FACTORS ASSOCIATED WITH FRUIT AND VEGETABLE CONSUMPTION IN A WEST AFRICAN STUDENT POPULATION

Maiga Seydou[1,2], Malik Koussoh Simone[3], Tienin B. Pascal[4], Sackou-Kouakou Julie[2,3]

[1]*UFR Medical Sciences, University Felix Houphouët-Boigny, Abidjan, Cote d'ivoire*

[2]*UFR Sciences Pharmaceutic et Biologic, University Felix Houphouët-Boigny, Abidjan, Cote d'ivoire*

[3]*Cardiology Unit, National Institut of Public Health, Abidjan, Cote d'ivoire*

[4]*Faculty of Medicine, Cheik Anta Diop University, Dakar, Burkina Faso*

Corresponding author: mseydou313@gmail.com

ABSTRACT

Introduction: WHO recommends the daily consumption of five servings of fruits and vegetables. The general objective of this study was to identify the factors associated with fruit and vegetable consumption among a population of students in West Africa.

Method: This was a descriptive cross-sectional study conducted from November 15 to December 31, 2023. Included in the study were medical students from the second to the seventh year who were regularly enrolled during the academic year. The sociodemographic characteristics collected included age, gender, year of study, whether or not the student received a scholarship, and whether or not they lived in a university residence. The fruit and vegetable consumption was assessed through a questionnaire. Data were collected online and responses were anonymous. No identifying information was recorded.

Results: A total of 253 students were included. There was a male predominance (sex ratio = 1.4). The average age was 22.77 ± 2.55 years, ranging from 17 to 35. Only 4.35% of the students ate more than five fruits and vegetables per day. The average daily intake was less than two (1.84). Consumption was associated with financial accessibility (p=0.003), year of study (p=0.02), and lack of time to cook (p=0.017).

Conclusion: This study revealed a low rate of fruit and vegetable consumption according to WHO recommendations. Associated factors were year of study, financial accessibility, and lack of time to prepare meals. A good knowledge of the health benefits of fruits and vegetables was not significantly associated with their consumption.

Keywords: fruit and vegetables, consumption, medical student, Côte d'Ivoire

INTRODUCTION

WHO recommends the daily consumption of five servings of fruits and vegetables, which corresponds to a minimum of 400 g per day (OMS, 2018). Indeed, a diet rich in fruits and vegetables reduces overall mortality, especially from cardiovascular diseases (Aune et al., 2017; W. Liu et al., 2021). More advantages of such a diet are a lower prevalence of obesity, diabetes, cardiovascular diseases, depression, dementia, and some cancers (Alicja Basiak-Rasała, 2019; Alissa & Ferns, 2015; Bailey et al., 2021; X. Liu et al., 2016; Mottaghi et al., 2018; Zurbau et al., 2020). Young populations are an important target as they can adopt healthy eating habits more easily and benefit from long-term advantages. However, fruit and vegetable consumption remains low among students (Aiello et al., 2022; Mello Rodrigues et al., 2019). Only 12.3% of students consume five fruits and vegetables per day (Peltzer & Pengpid, 2015), and the rate is even lower in low-income countries (Miller et al., 2016). This prevalence varies by region: 13.6% in Singapore, and 9% in Italy (Lim et al., 2017; Poscia et al., 2017).

In Africa, this prevalence was 20% among Kenyan students (Nyanchoka et al., 2022) and 35.6% in 2013 in Côte d'Ivoire (Peltzer & Pengpid, 2015). Recent data are lacking. This study aims at identifying the factors associated with fruit and vegetable consumption among students in West Africa.

METHODS

The study was conducted at the Faculty of Medicine (UFR) of the Félix Houphouët-Boigny University in Abidjan, Côte d'Ivoire. Established in 1962 under the name of école de médecine , it became a medical faculty in 1968 and was integrated into the university in 1969.

This was a descriptive cross-sectional study conducted from November 25 to December 15, 2023. The survey included medical students from the second to the seventh year of study in the 2023–2024 academic year. Bedridden students were excluded.

