



Original article

Prevalence of salt rich fast food consumption: A focus on physical activity and incidence of hypertension among female students of Saudi Arabia



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ABSTRACT

Young generations of Saudi Arabia have adapted a culture of eating fast food items, which are rich in salt. Excess salt intake is a threat to cardiovascular functioning and risk for various cardiovascular diseases. The study, therefore, determines the prevalence and consumption of fast food, the level of physical activity, and the occurrence of hypertension among female students. A cross-sectional study design has been employed to include female students from the College of Arts and Science and Applied Medical Science Wadi Addawasir from January to April 2018. Chi-square/Fisher Exact test has been used for determining the occurrence of categorical variables. The questionnaire was intended to determine fast food habits prevalent among students. 97% of the students consumed fast food daily, 34% of the students were classified as prehypertensive, and 16.4% of the students were classified as hypertensive. Diastolic blood pressure was more compared to systolic blood pressure. Moreover, it was reported that 87% of the students knew the health effects of fast food. 58% of the students were not involved in physical activity and 49% of the students consumed soft drinks along with fast food. 70% of the students used table salt and 57% of the students felt thirsty after fast-food consumption. 55% of the students showed a positive response to the family history of hypertension. The findings have also shown a positive relationship between daily soft drink consumption and the incidence of prehypertension and hypertension among students. Increased consumption of salt-rich fast food, physical inactivity, genetic background of hypertension, prehypertensive and hypertensive conditions observed in the present study may expose to various cardiovascular diseases among the adult population in the future.

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1. Introduction

Modern Saudi society is adapting a culture of eating unhealthy food items. Fast food items are rich in high salt and long been associated with blood pressure. Chronic intake of high salt, above the recommended level, could increase the blood pressure level and is a risk for various cardiovascular diseases and stroke (Ha, 2014). Therefore, studying the relationship between people's sodium intake and its risk factor becomes important. Since

cardiovascular diseases are responsible for 24% of all deaths in the Kingdom of Saudi Arabia (KSA), this accounts for the major burden on healthcare sector due to high dependence on government for healthcare financing (Arab News, 2015). Recent evidence has shown that the dietary habit of fast food consumption, especially in the young people, has significantly increased. This has led to a surge in many cardiovascular diseases and associated risk factors such as hypertension (Musaiger et al., 2012). Moreover, fast food intake among young adults is associated with lower intake of healthy food such as vegetables and fruits.

Risk factors such as high level of experimentation with smoking and alcohol, low physical activity, and fast food consumption have led to a high prevalence of hypertension and obesity in young individuals (Arora et al., 2017). Consumption of greater quantities of fast food is generally heavier among children and adolescents, which particularly have poorer diet quality and total energy intake. Among patients with acute hypertension, obesity, smoking, and

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diabetes mellitus were common risk factors (Haque et al., 2016). 78% of mortality is estimated due to the increased prevalence of non-communicable diseases such as cancer, diabetes, and heart disease (Alsabieh et al., 2019).

According to the American Heart Association (AHA), behavioral risk factors including smoking, physical activity, and diet are the major determinants of both poor cardiovascular health and obesity, which account 50% of deaths in the United States between 2009 and 2010 (Briggs et al., 2019). The prevalence of fast food is high in salt, sugar, and unhealthy fats, which leads to increased blood pressure and obesity, and has been positively related with the obesity prevalence due to its elevating energy density, large portions, and availability. The association of sodium intake is also positively observed with systolic blood pressure and diastolic blood pressure among both children and adults (Zhao et al., 2017). Similarly, the prevalence of processed meats, trans fats, and added sugars is higher than the suggested daily intake. Young adults are constantly confronted to make healthy food choices, after the transition from adolescence to young adulthood, when independency increases (Sogari et al., 2018). The consumption of fast food among students might be affected by several determinants, which include medical education background, body mass index, physical activity, gender, high-fat- and high-sugar food, and degree level (Jiang et al., 2019).

