



Exploring the Association between Nutritional Knowledge and Fruit and Vegetable Consumption among Young Adults: A Cross-sectional Study

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Abstract

The major cause of death globally is chronic diseases linked to lifestyle choices, such as diabetes and cardiovascular disease. Consuming fruits and vegetables is crucial to receiving the critical nutrients the body needs in small amounts. However, there is little knowledge of and intake of this crucial part of nutrition worldwide. The current study postulated a strong correlation between young adults in Riyadh knowledge of and consumption of fruit and vegetables. Hence, the present study aimed to investigate the knowledge of fruits and vegetables among young adults in Riyadh, to investigate the intake of fruit and vegetables among young adults in Riyadh, in addition to investigate the association between knowledge and intake of fruit and vegetables among young adults in Riyadh. The obtained results revealed that 98.3% of the 463 participants who were evaluated at baseline had adequate knowledge of fruits and vegetables, while 1.7% had inadequate knowledge. In addition, we discovered that 91.6% of participants consumed fewer fruits and vegetables than those who consumed more (2.8%). Therefore, for the greatest impact, health promotion messages should specifically target these subgroups of fruit and vegetable intake.



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Introduction


The association between lifestyle choices and various chronic diseases, including diabetes, cardiovascular diseases, and obesity, is widely recognized in

the medical literature. The consumption of fruits and vegetables is crucial due to their nutritional composition. Nonetheless, a significant lack of global understanding and awareness remains regarding the

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importance of incorporating an adequate amount of fruits and vegetables into one's diet.¹ An optimal threshold for fruit and vegetable (F&V) consumption has not been definitively determined. Research findings indicate that a daily intake of less than 500 g of F&V can have long-term implications on human health.

Conversely, studies have revealed that a significant proportion of the global population consumes less than 400 g of F&V daily.² Adopting F&V-rich diets is advocated as a preventive measure against severe illnesses, as it is widely recognized that these dietary choices offer significant health benefits. Fruits and vegetables are particularly valued for their high levels of essential vitamins, notably vitamins C and A, as well as minerals, electrolytes, and more recently identified phytochemicals, including antioxidants. Throughout history, fruits and vegetables have consistently played a crucial role in nutritional guidance and recommendations.³⁻⁶

Numerous diseases and their associated complications stem primarily from oxidative stress. A significant characteristic of many fruits and vegetables is their rich content of phytochemicals with potent anti-oxidant properties, which exhibit scavenging abilities. These phytochemicals have shown promise as anti-inflammatory, antioxidant, and anticancer agents. Furthermore, their consumption can offer protection against complications from obesity, diabetes mellitus, and cardiovascular diseases.⁷ In addition, Research findings provide evidence of a strong association between insufficient consumption of F&V and the development of chronic illnesses. Cardiovascular illness, high blood pressure, hypercholesterolemia, osteoporosis, different cancers, chronic obstructive lung diseases, respiratory issues, and mental health issues are a few of these, but they are not the only ones.

On the contrary, a study revealed that increased consumption of F&V leads to elevated levels of vitamin C and carotene within the human body while concurrently reducing body fat content.⁸ Moreover, a cross-sectional study demonstrated a positive correlation between individuals with a high level of knowledge and their consumption of F&V while concurrently exhibiting a reduced dietary fat intake.⁹ Based on the 2023 population statistics of Saudi

Arabia, around 25% of the population comprises adolescents, while approximately 37% consists of individuals under the age of 25. Given this demographic composition, it becomes imperative to prioritize interventions to promote healthy lifestyles among this age group to prevent or slow the onset of diseases and complications. A study conducted among university students in Kuwait reported an average daily consumption of 2.06 servings of fruits and vegetables. Furthermore, the study observed a notable gender disparity, with a higher proportion of female students consuming fruits and vegetables to manage or control weight.¹⁰ Furthermore, a study revealed that a substantial majority (70% or higher) of Kuwaiti adults failed to meet the recommended dietary guidelines for fruit, vegetable, legume, and high-fiber food consumption.¹¹⁻¹²

Nutrition knowledge pertains to an individual's cognitive capacity to comprehend information related to food and nutrition, encompassing the factors influencing food choices and the efficacy of dietary interventions in preventing non-communicable diseases.¹³⁻¹⁴ By possessing adequate nutrition knowledge, individuals are more likely to modify their eating behaviors, reducing the risk of developing non-communicable diseases and promoting nutritious foods. These conditions, responsible for a considerable proportion of global mortality, can be effectively prevented by adopting healthy lifestyle choices and a balanced diet.¹⁵⁻¹⁶ Comprehensive nutrition knowledge is vital for individuals to comprehend and address their nutritional requirements, enabling them to make informed decisions regarding their food intake.¹⁷⁻¹⁸