This was a secondary analysis of data from a survey on students' knowledge and consumption of fruits and vegetables.

The sample size was calculated using the following SCHWARTZ's formula: $N = z^2 \times p (1 - p) / E^2$, where z=1.96 (for a 95% confidence level)

p=18% refers to the prevalence of consumption of at least 5 fruits and vegetables in low- and middle-income countries in 2019 (Frank et al., 2019).

E=5% corresponds to the margin of error.

This formula gives us a sample size of N=227.

The survey was conducted online. The questionnaire link was sent via WhatsApp and Google form (Ho et al., 2023; Martel & Saint-Lorant, 2019; Takvorian et al., 2020).

A lot of data were collected. They included:

The sociodemographic characteristics of the students: age, gender, year of study, scholarship status, residence in university housing, physiological state (pregnancy, breastfeeding).

Fruit and vegetable consumption was assessed using questions (Frank et al., 2019; Koyanagi et al., 2020):

″do you consume fruit and vegetables? ″

″If yes, how often? ″

″If not why (give 3 reasons) ″

″How many fruits and vegetables do you usually consume per day? ″

″Did you consume any yesterday? ″

″If yes, how many? ″

The data collected were analyzed using Stata software version 12.0. The qualitative variables were expressed as counts and percentages, while quantitative variables were expressed as mean, standard deviation, and median. A Chi-square test was performed for the compared variables, and differences between groups were considered significant for a p-value less than or equal to 0.05.

To determine the independent determining factors, a logistic regression adjustment including all significant variables was performed.

We respected the confidentiality of the information collected during our survey. To ensure confidentiality throughout the study, the questionnaire was completed anonymously. No information that could identify the respondent was included.

Participation in this study involved no health or life-threatening risks. The only requirements for participants were having access to a phone or device with WhatsApp and Google Forms, as well as an internet connection.

RESULTS

Sociodemographic characteristics of the population

A total of 253 medical students were included. There was a male predominance with a sex ratio of 1.4. The average age was 22.77 ± 2.55 years, with extremes ranging from 17 to 35 years. The age group of 24 years and above was the most represented (40.08%).

Regarding scholarship status, 200 students (79.05%) reported receiving scholarships. More than one-third of students lived in university dormitories (35.97%). Seventh-year students were the most represented

(23.32%). Finally, nearly 92.09% were aware of the benefits of fruits and vegetables, and 79.45% knew the number of fruits and vegetables recommended by the WHO. The general characteristics of the students are summarized in Table 1.

Table 1: General characteristics of the study population

Characteristics	N (%)
Gender	
Male	148 (58.50)
Female	105 (41.50)
Scholarship status	
Scholarship	200 (79.05)
No Scholarship	53 (20.95)
Residence	
University City	91 (35.97)
Out of the university	162 (64.03)
Study level	
License 2	23 (09.09)
License 3	52 (20.55)
Master 1	28 (11.07)
Master 2	45 (17.79)
Doctorate 1	46 (18.18)
Doctorate 2	59 (23.32)

Fruit and vegetable consumption by students

Usual Consumption of Fruits and Vegetables

A total of 236 students (93.68%) consumed fruits and vegetables at least once a week, and only 20 students (8.47%) consumed them daily as recommended by the WHO. The average daily consumption of fruits and vegetables was 1.84 (table 2).

Table 2: Fruit and vegetable consumption frequency

Number of days/week	N	%
<1	30	12.73
1	36	15.25
2	44	18.64
3	49	20.76
4	28	11.86
5	22	09.32
6	07	02.97
7	20	08.47
Total	236	100

Figure 1 shows daily consumption and 24-hour dietary recall. Only 4.35% of students reported consuming more than five fruits and vegetables per day in accordance with WHO recommendations.

Regarding the recall frequency, 49.6% of students reported having consumed fruits and vegetables the previous day. Among them, only 3.88% had consumed at least five.