Lifestyle and diet-related increases in chronic diseases have become major public health problems (Musaiger et al., 2012). Easy availability of junk food rich in high salt in the college campus and lack of physical activity has exposed young adults to many health-related risk factors. This has led to an increase in the prevalence of the cardiovascular disease. Diets rich in high salt causes detrimental effects as left ventricular hypertrophy, renal disease, and stroke (World Health Organization, 2012). Studies have shown that the dramatic rise in the occurrence of cardiovascular diseases to an alarming rate poses a major public health challenge to the KSA (Al-Hazzaa, 2018). Statistical reports suggest that 24% of total deaths are due to cardiovascular diseases (Arab News, 2015). There is an increased concern for these multifactorial disorders in the Gulf countries and the factors responsible in addition to genetics are changing the lifestyle of adolescents (Ahmed et al., 2017).

Sodium has been a subject of interest with respect to public health related to nutrition and because of its association with hypertension and cardiovascular disease, particularly coronary heart disease and Stroke (World Health Organization, 2012). Evidence has shown that food consumed in the Gulf countries have a high content of sodium (Zain, 2018). Among young adults, the high consumption of fast foods is playing a significant role in increasing the intake of sodium far more than the recommended level (Zain, 2018). Therefore, consumption of junk food rich in high salt combined with a sedentary lifestyle are detrimental factors to health and will aggravate existing lifestyle-related diseases in the country.

Population-based interventions are required to decrease the burden of cardiovascular disease in the Kingdom. Reducing salt intake should emerge as a primary aim in prevention. This study aims to intervene in the eating frequency of high salt-rich fast food and soft drinks, level of physical activity, and the prevalence of hypertension among female students. Furthermore, the study has formulated secondary objectives to fulfill the primary objective of this study. These objectives include (1) To find the prevalence and consumption of fast food, level of physical activity and incidences of hypertension among female students; (2) Analyze the percentage of high salt food consumption levels among Saudi female students; (3) Identification of the percentage of students with those at risk of hypertension; and (4) To investigate family history of hypertension and establish the level of physical activity among female student

2. Materials and methods

The cross-sectional study design has been employed to determine the eating frequency of high salt-rich fast food and soft drinks, level of physical activity, and the prevalence of hypertension among female students. The study has targeted female students of the College of Arts and Science and Applied Medical Science in Wadi Ad-dawasir and collected data in 4 months from January to April 2018. Inclusion Criteria: Consent was obtained from female students before the survey, it also includes university regular student willing to participate in the study and honestly answer all the question. Inclusion criteria also includes that the questionnaire was translated in Arabic language for better understanding of questions and will be easy to answer in order to get a correct information.

Exclusion Criteria: Students were excluded who not properly took part in answering the question. Exclusion involves the student whose blood pressure was not recorded in two times consequently due to lack of tendency to continue participating in the study.

Two hundred and sixteen female students were surveyed by distributing the questionnaire. Prior to the data collection, students were informed about the details of the study. The researcher distributed the questionnaire to the students and requested them to read the questions carefully and answer all the questions correctly and honestly. Consent was obtained from female students before the survey. The information obtained from each student was kept confidential. This current study was done with ethical clearance from university. Study abide all ethical guidelines of the University and the Kingdom of Saudi Arabia. Once the student completed answering the questionnaire, blood pressure was recorded through a sphygmomanometer and three successive blood pressure readings were obtained. Guidelines and classification of hypertension in the present study were based on American Heart Association. The classification is as follows, normal blood pressure has systolic pressure less than 120 and diastolic less than 80, prehypertensive systolic range from 120 to 139 and diastolic prehypertensive range from 80 to 89, and for hypertensive category the systolic blood pressure range is above 140 and diastolic is above 90.

A questionnaire survey was distributed during the classroom visit at the end of the lecture. Students were asked not to mention their names to prevent the violation of confidentiality. All data were analyzed by using the Microsoft Excel sheet. Following information was included in the questionnaire: (1) Daily fast food and soft drink consumption; (2) Frequency of fast food and soft drink consumption daily; (3) Family history of hypertension; (4) Physical activity; (5) Knowledge of health effect of salt-rich snacks and soft drink; (6) Type of fast food consumed; (7) Recording of blood pressure; (8) Use of table salt; and (9) Thirst sensation after fast food intake.

