed to examine the knowledge, perception, and usage of the KD among college students at Kent State University, USA, the students also had low knowledge about KD.[17] In contrast to this and the present study that enrolled participants with different specialties, a study conducted among medical students in Lahore, Pakistan showed higher level of knowledge and perception about KD. This indicates that type of courses and level of education are also one of the factors that influence the knowledge and perceptions about KD. Regarding short-term effects of KD, 60% of the students knew that fatigue, headache, dizziness, nausea, vomiting, and constipation are experienced by the users. This is may be due to the fact that these effects are usually associated with most diet regimens as a result of caloric restriction and energy decline. The students in the present study depicted high perception regarding safety of KD to be used for long-term purpose. This perception is in an alignment with the high level of disagreement reported in literature about the safety of KD to be adopted lifelong.[21,22] In addition to that, 68.6% of the students in the current study had a perception that KD should only be recommended to individuals by a physician under supervision. This perception is already supported by the study of Rosha et al.[23] who found the 5-rubric model of the keto counseling. This model can guide people toward efficient and healthy way to achieve their goals. The present study necessitates the importance of dissemination of knowledge in the general population regarding KD to circumvent any short-term or long-term side effects of unsupervised use of KD.

Conclusion

Keto diet is primarily considered to be used for weight loss purpose, while the relevant knowledge and perception regarding its clinical and nutritional aspects is inconsistent among Jazan University students.

Limitations of the study

The present study was conducted only on the enrolled students of Jazan University. Larger sample size with multicentric study population may be chosen for better generalizability of the results. Also, a comparative study between health sciences and non-health sciences students may also be beneficial in mapping the trend of knowledge and perception regarding KD among university students.

Acknowledgement

The authors would like to acknowledge the students of the Jazan University, Saudi Arabia for participating in the study. The authors would also like to thank the management of the University for their logistic support during the execution of the study.

List of Abbreviations

KD	Ketogenic diet
T2DM	Type 2 diabetes mellitus

Conflict of interest

None to declare.

Grant support and financial disclosure

None to disclose.

Ethical approval

Ethical approval to conduct research was obtained from the Institutional Review Board at Jazan University, Saudi Arabia vide Letter No. REC-43/04/065 dated 15 November, 2021.

Author's contribution

NAA: Conception and design of the study, data collection, drafting of the manuscript and approval of the final version of the manuscript to be published.

Author's Details

Nahla A. Alshaikh

1. Assistant Professor of Biochemistry, Department of Medical Laboratory Technology, Faculty of Applied Medical Sciences, Jazan University, Jazan, Saudi Arabia