An analysis of food and beverage intake in nine Eastern Mediterranean nations found that 70% of adults (15–65 years old) don't consume the required five servings per day.⁵ Only 19.4% of adolescents in eleven countries in the Eastern Mediterranean region who were investigated on their eating of fruit and vegetables reported doing so at least five times each day.¹⁹ 95.6% of persons aged 25 to 64 eat fewer than 5 servings of fruits and/or vegetables per day, according to a population-based survey (STEPS) done in Egypt on 5300 adults aged 15 to 65.5

Furthermore, McEachern *et al.*²⁰ found that the proportions of children who report intake of ≥ 5 servings of F&V per day is lower than the Canada's

Food Guide, and the mean total food knowledge reported by their sample is also quite low at 63.5%. Moreover, children's F&V intakes in Ireland, the Netherlands, and the UK varied from 221 to 272 g/d, whereas it was 404 g/d in Denmark and 341 to 350 g/d in Italy and Spain.²¹

Whilst, in pregnant women in Japan F&V intake (278.6–258.1 g/d) is lower than the recommended target value for vegetable consumption in Japan (350 g/d). The difference in average fruit intake in the Spanish mother-infant cohort study was 537.4 g/d.²² and that of a delivered women cohort study in Denmark was 283.2 g/d.²³

For elderly, older adults consume more servings of F&V, which might be nutritionally essential given the change in metabolic processes that happens in older age. Less than half of older persons consume the recommended five servings of fruit and vegetables each day, despite the fact that the majority of elderly people reported including at least one serving of F&V in their daily diet (85 and 95%, respectively). According to the study's methodology, just 21 to 37% of men and 29 to 45% of women aged 65 and older are believed to consume the required servings per day.²⁴

Among various age groups, young adults (18-25 years old) typically exhibit comparatively lower levels of knowledge and consumption of fruits and vegetables. Simultaneously, they tend to be the highest consumers of fast food, takeaways, and trendy food options, making them susceptible to weight gain. Multiple studies have suggested that these patterns may arise from shifts in dietary habits, including skipping breakfast and relying on external dining options. Furthermore, lifestyle changes resulting from increased social activities have also been identified as contributing factors.²⁵⁻²⁷ This particular age group represents a transitional phase characterized by dietary adjustments influenced by social and environmental factors.²⁸ Moreover, to the best of our knowledge, our study is the first to investigate the correlation between fruit and vegetable knowledge and consumption among young adults residing in Riyadh.

Study Hypothesis

There is growing evidence that young adults are more susceptible to health inequities. These

disparities could be caused by healthy habits like eating enough fruits and vegetables. There isn't much data from population-based studies at the national level about how frequently young adults in Riyadh eat fruits and vegetables.

Study Objectives

The primary objective of this study was to examine the level of knowledge and consumption patterns of fruits and vegetables among young adults in Riyadh. Furthermore, the study was extended to determine the potential correlation between knowledge and intake of fruits and vegetables.

Materials and Methods

Research Design

A cross-sectional study was undertaken among young adults in Riyadh, Saudi Arabia. The inclusion criteria encompassed Saudi males and females aged 18-25 years living in Riyadh. Conversely, pregnant or lactating women and individuals with chronic diseases that could potentially impact their dietary intake, such as food allergies, cardiovascular disease, diabetes, and celiac disease, were excluded from the study. The participants for this study were recruited through the snowball sampling technique, wherein initial participants were referred to additional individuals who met the eligibility criteria. The sample size was determined using a non-probability sampling approach, employing a sample size equation with an assumed prevalence of 50%. Consequently, the calculated sample size for the study is 385 participants.

Semi-Structured Knowledge Questionnaire

The semi-structured knowledge questionnaire was validated.²⁹ The assessment instrument comprises a set of 10 questions designed to evaluate the participants' nutritional knowledge concerning the health advantages associated with fruit and vegetable consumption. The questionnaire was translated into Arabic and underwent validation by an expert in the field. The questionnaire utilized a 20-point knowledge scale to assess participants' understanding of fruit and vegetable intake. Scores below or equal to 10 indicate poor nutritional knowledge, while scores greater than or equal to 11 indicate good nutritional knowledge.