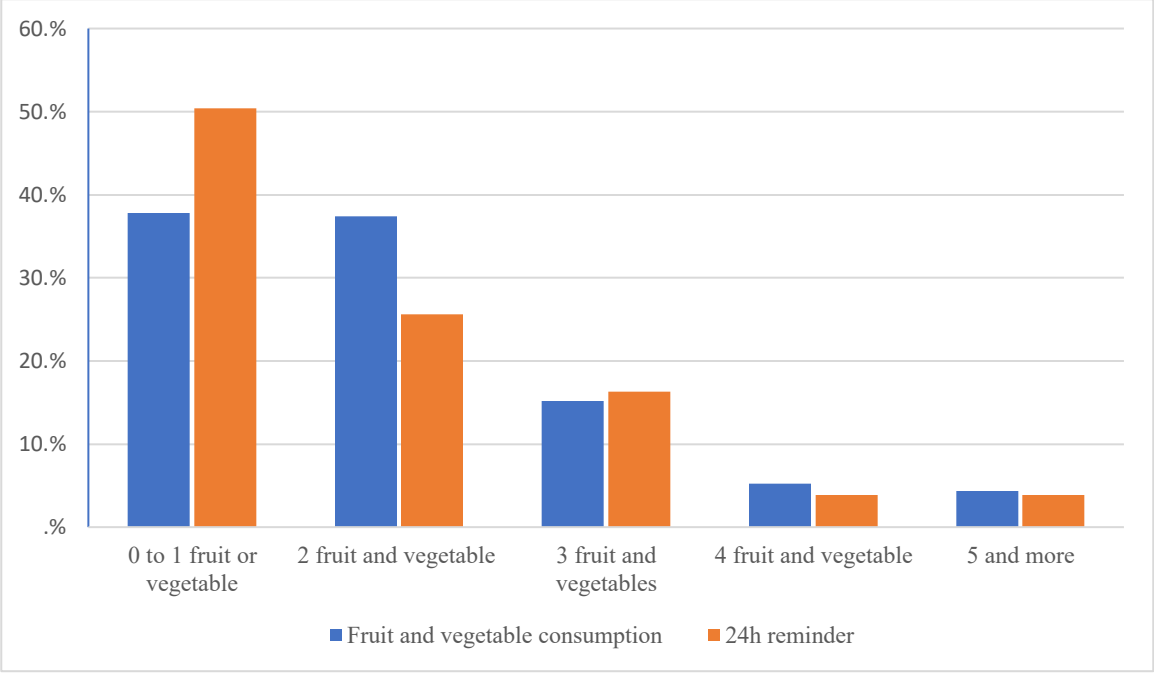

Figure 1: Daily fruit and vegetable consumption and 24-hour recall

Factors associated with fruit and vegetable consumption

Factors Cited by Students

The factors cited by students were either facilitators or barriers to fruit and vegetable consumption.

For facilitators, 244 students (96.44%) believed that fruits and vegetables were geographically available, versus 9 (3.56%). About 185 students (75.20%) saw price as a facilitating factor, versus 24.80%. A total of 20.78% reported that fruits and vegetables were served in the cafeteria where they ate. Taste was a motivating factor for 96.79%.

Among the barriers: 41.11% said they lacked time to prepare fruits and vegetables; 32.41% lacked knowledge on how to cook them; 63.24% cited insufficient financial means; 1.18% reported lack of habit; and 0.79% mentioned lack of time to obtain them. Table 3 summarizes these influencing factors.

Table 3: Factors influencing fruit and vegetable consumption according to students

Fruit and vegetable consumption factors	Responses N(%)		
	Yes	No	No answer
Favoring factors			
Geographical availability	244 (96.44)	09 (03.56)	00 (00)
Affordable price	185 (73.12)	61 (24.11)	07 (02.77)
Pleasant taste	241 (95.26)	08 (03.16)	04 (01.58)
Served in restaurant	183 (72.33)	48 (18.97)	22 (08.69)
Limiting factors			
Lack of money	160 (63.24)	89 (35.18)	04 (01.58)
Lack of cooking skills	82 (32.41)	156 (61.66)	15 (05.93)
Lack of time to cook	104 (41.11)	134 (52.96)	15 (05.93)
Lack of time to buy them	02 (00.79)	12 (04.74)	239 (94.47)
Lack of habit	03 (01.18)	11 (04.35)	239 (94.47)

Regarding suggestions for improving students' adherence to fruit and vegetable consumption: 94% believed awareness campaigns on healthy eating would help; 92.65% proposed price reduction; 94.74% suggested offering more variety; and 96.27% advocated for promoting local products.