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements were presented as Mean \pm SD (Min-Max) and results on categorical measurements were presented in frequency (%). Chi-square/ Fisher Exact test has been used to find the significance of study parameters on a categorical scale between two or more groups considering a 5% level of significance. The Statistical software namely statistical package for social sciences (SPSS) version 18.0 was used for the analysis of the data.

3. Results and discussion

Figs. 1 and 2 illustrate the distribution of age group and status of fast food consumption for female students. 140 (65%) of the female students were in the age group of 20–25, followed by 57 (27%) of the students in the 19-year age group, and 17 (8%) of

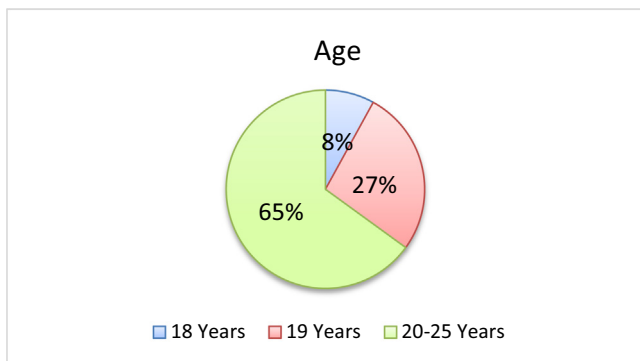


Fig. 1. Distribution of participants according to age group.

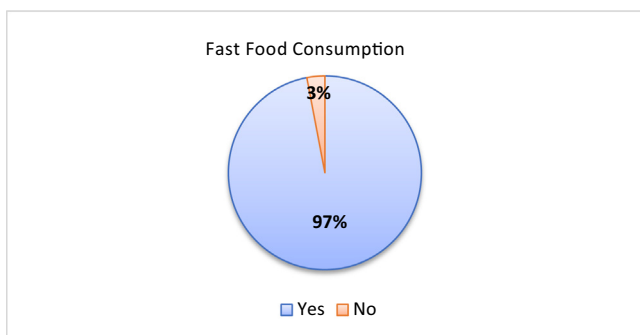


Fig. 2. Status of fast food consumption.

the students in 18-year age group. 44.9% of the female students, out of 216 students, agreed that they consume fast food 1–2 times a day and 50.5% of the students agreed on the consumption of fast food 3–5 times a day (Fig. 3b). Chips and French Fries (58.4%) were

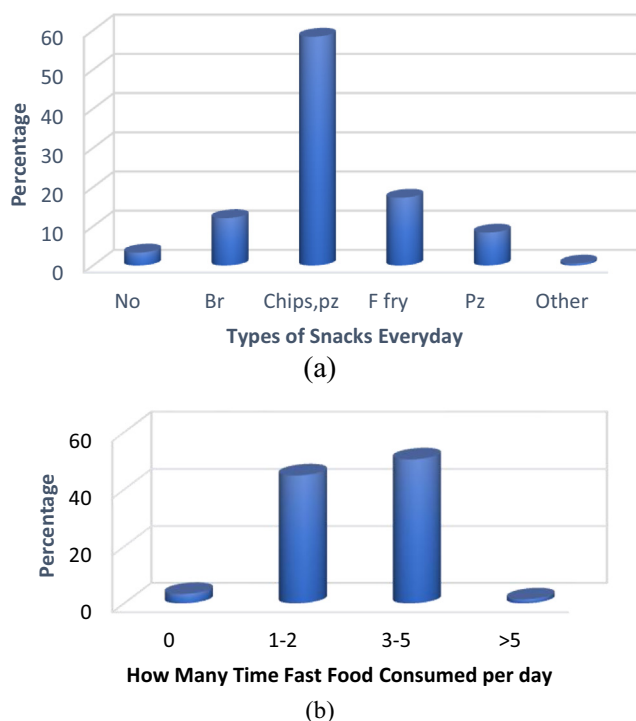


Fig. 3. (a) Frequency of fast food consumption per day and (b) Types of snacks consumed.

the most consumed fast food items among the fast-food category (Fig. 3a).