Fruits and vegetables intake screeners questionnaire
The Fruit and Vegetable Intake Screeners

questionnaire, previously validated by Thompson *et al.* in 2000, was employed for this study. This assessment tool comprises ten questions to estimate the participants' fruit and vegetable intake. The questionnaire was translated into Arabic and subsequently validated by subject matter experts.³⁰

Table 1: Sociodemographic characteristics of participants

Variable	Mean	SD
Age	20.44	1.7
BMI	23.8	15.2
Variable	Frequency	Percentage
Gender	(n)	(%)
Female	386	83.3%
Male	77	16.6%
Nationality		
Saudi	451	97.4%
Non-Saudi	12	2.6%
B.M.I. categories		
Underweight	78	16.8%
Normal	265	57.2%
Overweight	81	17.5%
Obese	39	8.4%
Education		
High school	146	31.5%
Bachelor degree	315	68.0%
Higher than the bachelor's degree	2	0.4%
Career		
Student	418	90.3%
Employee	12	2.6%
Unemployed	33	7.1%
Income		
Limited (less than 3000)	344	74.3%
Middle (3000-10000)	80	17.3%
High (11000-25000)	27	5.8%
Higher than 25000	12	2.6%
Marital status		
Single	441	95.2%
Married	22	4.8%

Questionnaire Design and Collection Method

Using Google Forms, an online survey was created and disseminated across a number of social media channels, including WhatsApp, Twitter, Telegram, and Snapchat. The questionnaire will request participants to provide demographic details such as

age, gender, weight, height, marital status, income level, education level, and occupation. Furthermore, participants were asked to report their weight and height, enabling the calculation of their body mass index (B.M.I.) calculation.

Statistical Analysis

Before data processing and analysis, incomplete data and data from participants who didn't fit the predetermined criteria were eliminated. To assess the validity of the hypothesis and make predictions, inferential statistics were used. For data entry and analysis, the Statistical Package for the Social Sciences (SPSS) programme (version 22) was used. While continuous variables were given as mean + standard deviation (SD) or median, categorical variables were shown as frequencies and percentages. An ANOVA test was used to evaluate the relationship between knowledge levels and fruit and vegetable consumption. Fisher's chi-square test was used to determine whether the intergroup distribution in descriptive statistics was significant. For data that did not follow a normal distribution, Wilcoxon's ranked sum test was employed, and for data that did, the paired samples t-test was utilized. The linear regression analysis was used to examine the relationships between independent variables relating to fruit and vegetable consumption. Correlation analysis was used to look at how continuous variables related to one another. The graphics were created using the Forest Plot technique. Odds ratios (OR) and adjusted odds ratios (adjusted OR) with 95% confidence intervals (95% CI) were used to represent relationships. At a significance level of $p < 0.05$, the data were evaluated within a 95% confidence interval.

Ethical Consideration

Prior to commencing the study, prospective participants were provided with comprehensive information regarding the study's objectives, their role, and the voluntary nature of participation. They were also presented with a consent form detailing the research and its purpose and were free to decline participation or withdraw from the study at any point. Upholding the privacy and preserving the dignity of the participants was given utmost priority. To ensure anonymity, no identifiable demographic data were utilized, and all records about the study were treated with strict confidentiality.

Results

Table 1 presents the sociodemographic characteristics of the participants involved in the study. A total of 463 individuals were included, 83.4% being females and 16.6% males. The age range of the study sample varied from 18 to 25 years. The average age and BMI were 20.44 ± 1.7 and 23.8 ± 15.2 , respectively. The majority of participants was students (90.3%), Saudi nationals (97.4%), unmarried (95.2%), and had a limited income (74.3%). Over half of the participants exhibited a normal BMI (57.2%). Additionally, 68% of the participants held a bachelor's degree.

Association between Fruits and Vegetable Intake and Knowledge

Table 2 presents the relationship between knowledge and fruit and vegetable intake. The results indicate that participants who consumed an adequate amount of fruits and vegetables (2–5 servings/day) or a high amount (> 5 servings/day) possessed good knowledge regarding these food groups. Interestingly, out of the total sample, 424 participants (91.6%) reported a low intake of fruits and vegetables (<2 servings/day), and only 8 of them (0.2%) had poor knowledge (Figs. 1 and 2). However, the observed differences were insignificant ($p > 0.05$).