Measured factors

A significant link was found between the year of study and fruit and vegetable consumption ($p = 0.02$). Consumption was below 90% for second-year (86.96%) and third-year students (84.62%), and above 95% from the fourth year onward. There was also a statistically significant correlation between the estimated cost of fruits and vegetables and their consumption: 96.61% of those who considered the price affordable consumed them, versus 86.67% of those who found them expensive ($p = 0.003$).

Finally, lack of time to prepare fruits and vegetables was significantly associated with lower consumption ($p = 0.017$).

However, there was no significant link between consumption of fruits and vegetables and knowledge of their benefits ($p = 0.48$), nor with sex ($p = 0.21$), age ($p = 0.099$), scholarship status ($p = 0.82$), place of residence ($p = 0.34$), or geographic accessibility ($p = 0.42$), as shown in Table 4.

Table 4: Factors associated with fruit and vegetable consumption

Association factors	**Fruit and vegetable consumption**		***P-Value***
	Yes N (%)	**No N (%)**	
Study level:			
License 2	20 (86.96)	03 (13.04)	**0.02***
License 3	44 (84.62)	08 (15.38)	
Master 1	28 (100)	00 (00)	
Master 2	44 (97.78)	01 (02.22)	
Doctorate 1	44 (95.65)	02 (04.35)	
Doctorate 2	57 (96.61)	02 (03.39)	
Affordable price:			
Yes	171 (99.44)	06 (0.56)	**0.003***
No	65 (86.67)	10 (13.33)	
Lack of time to cook			
Oui	93 (89.42)	11 (10.58	**0.017***
Non	130 (97.01)	04 (02.99)	
Gender			0.21
Male	141 (95.27)	07 (04.73)	
Female	(91.43)	09 (08.57)	
Age			**0.09***
17-20	20 (86.96)	03 (13.04)	
20-22	56 (88.89)	07 (11.11)	
22-24	63 (96.92)	02 (03.08)	
≥ 24	97 (96.04)	04 (04.96)	
Residence			0.34
University city	87 (95.60)	04 (04.40)	
Out of university	150 (92.59)	12 (07.41)	
Scholarship			0.82
Yes	187 (93.50)	13 (06.5)	
No	50 (94.34)	03 (05.66)	
Knowledge of fruit and vegetable benefits:			0.48

Yes	219 (93.99)	14 (06.00)	
No	18 (90)	02 (10)	
Geographical accessibility			
Yes	228 (93.44)	16 (06.56)	0.42
No	09 (100)	00 (00)	

After adjustment by logistic regression, only one independent factor was found: lack of time for cooking (p=0.030), as shown in Table 5.

Table 5: independent factors associated with fruit and vegetable consumption

Association factors	OR	95% CI	P-Value
Affordable price	0.199	[0.002-18.334]	0.484
Gender	0.149	[0.005-4.108]	0.261
Geographical accessibility	1.50	[0.024-92.987]	0.843
Knowledge of fruit and vegetable benefits	1.490	[0.13-44.73]	0.803
Knowledge of WHO's recommendation	0.050	[0.0001-20.317]	0.329
Lack of time to cook	**0.01**	**[0.0002-0.667]**	**0.030***
Scholarship	0.276	[0.008-9.458]	0.475
University residence	1.779	[0.042-74.034]	0.762

DISCUSSION

Our study aimed to identify factors associated with fruit and vegetable consumption among West African students. A total of 253 students were included, with an average age of 22.77 ± 2.55 years (range: 17–35). This average was close to that found by Zobo among students at the National Polytechnic Institute of Côte d'Ivoire in 2023, who had an average age of 20 years (Zobo et al., 2023). Nyanchoka, in a 2022 study on the correlation between fruit and vegetable consumption and risk factors for chronic diseases among students at Kenyatta University in Kenya, reported an average age of 22.46 ± 2.96 years, ranging from 19 to 30 years (Nyanchoka et al., 2022). Like our study, these focused exclusively on student populations, which are generally young.

