*Biological and Clinical Sciences Research Journal*
*eISSN: 2708-2261; pISSN: 2958-4728*
*www.bcsrj.com*
DOI: https://doi.org/10.54112/bcsrj.v2023i1.627
*Biol. Clin. Sci. Res. J., Volume, **2023**: 627*
***Original Research Article***

# ASSOCIATION BETWEEN OBESITY INDUCED HYPERTENSION AND CONSUMPTION OF JUNK FOOD AMONG UNIVERSITY STUDENTS OF DISTRICT SIALKOT

**NAEEM W[1], ASHRAF S[*1], FATIMA R[2], MALIK A[2], KHARL HAA[3], SHABBIR A[1]**

*[1]Department of Zoology University of Sialkot, Pakistan*
*[2]Department of Zoology, Lahore College for Women University, Lahore, Pakistan*
*[3]Department of Pharmacy, University of Agriculture Faisalabad, Pakistan*
**Corresponding author email address:* saima.ashraf@uskt.edu.pk

*(Received, 30th September 2023, Revised 25th November 2023, Published 31st December 2023)*

**Abstract:** *The principal cause of early death throughout the world is cardiovascular diseases (CVDs). It has been found that, in young adults, high blood pressure (BP) is considered a significant public health concern, with approximately 26.4% of global prevalence. A diet containing junk food is the preliminary cause of obesity, which leads to hypertension and other cardiovascular diseases in adults. The risk factors are prevailing at an alarming rate and have affected university students' physical and mental health. Moreover, these health concerns have caused low productivity among students as well. This problem has not been studied and analyzed in sufficient profundity. This cross-sectional and correlational study investigated the relationship between fast food consumption, obesity, and hypertension among university students. This cross-sectional study was conducted on a sample size of three hundred participants aged twenty-five to forty. To calculate the BMI, the weight and height of the participants were measured, along with the measurements of their systolic and diastolic blood pressure and age, through standard tools and procedures. Their dietary intake was assessed using a questionnaire of food intake that records a 168-hour food intake. The study results revealed that significant positive correlations of high strength between fast food consumption and obesity were found using Spearman rank order correlations (rs = 0.81) and moderate strength of positive correlation between frequent fast-food consumption and hypertension (rs = 0.58). The resultant conclusion of the study shows that junk food is strongly linked with obesity and prehypertension. The findings of the study can reduce the prevalence of obesity and hypertension.*

**Keywords:** Blood Pressure, Hypertension, Body Mass Index, Cardiovascular Diseases, Junk Food, Obesity

## Introduction

One of the most persistent health concerns today is obesity, which is prevailing at an alarming rate. Obesity is a complex disease, involving an excess amount of body fat. The body mass index (BMI) ranging from 25 to 29.9 is said to be overweight and over 30 is considered obese. Obesity is a severe health problem that increases the risk of various other health concerns, such as cardiovascular disease, high blood pressure, hypertension, and diabetes. Overweight obesity is widespread among 55% of the adult population in the US. National estimates have shown a prevalence of 40% among adults in Pakistan (Ahmad, Alasmari, Alnomsi, & Alshehri, 2018).

University students stay busy studying for several hours a day, and almost 80% do some job to meet their academic expenses. Many university students are also married as well and thus have to work more for their family needs. Fast food consumption is increasing because these individuals have less time to prepare healthy meals at their homes. Frequent consumption and ever-increasing demand for fast food amplified the expansion of fast-food restaurant chains. (Tavares, Fonseca, Rosa, & Yokoo, 2012)

To determine an individual's weight problems, their body mass index (BMI) is used. Which is computed by dividing the weight (kg) by the square of the height. This study used the BMI to determine whether a person is overweight or obese. An individual is said to be overweight or obese when his BMI ranges from 25 to 29.9 or greater or equal to 30, respectively. The overall pervasiveness of obesity is alarming, surpassing 35% in most gender and age groups in the United States (Ardissino et al., 2019).