Table 2: The association between knowledge and intake

			The intake				Chi-square test
			Low	Appropriate	High	Total	
Knowledge	Poor	Count	8	0	0	8	0.749= χ^2
		%	100%	0%	0%	100%	
	Good	Count	416	26	13	455	
		%	91.4%	5.7%	12.8%	100%	
Total		Count	424	26	13	463	
		%	91.6%	5.6%	2.8%	100%	

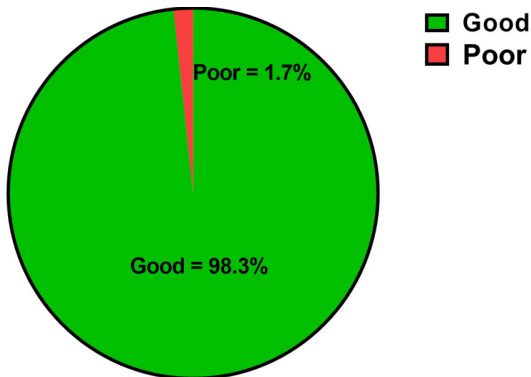


Fig.1: shows the knowledge of the participants. The pie chart reveals that those with good knowledge were the highest (98.3%), compared to those with poor knowledge (1.7%)

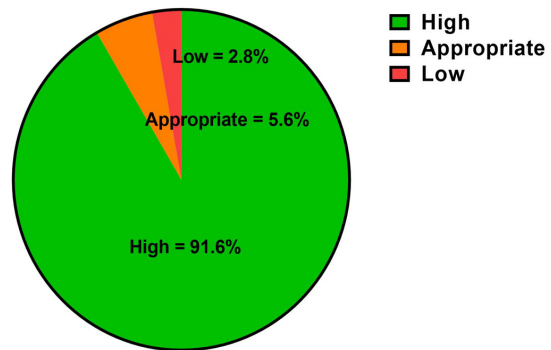


Fig.2: shows the fruit and vegetable intake of the participants. The pie chart reveals that those with a low intake of fruits and vegetables were the highest (91.6%) compared to those with a high intake of fruits and vegetables (2.8%)

Association between Fruit and Vegetable Intake and Gender

Table 3 represents the differences in fruits and vegetable intake between males and females. As revealed in the Table 3, the majority of male and

female participants had a low intake of fruits and vegetables (<2 servings/day), and it was slightly higher among females than males (92.5% and 87%, respectively). Males had a higher appropriate intake

of fruits and vegetables (2–5 servings/day) (10.4%) than females (4.7%). Furthermore, both males and females had similar percentages when it comes to high intake of fruits and vegetables (>5 servings/day) (2.6% and 2.8%, respectively). However, all these differences in the Table were insignificant ($p > 0.05$).

Table 3: The association between gender and intake

			The intake				Chi-square test
			Low	Appropriate	High	Total	
Gender	Female	Count	357	18	11	386	$\chi^2=3.973$
		%	92.5%	21.7%	10.8%	100%	
	Male	Count	67	8	2	77	
		%	87.0%	10.4%	2.6%	100%	
Total		Count	424	26	13	463	
		%	91.6%	5.6%	2.8%	100%	

The Association Between Fruit and Vegetable Intake and both Knowledge and B.m.i.

Table 4 displays the absence of a significant correlation between fruit and vegetable intake

and B.M.I. ($p = 0.841$). Conversely, a statistically significant negative association is observed between fruit and vegetable intake and knowledge ($p = 0.05$).

Table 4: The correlation between fruit and vegetable intake with Knowledge and B.M.I.

	Intake		Knowledge	
	CC	p-value	CC	p-value
BMI	-0.009	0.841	----	----
Intake	----	----	-0.131**	0.05

Discussion

In this cross-sectional study, most participants exhibited a normal BMI, with the age group between 18 and 25 being the most prevalent in the sample. Additionally, the findings revealed that only 91.6% of individuals consumed adequate fruits and vegetables. These results align with typical patterns observed in population-based research. For instance, a study conducted in the UK called Understanding Society reported that only 13% of individuals aged 15 to 29 and 20% of those aged 30 to 41 met the recommended daily intake of fruits and vegetables.³¹ Based on data obtained from the World Health Survey,³² individuals in three South Asian countries did not meet the recommended guidelines for vegetable consumption. The prevalence of inadequate vegetable intake was exceptionally high, reaching approximately 14% in Bangladesh.