Fruit and vegetable consumption

The vast majority of participants (93.68%) consumed fruits and vegetables. However, only 7.47% consumed them daily, and just 4.35% met the WHO recommendation of at least five servings per day. This low proportion was confirmed by the recall measure, with only 3.88% reporting five or more servings consumed the previous day.

The average consumption by the students was 1.84 servings per day. This is close to the average reported by Nyanchoka et al., who found an average of 1.72 for fruits and 1.91 for vegetables (Nyanchoka et al., 2022). These findings contrast with the high level of knowledge about the benefits of fruits and vegetables, which might have suggested higher consumption. However, consumption does not reflect this knowledge level ($p = 0.48$).

Other authors have reported significantly higher values. For example, Peltzer and Pengpid in Laos, in a multicenter study across 26 low-income countries including Côte d'Ivoire, reported that 17.2% of students consumed more than five fruits and vegetables daily. For Côte d'Ivoire, the average consumption was ≥3.9 portions per day (Peltzer & Pengpid, 2015). Similarly, Nyanchoka et al. found that 21.5% of students met the five-a-day recommendation (Nyanchoka et al., 2022).

Lim et al. found in Singapore that 13.6% of students met the international recommendation, with an average of three servings per day (Lim et al., 2017). In Brazil, Mello Rodrigues et al. found an average daily consumption of more than five servings in 40.2% of high school and university students, based on a meta-analysis of multiple countries (Mello Rodrigues et al., 2019).

Despite low overall rates, these studies reported higher consumption levels than ours. Moreover, there is a lack of previous studies on this topic in Côte d'Ivoire, making it difficult to assess trends over time.

We found a significant link between the year of study and fruit and vegetable consumption ($p = 0.02$), with consumption increasing with higher years of medical study—likely reflecting greater awareness. There was also a significant correlation between estimated affordability and consumption ($p = 0.003$): students who perceived fruits and vegetables as affordable were more likely to consume them.

Additionally, lack of time was significantly associated with lower consumption ($p = 0.017$). However, there was no significant association with sex ($p = 0.21$), age ($p = 0.09$), residence ($p = 0.34$), scholarship status ($p = 0.82$), or geographic accessibility ($p = 0.42$).

After adjustment by logistic regression, only lack of time to cook was independently associated with non-consumption of fruit and vegetables ($p=0.030$). Some authors found associations between consumption and socioeconomic level or year of study (Lim et al., 2017; Peltzer & Pengpid, 2015).

Limitations

Our study has some limitations. First, it was a single-center study, so the results cannot be generalized to all universities in the country or to young adults in Côte d'Ivoire in general. Also, the data were self-reported, which may lead to memory and/or social desirability bias, with a tendency to give "acceptable" answers. Finally, the associated factors we explored are not exhaustive. Other factors such as the number of daily meals, family mealtime, sleep habits, psychosocial factors, media, and advertising could have provided further insights.

CONCLUSION

Our study highlighted a low rate of fruit and vegetable consumption according to WHO recommendations among students. The associated factors were year of study, financial accessibility, and lack of time for preparation and the independent one was this last. On the other hand, a high level of knowledge about the benefits of fruits and vegetables was not significantly associated with higher consumption.

The results of this study suggest that the relevant authorities step up activities to promote the consumption of fruit and vegetables by the general public, increase the number of fruit and vegetables in university canteen meals, and manage students' programs to allow them to cook.

Students should set up vegetable gardens and fruit trees in their universities, and comply with WHO recommendations on fruit and vegetable consumption.