Table 1 presents the frequency of general characteristics including eating habits of fast food items and soft drink, history of hypertension, knowledge of health effects of fast food items, and level of physical activity. 97% (Figure-2) of the students consume fast food daily and 45% of the students agreed for daily soft drink intake. 50.5% of the students said that they take fast food along with a soft drink. 87% of the students agreed that they have knowledge of the health effect of snacks and soft drink and 58% of the students were not involved in any physical activity. 55% of the students said that they have a history of hypertension and 57% of the students said they feel thirsty after eating fast food items (Table 1). Fig. 4 shows that 70% of the students use table salt.

Table 2 shows the frequency and percentage of systolic and diastolic blood pressure measurements among female students. 130 students had systolic blood pressure less than 120 mmHg and 107 students had diastolic blood pressure less than 80 mmHg. These students were classified as normotensive which accounts for 60% and 50%, respectively. Female students were having systolic (n = 74) and diastolic blood pressure (n = 72) between 129 and 139 mmHg and 80–89 mmHg that accounts for 34% and classified as prehypertensive.

For correlation of hypertension according to soft drink, findings have shown that the normotensive students consume less intake of soft drink (systolic 66.7%, diastolic 52.1%) compared to the students who consume soft drink intake every day (systolic 53.6%, diastolic 47.4%) (Table 3). The percentage of students who consume soft drinks are prehypertensive (systolic 41.2% diastolic 33%) as compared to the students who did not consume soft drink (systolic 29.1%, diastolic 34.2%).

4. Discussion

Saudi Arabia is undergoing a stage of nutrition switch that has led to the prevalence of non-communicable diseases such as hypertension, especially among young adults. These non-communicable diseases account for 78% of all deaths in the Kingdom according to world health organization (ALFaris et al., 2015).

The action needed to promote healthy nutrition and a healthy lifestyle has been stressed at several meetings in Arab Gulf countries (Walle, 2018). The consequence of increased fast food and soft drink consumption among college students is rising. The findings of the present study revealed an increasing prevalence of daily consumption of fast food items and soft drinks. 97% of the student shows a positive response to daily fast food consumption.

Fast food items are rich in salt, which is traditionally linked to the increase in blood pressure. However, even in the absence of its effect on blood pressure, excess dietary sodium can adversely affect target organs, including the blood vessels, heart, kidneys, and brain. High salt in a chronic period can cause organ damage

Table 1

Shows percentage and number of students assessed for eating habit of fast food item and soft drink, history of hypertension, knowledge of health effect of fast food items and level of physical activity.

Percentage of students who say no	Percentage of students who say yes	Questionnaire on dietary habit
55% (No-107)	45% (No-97)	Daily soft drink consumption.
13% (No-28)	87% (No-186)	Knowledge of health effect of soft drink and fast food.
58%(No-124)	42%(No-90)	Physical Activity.
49.5%(No-106)	50.5%(No-108)	Soft drink along with fast food.
43%(No-91)	57%(No-123)	Thirsty after eating fast food.
44.9% (No-96)	55.1% (No-118)	History of Hypertension.

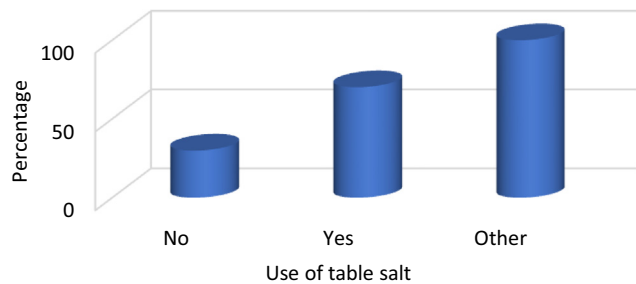


Fig. 4. Use of table salt by the student.

Table 2

Shows the percentage and number of systolic and diastolic blood pressure measurements among female student.

Variables	No. of patients (n = 214)	%
SBP		
Normotensive	130	60.7
Prehypertensive	74	34.6
Hypertensive	10	4.7
DBP		
Normotensive	107	50.0
Prehypertensive	72	33.6
Hypertensive	35	16.4

without increasing blood pressure. The independent effect of salt on blood pressure includes left ventricular hypertrophy, sensitizes sympathetic neuron, decreases glomerular filtration rate, excretion of protein, impaired endothelial function, and increases arterial stiffness (Benajiba, 2016). The frequency of fast food items intake among students was ranging from one to six times per day. Also, 70% of the students have the habit of using table salt and 57% of the students feel thirsty after eating fast food. The thirst sensation reportedly owes to change in the plasma osmolality due to excess sodium intake.