Furthermore, around 40.5% of individuals reported consuming fresh fruit only twice a week, while approximately 48% reported consuming vegetables once a week.^{5,32-34}

The findings regarding awareness of fruit and vegetable intake were diverse. Participants across different studies indicated that they were cognizant of the importance of incorporating fruits and vegetables into their diet and the associated health benefits. The prevalence of obesity and overweight among young adults is a significant global public health concern. According to the Kenya STEPwise 2015 survey, 4.9% of young individuals aged 18 to 29 were classified as obese, while 16.6% were categorized as overweight.³⁵ In our study, the prevalence of inadequate fruit and vegetable intake was slightly higher, with 7% observed in India and 3% in Nepal.

Previous research has indicated that individuals typically consume between 10% and 37% less fruits and vegetables than the recommended guidelines suggest.³⁶

Although the specific number of daily servings was not specified, a cross-sectional survey conducted among undergraduates in 11 faculties at Assuit University yielded contrasting results to those of the present study. In that survey, it was found that 21.2% of the participants consumed fruits many times each day, while 22.8% consumed vegetables many times each day. In contrast, a survey conducted among Saudi Arabians indicated that 85.5% of the participants consumed fewer than three servings of fruits and vegetables per day, with percentages of 17.5% for fruits and 8.4% for vegetables. Studies conducted among younger adults have reported similar or even higher prevalence rates than the present study. For instance, a Saudi Arabian university reported a prevalence of overweight and obesity of 20.4% and 14.9%, respectively; three Cameroonian universities reported rates of 21.7% and 3.0%; a US university reported rates of 23.2% and 11.3%, a Colombian university reported rates of 25.1% and 7.6%, and an Egyptian university reported rates of 27% and 8.5% respectively.^{5,37-38} Gender was not consistently associated with fruit and vegetable consumption in previous studies. Consistent with previous research findings, the present study did not find any correlation between gender and the adequate intake of fruits and vegetables. However, studies conducted in Greece, Saudi Arabia, and the US have reported that women consume fruits and vegetables more regularly than men.³⁹⁻⁴¹ A study conducted in Turkey found that women exhibited higher motivation and a more positive attitude toward consuming adequate fruits and vegetables.⁴² Based on a study conducted in Egypt, it was observed that male university students had significantly higher vegetable consumption compared to female students. However, no significant difference was found in fruit intake between male and female students.⁴³ The current study did not find any conclusive evidence to suggest that students' knowledge influenced their fruit and vegetable consumption. Although male students had

higher knowledge scores than female students, this did not translate into a significant increase in their consumption. Conversely, two previous studies have reported a positive association between knowledge and consumption.^{34,44}

The students in the current study consumed little fruit and vegetables, regardless of their knowledge or attitude scores for this food group. However, the study found that many students indicated a desire to buy healthier food if it were available. The presence of healthy food events sponsored by the Department of Community Medicine seems to have a favourable influence on students' understanding of and attitudes towards the advantages and difficulties of eating fruits and vegetables.

Conclusion

To conclude, a significant percentage of participants exhibited a low intake of fruits and vegetables, accompanied by limited knowledge and perceptions concerning the advantages and obstacles related to consuming these food items. Future and more thorough research should take into account a wide range of additional crucial variables, including family intake, education, income, fruit availability and accessibility at home, school nutrition instruction, social circumstances, issue of food insecurity, etc.

Authors' contributions

All the authors shared equally towards this submission.

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Conflicts of Interest

All authors mentioned no conflicts of interest in this research.