Conflict of interest

The authors declare no conflicts of interest**.**

REFERENCES

- Aiello, P., Peluso, I., Di Giacomo, S., Di Sotto, A., & Villaño Valencia, D. (2022). Body Composition and Metabolic Status of Italian and Spanish University Students : Relationship with Fruit and Vegetable Consumption. *Nutrients*, *14*(16), 3296. https://doi.org/10.3390/nu14163296
- Alicja Basiak-Rasała. (2019). Food groups in dietary prevention of type 2 diabetes. *Roczniki Państwowego Zakładu Higieny*, 347-357. https://doi.org/10.32394/rpzh.2019.0086
- Alissa, E. M., & Ferns, G. A. (2015). Dietary Fruits and Vegetables and Cardiovascular Diseases Risk. *Critical Reviews in Food Science and Nutrition*, 00-00. https://doi.org/10.1080/10408398.2015.1040487
- Aune, D., Giovannucci, E., Boffetta, P., Fadnes, L. T., Keum, N., Norat, T., Greenwood, D. C., Riboli, E., Vatten, L. J., & Tonstad, S. (2017). Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality—A systematic review and dose-response meta-analysis of prospective studies. *International Journal of Epidemiology*, *46*(3), 1029-1056. https://doi.org/10.1093/ije/dyw319
- Bailey, R. R., Singleton, J. R., & Majersik, J. J. (2021). Association of obesity and diabetes with physical activity and fruit and vegetable consumption in stroke survivors. *Family Practice*, *38*(1), 56-61. https://doi.org/10.1093/fampra/cmaa101
- Frank, S. M., Webster, J., McKenzie, B., Geldsetzer, P., Manne-Goehler, J., Andall-Brereton, G., Houehanou, C., Houinato, D., Gurung, M. S., Bicaba, B. W., McClure, R. W., Supiyev, A., Zhumadilov, Z., Stokes, A., Labadarios, D., Sibai, A. M., Norov, B., Aryal, K. K., Karki, K. B., … Jaacks, L. M. (2019). Consumption of Fruits and Vegetables Among Individuals 15 Years and Older in 28 Low- and Middle-Income Countries. *The Journal of Nutrition*, *149*(7), 1252-1259. https://doi.org/10.1093/jn/nxz040
- Ho, A., Auerbach, A., Faulkner, J. J., Guru, S. K., Lee, A., & Manna, D. (2023). Barriers to research opportunities among osteopathic medical students. *Journal of Osteopathic Medicine*, *123*(4), 187-194. https://doi.org/10.1515/jom-2022-0116