References

1. Powell-Wiley TM, Poirier P, Burke LE, Després JP, Gordon-Larsen P, Lavie CJ, et al. Obesity and cardiovascular disease: a scientific statement from the American Heart Association. Circulation. 2021;143(21):e984–1010. https://doi.org/10.1161/CIR.0000000000000973
2. Zammit C, Liddicoat H, Moonsie I, Makker H. Obesity and respiratory diseases. Int J Gen Med. 2010;3:335–43. https://doi.org/10.2147/IJGM.S11926
3. Crowson CS, Matteson EL, Davis JM 3rd, Gabriel SE. Contribution of obesity to the rise in incidence of rheumatoid arthritis. Arthritis Care Res (Hoboken). 2013;65(1):71–7. https://doi.org/10.1002/acr.21660
4. Althumiri NA, Basyouni MH, AlMousa N, AlJuwaysim MF, Almubark RA, BinDhim NF, et al. Obesity in Saudi Arabia in 2020: prevalence, distribution, and its current association with various health conditions. Healthcare (Basel). 2021;9(3):311. https://doi.org/10.3390/healthcare9030311
5. Freeman JM, Kossoff EH, Hartman AL. The ketogenic diet: one decade later. Pediatrics. 2007;119(3):535–43. https://doi.org/10.1542/peds.2006-2447
6. García-Rodríguez D, Giménez-Cassina A. Ketone bodies in the brain beyond fuel metabolism: from excitability to gene expression and cell signaling. Front Mol Neurosci. 2021;14:732120. https://doi.org/10.3389/fnmol.2021.732120
7. Martin-McGill KJ, Bresnahan R, Levy RG, Cooper PN. Ketogenic diets for drug-resistant epilepsy. Cochrane Database Syst Rev. 2020;6(6):CD001903. https://doi.org/10.1002/14651858.CD001903.pub5
8. Santos FL, Esteves SS, da Costa Pereira A, Yancy WS, Nunes JPL. Systematic review and meta-analysis of clinical trials of the effects of low carbohydrate diets on cardiovascular risk factors. Obes Rev. 2012;13(11):1048–66. https://doi.org/10.1111/j.1467-789X.2012.01021.x
9. Yancy WS Jr, Foy M, Chalecki AM, Vernon MC, Westman EC. A low-carbohydrate, ketogenic diet to treat type 2 diabetes. Nutr Metab (Lond). 2005;2(1):34–7. https://doi.org/10.1186/1743-7075-2-34
10. Yuen AWC, Walcutt IA, Sander JW. An acidosis-sparing ketogenic (ASK) diet to improve efficacy and reduce adverse effects in the treatment of refractory epilepsy. Epilepsy Behav. 2017;74:15–21. https://doi.org/10.1016/j.yebeh.2017.05.032
11. Çağlar A, Edizer S, Sarıtaş S, Çelebi Çelik F, Önder M, Er A, et al. Pediatric emergency department visit characteristics of the patients on the ketogenic diet. Epilepsy Behav. 2019;99:106446. https://doi.org/10.1016/j.yebeh.2019.106446
12. Batch JT, Lamsal SP, Adkins M, Sultan S, Ramirez MN. Advantages and disadvantages of the ketogenic diet: a review article. Cureus. 2020;12(8):e9639. https://doi.org/10.7759/cureus.9639
13. Liu Q, Zhou J, Yang Z, Xie C, Huang Y, Ling L, et al. The ginsenoside exhibits antiosteoporosis effects in ketogenic-diet-induced osteoporosis via rebalancing bone turnover. Front Pharmacol. 2020;11:593820. https://doi.org/10.3389/fphar.2020.593820
14. Abbasi J. Interest in the ketogenic diet grows for weight loss and type 2 diabetes. J Am Med Assoc. 2018;319:215–7.
15. Di Rosa C, Lattanzi G, Taylor SF, Manfrini S, Khazrai YM. Very low-calorie ketogenic diets in overweight and obesity treatment: effects on anthropometric parameters, body composition, satiety, lipid profile and microbiota. Obes Res Clin Pract. 2020;14(6):491–503. https://doi.org/10.1016/j.orcp.2020.08.009
16. Arora N, Mehta TR. Role of the ketogenic diet in acute neurological diseases. Clin Neurol Neurosurg. 2020;192:105727. https://doi.org/10.1016/j.clineuro.2020.105727
17. D'Agostino AM. Knowledge, perception, and use of the ketogenic diet in college students at a Midwestern University (doctoral dissertation). Kent, OH: Kent State University; 2019.
18. Connor-Greene PA. Gender differences in body weight perception and weight-loss strategies of college students. Women Health. 1988;14:27–42. https://doi.org/10.1300/J013v14n02_03
19. Butt MU, Bawa MD, Biomedica HA. Knowledge and perception about ketogenic diet among medical students. Biomedica. 2020;36(2):126–31.

20. Al Aamri KS, Alrawahi AH, Al Busaidi N, Al Githi MS, Al Jabri K, Al Balushi F, et al. The effect of low-carbohydrate ketogenic diet in the management of obesity compared with low caloric, low-fat diet. Clin Nutr ESPEN. 2022;49:522–8. https://doi.org/10.1016/j.clnesp.2022.02.110
21. Watanabe M, Tuccinardi D, Ernesti I, Basciani S, Mariani S, Genco A, et al. Scientific evidence underlying contraindications to the ketogenic diet: an update. Obes Rev. 2020;21(10):e13053. https://doi.org/10.1111/obr.13053
22. Shilpa J, Mohan V. Ketogenic diets: boon or bane? Indian J Med Res. 2018;148(3):251. https://doi.org/10.4103/ijmr.IJMR_1666_18
23. Rosha R, Singla R, Kalra B. Predietary counseling in ketogenic 79.7