References

1. Banwat ME, Lar LA, Daboer J, Audu S, Lassa S. Knowledge and intake of fruit and vegetables consumption among adults in an urban community in North Central Nigeria. *Niger health J.* 2012;12(1):12-15.
2. Hill CR, Blekkenhorst LC, Radavelli-Bagatini S, *et al.* Fruit and vegetable knowledge and intake within an Australian population: the AusDiab study. *Nutrients.* 2020;12(12):3628.
3. Steinmetz KA, Potter DJ. Vegetables, fruit, and cancer prevention: a review. *J Am Diet Assoc.* 1996;96(10):1027-1039.
4. Block G, Patterson B, Subar A. Fruit, vegetables, and cancer prevention: a review of the epidemiological evidence. *Nutr Cancer.* 1992;18(1):1-29.
5. Sabbour SM, Hussein WM, Eldin Amin GE. Fruit and Vegetable Consumption among Medical Students in an Egyptian University: Knowledge, Practice, and Attitude towards Accessible Healthy Food. *Egypt J Community Med.* 2018;36 (1):75-93.
6. Slavin JL, Lloyd BJAin. Health benefits of fruits and vegetables. 2012;3(4):506-516.
7. Zhang Y-J, Gan R-Y, Li S, *et al.* Antioxidant phytochemicals for the prevention and treatment of chronic diseases. *Molecules.* 2015;20(12):21138-21156.
8. Fulton SL, McKinley MC, Young IS, Cardwell CR, Woodside JV. The effect of increasing fruit and vegetable consumption on overall diet: a systematic review and meta-analysis. *Crit Rev Food Sci Nutr.* 2016;56(5):802-816.
9. Wardle J, Parmenter K, Waller J. Nutrition knowledge and food intake. *Appetite.* 2000;34(3):269-275.
10. Alkazemi D, Salmean Y. Fruit and Vegetable Intake and Barriers to Their Consumption among University Students in Kuwait: A Cross-Sectional Survey. *J Environ Public Health.* 2021;2021:9920270.
11. Zaghoul S, Al-Hooti SN, Al-Hamad N, *et al.* Evidence for nutrition transition in Kuwait: over-consumption of macronutrients and obesity. *Public Health Nutr.* 2013;16(4):596-607.
12. Zaghoul S, Waslien C, Al Somaie M, Prakash P. Low adherence of Kuwait adults to fruit and vegetable dietary guidelines. *East Mediterr Health J.* 2012;18(5):461-467.
13. Ziaei R, Shahi H, Dastgiri S, Mohammadi R, Viitasara E. Fruit and vegetable intake and its correlates among high-school adolescents in Iran: a cross-sectional study. *J Public Health.* 2020/12/01 2020;28(6):711-718.
14. Richard H, Boika R, Allan BC, Claire G, Smith SJL, Ailsa AW. Cross-sectional associations of schoolchildren's fruit and vegetable consumption, and meal choices, with their mental well-being: a cross-sectional study. *BMJ Nutr Prev Health.* 2021;4(2):447.
15. Vainio H, Weiderpass E. Fruit and vegetables in cancer prevention. *Nutr Cancer.* 2006;54(1):111-142.
16. Pandey S, Budhathoki M, Yadav DK. Psychosocial Determinants of Vegetable Intake Among Nepalese Young Adults: An Exploratory Survey. Original Research. *Frontiers in Nutrition.* 2021;2021:8.
17. Scalvedi ML, Gennaro L, Saba A, Rossi L. Relationship between nutrition knowledge and dietary intake: an assessment among a sample of Italian adults. *Front Nutr.* 2021;8:714493.
18. Bany-Yasin H, Elmor AA, Ebrahim BK, *et al.* Exploration of the nutrition knowledge among general population: multi-national study in Arab countries. *BMC Public Health.* 2023;23(1):1178.
19. AlAni MF, Al Subhi LK, Bose S. Consumption of fruits and vegetables among adolescents: a multi-national comparison of eleven countries in the Eastern Mediterranean Region. *Br J Nutr.* 2016;115(6):1092-9.
20. McEachern LW, Ismail MR, Seabrook JA, Gilliland JA. Fruit and Vegetable Intake Is Associated with Food Knowledge among Children Aged 9-14 Years in Southwestern Ontario, Canada. *Children (Basel).* Sep 23 2022;9(10):9101456
21. McCarthy R, Kehoe L, Flynn A, Walton J. The role of fruit and vegetables in the diets of children in Europe: current state of knowledge on dietary recommendations, intakes and