A slight increase in the plasma osmolality that may be 2%–3%, due to salt intake, can stimulate the thirst mechanism. Consequently, water intake followed by salt-rich food can restore plasma osmolality in healthy individuals. However, the dipsogenic effect due to excessive salt intake causes a transient increase in body fluid retention that can increase the risk of hypertension in some salt-sensitive individuals (WHO, 2004; Killoran, 2015).

Additionally, more than half of the students (53%) have a family history of hypertension in this study. Therefore, chronic intake of high fast food can greatly expose to developing hypertension. The study has reported that students were aware of the knowledge of the health effect of eating too much fast food items and soft drinks. But their habits are not associated with their knowledge of the health effect of eating fast food items. This study has

reported that the habit of physical activity among students is lower. Physical activity is an important lifestyle modification for the prevention and treatment of hypertension. Physical activity improves blood flow through a decrease in vascular constriction by improving the arterial endothelial function due to an increase in nitric oxide production (Stachenfeld, 2008). One of the advantages of exercise is the loss of salt through sweat. Increased salt-rich fast food and soft drink intake due to thirst stimulation, followed by decrease physical activity in the long term, can affect blood pressure (Sawka et al., 2007).

34% of the students were under the pre-hypertensive stage, and 16% of the students were categorized as hypertensive. There is an increasing tendency of the diastolic blood pressure than systolic blood pressure. This could have a risk of cardiovascular functioning in long-range if left untreated. High diastolic blood pressure is associated with a great risk of abdominal aortic aneurysm, diastolic hypertension progression of systolic hypertension and excessive arteriolar narrowing are some of the effects of increasing diastolic blood pressure.

High blood pressure is generally considered as silent killer (Hambrecht et al., 2000). Fast food items contain a high level of calories and salt that is detrimental to health. High blood pressure is one of the leading risk factors for cardiovascular disease and is a leading cause of stroke, heart attack, heart failure, kidney disease, and coronary heart disease (Yehuda, 2019). A traditional recommendation among physicians for treating and preventing high blood pressure is to counsel patients on reducing sodium intake.

According to American heart association, the recommended intake of salt per day is less than 2,300 mg (mg) that is equal to one teaspoon and less than 1,500 mg per day for those with cardiovascular disease or blood pressure, yet current salt intake is more than 3,400 mg a day (Zain, 2018).

High salt-related increase in blood pressure is also due to enhanced activation of the renin-angiotensin system and renal sympathetic system.¹⁸ Endothelial dysfunction could possibly play an important role in the influence of high sodium intake on blood pressure, while the exact mechanisms of how high salt increases the reactive oxygen species are not known (O'Donnell et al., 2012).

To achieve this goal, every sector must take initiative in reducing the high salt exposer of the body. Food manufacturers should reduce the salt content of their products. Moreover, families and individuals must play a major role. The World Health Organization has recommended a limit of 2,000 mg of salt per day (Drenjančević-Perić et al., 2011). People consume 4,000 mg of sodium each day and are three times more likely to suffer a stroke as compared to those who eat salt below 1,500 mg (Boegehold, 2013). College and school students are greatly exposed to unhealthy eating habits prompting the development of hypertension at an early age. These habits should be corrected by bringing awareness program and coordinated strategies in the educational institutions by healthcare professionals, academicians and within

Table 3

Correlation of incidence of hypertension according to soft drink every day.

Variables	Soft drink every day		Total (n = 214)	P value
	No (n = 117)	Yes (n = 97)		
SBP				
Normotensive	78(66.7%)	52(53.6%)	130(60.7%)	0.146
Prehypertensive	34(29.1%)	40(41.2%)	74(34.6%)	
Hypertensive	5(4.3%)	5(5.2%)	10(4.7%)	
DBP				
Normotensive	61(52.1%)	46(47.4%)	107(50%)	0.499
Prehypertensive	40(34.2%)	32(33%)	72(33.6%)	
Hypertensive	16(13.7%)	19(19.6%)	35(16.4%)	

Chi-square/fisher exact test.

the family to promote healthy eating behaviors among young students in the Kingdom (He and MacGregor, 2003).