- Koyanagi, A., Veronese, N., Solmi, M., Oh, H., Shin, J. I., Jacob, L., Yang, L., Haro, J. M., & Smith, L. (2020). Fruit and Vegetable Consumption and Sarcopenia among Older Adults in Low- and Middle-Income Countries. *Nutrients*, *12*(3), 706. https://doi.org/10.3390/nu12030706
- Lim, R. B. T., Tham, D. K. T., Müller-Riemenschneider, F., & Wong, M. L. (2017). Are University Students in Singapore Meeting the International and National Recommended Daily Servings of Fruits and Vegetables? *Asia Pacific Journal of Public Health*, *29*(3), 199-210. https://doi.org/10.1177/1010539517696553
- Liu, W., Hu, B., Dehghan, M., Mente, A., Wang, C., Yan, R., Rangarajan, S., Tse, L. A., Yusuf, S., Liu, X., Wang, Y., Qiang, D., Hu, L., Han, A., Tang, X., Liu, L., Li, W., Liu, L., Li, W., … Zhao, Q. (2021). Fruit, vegetable, and legume intake and the risk of all-cause, cardiovascular, and cancer mortality : A prospective study. *Clinical Nutrition*, *40*(6), 4316-4323. https://doi.org/10.1016/j.clnu.2021.01.016
- Liu, X., Yan, Y., Li, F., & Zhang, D. (2016). Fruit and vegetable consumption and the risk of depression : A meta-analysis. *Nutrition*, *32*(3), 296-302. https://doi.org/10.1016/j.nut.2015.09.009
- Martel, B., & Saint-Lorant, G. (2019). Circuit pharmaceutique, transplantation de microbiote fécal : Des pratiques hétérogènes. *Annales Pharmaceutiques Françaises*, *77*(5), 435-442. https://doi.org/10.1016/j.pharma.2019.06.001
- Mello Rodrigues, V., Bray, J., Fernandes, A. C., Luci Bernardo, G., Hartwell, H., Secchi Martinelli, S., Lazzarin Uggioni, P., Barletto Cavalli, S., & Proença, R. P. D. C. (2019). Vegetable Consumption and Factors Associated with Increased Intake among College Students : A Scoping Review of the Last 10 Years. *Nutrients*, *11*(7), 1634. https://doi.org/10.3390/nu11071634
- Miller, V., Yusuf, S., Chow, C. K., Dehghan, M., Corsi, D. J., Lock, K., Popkin, B., Rangarajan, S., Khatib, R., Lear, S. A., Mony, P., Kaur, M., Mohan, V., Vijayakumar, K., Gupta, R., Kruger, A., Tsolekile, L., Mohammadifard, N., Rahman, O., … Mente, A. (2016). Availability, affordability, and consumption of fruits and vegetables in 18 countries across income levels : Findings from the Prospective Urban Rural Epidemiology (PURE) study. *The Lancet Global Health*, *4*(10), e695-e703. https://doi.org/10.1016/S2214-109X(16)30186-3
- Mottaghi, T., Amirabdollahian, F., & Haghighatdoost, F. (2018). Fruit and vegetable intake and cognitive impairment : A systematic review and meta-analysis of observational studies. *European Journal of Clinical Nutrition*, *72*(10), 1336-1344. https://doi.org/10.1038/s41430-017-0005-x
- Nyanchoka, M. A., Van Stuijvenberg, M. E., Tambe, A. B., Zuma, M. K., & Mbhenyane, X. G. (2022). Fruit and Vegetable Consumption Patterns and Risk of Chronic Diseases of Lifestyle among University Students in Kenya. *International Journal of Environmental Research and Public Health*, *19*(12), 6965. https://doi.org/10.3390/ijerph19126965
- OMS. (s. d.). Alimentation saine. *23 Octobre 2018*. Consulté 15 novembre 2023, à l'adresse https://www.who.int/fr/news-room/fact-sheets/detail/healthy-diet
- Peltzer, K., & Pengpid, S. (2015). Correlates of healthy fruit and vegetable diet in students in low, middle and high income countries. *International Journal of Public Health*, *60*(1), 79-90. https://doi.org/10.1007/s00038-014-0631-1
- Poscia, A., Teleman, A. A., Azzolini, E., de Waure, C., Maged, D., Virdis, A., Ricciardi, W., & Di Pietro, M. L. (2017). Eating episode frequency and fruit and vegetable consumption among Italian university students. *Annali Dell'Istituto Superiore Di Sanita*, *53*(3), 199-204. https://doi.org/10.4415/ANN_17_03_04
- Takvorian, C., Le Reun, C., Jourdain, M., Nuytten, A., Martinot, A., & Dubos, F. (2020). Simulation-based pediatric training : A French national survey. *Archives de Pédiatrie*, *27*(8), 469-473. https://doi.org/10.1016/j.arcped.2020.08.003
- Zobo, P. C., Touré, F. Y., Coulibaly, I., Bitty-Anderson, A. M., Boni, S. P., Niangoran, S., Guié, A., Kouakou, H., Tchounga, B., Coffie, P. A., & Ekouevi, D. K. (2023). Prevalence of hypertension and other cardiovascular disease risk factors among university students from the National Polytechnic Institute of Côte d'Ivoire : A cross-sectional study. *PLOS ONE*, *18*(1), e0279452. https://doi.org/10.1371/journal.pone.0279452

- Zurbau, A., Au-Yeung, F., Blanco Mejia, S., Khan, T. A., Vuksan, V., Jovanovski, E., Leiter, L. A., Kendall, C. W. C., Jenkins, D. J. A., & Sievenpiper, J. L. (2020). Relation of Different Fruit and Vegetable Sources With Incident Cardiovascular Outcomes : A Systematic Review and Meta-Analysis of Prospective Cohort Studies. *Journal of the American Heart Association*, *9*(19), e017728. https://doi.org/10.1161/JAHA.120.017728