- contribution to energy and nutrient intakes. *Proc Nutr Soc.* 2020;79(4):479-486.
22. Ramon R, Ballester F, Iniguez C, *et al.* Vegetable but not fruit intake during pregnancy is associated with newborn anthropometric measures. *J Nutr. Mar* 2009;139(3):561-7.
 23. Mikkelsen TB, Osler M, Orozova-Bekkevold I, Knudsen VK, Olsen SF. Association between fruit and vegetable consumption and birth weight: a prospective study among 43,585 Danish women. *Scand J Public Health.* 2006;34(6):616-22.
 24. Nicklett EJ, Kadell AR. Fruit and vegetable intake among older adults: a scoping review. *Maturitas.* 2013;75(4):305-12.
 25. Huffman L, West DS. Readiness to change sugar sweetened beverage intake among college students. *Eat Behav.* 2007;8(1):10-14.
 26. Niemeier HM, Raynor HA, Lloyd-Richardson EE, Rogers ML, Wing RR. Fast food consumption and breakfast skipping: predictors of weight gain from adolescence to adulthood in a nationally representative sample. *J Adolesc Health.* 2006;39(6):842-849.
 27. Sheehan T, DuBrava S, DeChello L, Fang Z. Rates of weight change for black and white Americans over a twenty year period. *Int J Obes Relat Metab Disord.* 2003;27(4):498-504.
 28. Forray AI, Coman MA, Cherecheş RM, Borzan CM. Exploring the Impact of Sociodemographic Characteristics and Health Literacy on Adherence to Dietary Recommendations and Food Literacy. *Nutrients.* 2023;15.
 29. Adewale B, Schoeman L, Roussouw T. Knowledge and perceptions of research participants in Nigeria about clinical trials. *Indian J Med Ethics.* 2015;12(4):196-8.
 30. AlAjmi M, Al-Ghamdi S. Translation and validation of the Arabic version of the osteoarthritis quality of life questionnaire (OAQoL) in Saudi patients with osteoarthritis. *Health Qual Life Outcomes.* 17 2021;19(1):91.
 31. Iparraguirre RMP, Porrás MM, De La Cruz AH, Días Bonilla ML. Prevalence of overweight and obesity in Young Peruvian students at National University of Center of Peru-Region Junin-Huancayo. *Obes Med.* 2020;19:100242.
 32. Ganasegeran K, Al-Dubai SA, Qureshi AM, Al-Abed AA, Am R, Aljunid SM. Social and psychological factors affecting eating habits among university students in a Malaysian medical school: a cross-sectional study. *Nutr J.* 2012;11:48.
 33. Adejumo L, Adeoye I. Fruit and vegetable consumption among students of tertiary institutions in Oyo state. *Russ J Agric Soc-Econ Sci.* 2014;30:3-8.
 34. Perera T, Madhujith T. The Pattern of Consumption of Fruits and Vegetables by Undergraduate Students: A Case Study. *Trop Agric Res.* 2012;23(3):261-271.
 35. Nyanchoka MA, van Stuijvenberg ME, Tambe AB, Zuma MK, Mbhenyane XG. Fruit and Vegetable Consumption Patterns and Risk of Chronic Diseases of Lifestyle among University Students in Kenya. *Int J Environ Res Public Health.* 2022;19(12):19126965
 36. Dharmayani PNA, Mishra GD, Mihirshahi S. Fruit and vegetable consumption and depression symptoms in young women: results from 1973 to 1978 cohort of the Australian Longitudinal Study on Women's Health. *Eur J Nutr.* 2022/12/01 2022;61(8):4167-4178.
 37. Odum M, Xu L. Racial and sex differences of fruit and vegetable self-efficacy and intake among college students in a rural, southern location. *J Am Coll Health.* 2019;67(8):825-834.
 38. Syed NK, Syed MH, Meraya AM, *et al.* The association of dietary behaviors and practices with overweight and obesity parameters among Saudi university students. *PLOS ONE.* 2020;15(9):e0238458.
 39. Chourdakis M, Tzellos T, Papazisis Gea. Eating habits, health attitudes and obesity indices among medical students in northern Greece. *Appetite.* 2010;55(3):722-725.
 40. Elsoadaa S, Abdelhafez A, Rabeh N, Zahran S, Osfor M. Consumption of fruits and vegetables among Umm Al- Qura University students in Makkah, Saudi Arabia: A cross-section study. *Life Sci J.* 2013;10:223-231.
 41. Beech BM, Rice R, Myers L, Johnson C, Nicklas TA. Knowledge, attitudes, and practices related to fruit and vegetable consumption of high school students. *J Adolesc Health.* 1999;24(4):244-50.
 42. Unusan N. Fruit and vegetable consumption

- among Turkish university students. *Int J Vitam Nutr Res.* 2004;74(5):341-8.
43. El Ansari W, Berg-Beckhoff G. Nutritional Correlates of Perceived Stress among University Students in Egypt. *Int J Environ Res Public Health.* 6 2015;12(11):14164-76.
44. Alsunni AA, Badar A. Fruit and vegetable consumption and its determinants among Saudi university students. *J Taibah Univ Medical Sci.* 2015;10(2):201-207.