Diet rich in fiber and vegetables with less consumption of a diet rich in high salt intake are some of the modifications that can help avoid health-related risk factors associated with fast food consumption. The findings could potentially have important public healthcare implications regarding unhealthy eating habits and their effect on health. Decreased consumption of salt-rich food could substantially reduce the incidence of cardiovascular disease. A comprehensive and integrated approach is required with a full contribution from the public.

5. Conclusions

An increase in the prevalence and consumption of fast food and soft drink among female students of Prince Sattam bin Abdulaziz University at Wadi Ad-dawasir Branch Campus was reported in the present study. This was in combination with physical inactivity and genetic background of hypertension. Thus, increased fast food intake with less involvement in physical activity and a genetic back of hypertension could pose a risk for various cardiovascular diseases in the future. A widespread action to educate people especially students about the health-related risk factors associated with fast food items is urgent and essential. This research could help to bring awareness in the community about health-related risk factors associated with high salt food consumption. Consequently, the situation needs to be addressed to decrease the economic burden of cardiovascular diseases on health care sectors.

Efforts should also include a community service program to educate families to replace fast food with vegetables and fruits. The situation needs to be addressed to decrease the economic burden of cardiovascular diseases on healthcare sectors. These health risk factors among students can be avoided through successful joint collaborative efforts between health workers and the community. This can promote healthy eating and lifestyle. Further future contribution of the study includes measurement of heart rate variability through smart cardio-watch.

Data availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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This research is not funded by any resource.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- Ahmed, M., Hersi, A., Mashhoud, W., et al., 2017. Cardiovascular risk factors burden in Saudi Arabia: The Africa Middle East Cardiovascular Epidemiological (ACE) study. *J. Saudi Heart Assoc.* 29 (4), 235–243. <https://doi.org/10.1016/j.jsha.2016.04.031>.
- ALFaris, N.A., Al-Tamimi, J.Z., Al-Jobair, M.O., Al-Shwaiyat, N.M., 2015. Trends of fast food consumption among adolescent and young adult Saudi girls living in Riyadh. *Food & Nutr. Res.* 59 (1), 26488. <https://doi.org/10.3402/fnr.v59.26488>.
- Al-Hazzaa, H., 2018. Physical inactivity in Saudi Arabia revisited: a systematic review of inactivity prevalence and perceived barriers to active living. <https://doi.org/10.2196/preprints.9883>.
- Alsabieh, M., Alqahtani, M., Altamimi, A., et al., 2019. Fast food consumption and its associations with heart rate, blood pressure, cognitive function and quality of life. Pilot study e01566 *Heliyon* 5 (5). <https://doi.org/10.1016/j.heliyon.2019.e01566>.
- Arab News, 2015. "24% of deaths due to heart disease," 2015. Retrieved from: <https://www.arabnews.com/saudi-arabia/news/765236>.
- Arora, S., Gupta, S., Singh, P., 2017. Assessment of risk factors for hypertension and obesity among adolescents. *Sri Lanka J. Child Health* 46 (1), 48. <https://doi.org/10.4038/sljch.v46i1.8120>.
- Benajiba, N., 2016. Fast food intake among Saudi population: alarming fact. *Am. J. Clin. Nutr.*, 44–48.
- Boegehold, M.A., 2013. The effect of high salt intake on endothelial function: reduced vascular nitric oxide in the absence of hypertension. *J. Vasc. Res.* 50 (6), 458–467. <https://doi.org/10.1159/000355270>.
- Briggs, C., Black, A.W., Lucas, F.L., Siewers, A.E., Fairfield, K.M., 2019. Association between the food and physical activity environment, obesity, and cardiovascular health across Maine counties. *BMC Public Health* 19 (1), pp. <https://doi.org/10.1186/s12889-019-6684-6>.
- Drenjančević-Perić, Jelaković, B., Lombard, J.H., et al., 2011. High-salt diet and hypertension: focus on the renin-angiotensin system. *Kidney and Blood Pressure Res.* 34 (1), 1–11. <https://doi.org/10.1159/000320387>.
- Ha, S.K., 2014. Dietary salt intake and hypertension. *Electrolytes & Blood Pressure* 12 (1), 7. <https://doi.org/10.5049/ebp.2014.12.1.7>.
- Hambrecht, R., Wolf, A., Gielen, S., et al., 2000. Effect of exercise on coronary endothelial function in patients with coronary artery disease. *N. Engl. J. Med.* 342 (7), 454–460. <https://doi.org/10.1056/nejm200002173420702>.
- Haque, M.U., Ahmmed, S.B., Akanda, M.K.M., et al., 2016. Prevalence and risk factors of obesity and hypertension among university students in Rajshahi City, Bangladesh. *Bangladesh Pharm. J.* 19 (2), 179–184. <https://doi.org/10.3329/bpj.v19i2.29277>.
- He, F.J., MacGregor, G.A., 2003. How far should salt intake be reduced?. *Hypertension* 42 (6), 1093–1099. <https://doi.org/10.1161/01.hyp.0000102864.05174.e8>.
- Jiang, Y., Wang, J., Wu, S., et al., 2019. Association between take-out food consumption and obesity among Chinese university students: a cross-sectional study. *Int. J. Environ. Res. Public Health* 16 (6), 1071. <https://doi.org/10.3390/ijerph16061071>.
- Killoran, E., 2015. The dangers of salt: it's more than just a blood pressure problem. Retrieved from: <https://www.pritikin.com/dangers-of-salt-blood-pressure-problem>.
- Musaiger, O., Takruri, H.R., Hassan, A.S., Abu-Tarboush, H., 2012. Food-based dietary guidelines for the Arab gulf countries. *J. Nutr. Metab.* 2012, 1–10. <https://doi.org/10.1155/2012/905303>.
- O'Donnell, M.J., Mente, A., Smyth, A., Yusuf, S., 2012. Salt intake and cardiovascular disease: why are the data inconsistent?. *Eur. Heart J.* 34 (14), 1034–1040. <https://doi.org/10.1093/eurheartj/ehs409>.
- Sawka, M.N., Burke, L.M., Eichner, E.R., et al., 2007. "American college of sports medicine position stand", exercise and fluid replacement. *Med. Sci. Sports Exerc.* 39 (2), 377–390.
- Sogari, G., Velez-Argumedo, C., Gómez, M., Mora, C., 2018. College students and eating habits: a study using an ecological model for healthy behavior. *Nutrients* 10 (12), 1823. <https://doi.org/10.3390/nu10121823>.
- Stachenfeld, N.S., 2008. Acute effects of sodium ingestion on thirst and cardiovascular function. *Curr. Sports Med. Rep.* 7 (Suppl. 1), S7–S13. <https://doi.org/10.1249/jsr.0b013e31817f23fc>.
- Walle, G.V.D., 2018. How much sodium should you have per day? Retrieved from: <https://www.healthline.com/nutrition/sodium-per-day#bottom-line>.
- WHO, 2004. FAO/WHO technical consultation on national food-based dietary guidelines, Cairo, Egypt 6–9.
- World Health Organization, 2012. Effect of reduced sodium intake on cardiovascular disease, coronary heart disease and stroke.
- Yehuda, E.B., 2019. Dealing with high diastolic blood pressure. Retrieved from: <https://www.resperate.com/blog/hypertension/facts/definition-symptoms/lower-diastolic-blood-pressure-naturally>.
- Zain, A., 2018. Genetics, lifestyle major causes for heart diseases. Retrieved from: <https://www.khaleejtimes.com/nation/health/genetics-lifestyle-major-causes/-for-heart-diseases>.
- Zhao, Y., Wang, L., Xue, H., Wang, H., Wang, Y., 2017. Fast food consumption and its associations with obesity and hypertension among children: results from the baseline data of the Childhood Obesity Study in China Mega-cities. *BMC Public Health* 17 (1), pp. <https://doi.org/10.1186/s12889-017-4952-x>.