Hypertension is another name for high blood pressure. The blood flowing in the arteries exerts pressure on its walls, which is termed arterial blood pressure. When a person's blood pressure is elevated or more significant than usual, he is said to be hypertensive. This condition can be classified into two stages (Binka & Brady, 2019).

i) Stage-I: When blood pressure is at or above 140/90 mmHg
ii) Stage II: When blood pressure is at or above 160/99 mmHg

When a person has 120 to 139 mmHg of systolic blood pressure or 80 to 89 mmHg of diastolic blood pressure, elevated BP is considered prehypertension (Plantinga et al., 2009). Prehypertension is more common in those who eat fast food than in people who eat a healthy meal (Belancic, Krpina, Klobucar Majanovic, & Merlak, 2019). A study by the American Heart Association (AHA) found that one out of every three persons in the USA has excessive blood pressure.

"Food that is easy to make and serve" is how junk food, often known as fast food, is defined. Processed, canned, and packaged foods, as well as 'high-calorie' meals served in restaurants and cafeterias, include burgers, pizzas, fried

[Citation: Naeem, W., Ashraf, S., Fatima, R., Malik, A., Kharl, H.A.A., Shabbir, A. (2023). Association between obesity induced hypertension and consumption of junk food among university students of district sialkot. *Biol. Clin. Sci. Res. J.*, **2023***: 627*. doi: https://doi.org/10.54112/bcsrj.v2023i1.627]

chicken, potato fries, sausages, salty snacks, carbonated drinks and beverages, desserts, and chocolates. Junk food may taste good but has serious health effects (Tavares et al., 2012). Junk foods, often referred to as fast food in developing nations, are popular among teenagers and adults due to their ease of preparation, low cost, and deliciousness. However, each of these foods has a variety of detrimental health consequences (Phillips et al., 2014).

**Methodology**

The population size for the study was approximately three hundred university students from the City of Sialkot, Punjab. This includes male students randomly selected from various departments of two reputed universities, the University of Sialkot (USKT) and the University of Management Sciences (UMT). The study population was selected for its diversity among individuals, accessibility, and capacity to comprehend and complete the study Performa. They can understand and complete the research. Performa can give their informed consent and have regular access to fast-food restaurants.

A random technique was used to choose the sample. Each participant in the sample population has an equal probability of being chosen. The generalization of the research population from the sample improves with random sampling (Clark et al., 2019). The study's alpha level was set at p =.05. Standard summary statistics were used to tabulate the data at first (means, percentages, frequencies, and standard deviations). Pearson product-moment correlations (Bivariate comparisons) were performed, and paired sample t-tests were used for testing as a generic data analysis strategy. Multiple regression prediction equations were built to test the hypothesis.

A power analysis was used to determine an appropriate sample size subjected to correlation and regression models. When the sample size is increased to 300, the power is increased to .95. The study's demographic parameters included marital status, employment status, and location, encompassing both rural and urban areas.

Diet History Questionnaires (DHQ) or Food intake Questionnaires were used to survey participants. A digital sphygmomanometer was utilized to measure the systolic and diastolic blood pressure. A standard quality stadiometer (height measuring apparatus) was used to measure stature (height), and weight balance was used during data collection to measure weight.

The National Cancer Institute researchers developed the Diet History Questionnaire (DHQ), which is used to record the foods consumed over time. It is based on cognitive research findings and is aimed to reduce measuring error. To offer adequate nutrient values, the DHQ dietary items included in the list were generated by utilizing the database of the Continuing Survey of Individuals Consuming Junk Food (CSFII 1995-97). The DHQ has 144 food items and questions about food quantity or portion (NCI, 2005).

Standard tools and equipment were used to assess a participant's physique (weight and stature). The essential particulars of the study were measured using established testing techniques and standard equipment and tools.

A balancing beam scale was used to determine the human body weight. The scale was set on a hard, flat surface. Participants took off their shoes and their heavy clothing. The participant stood in the center of the scale with both feet. The weight was reported to the nearest decimal place.

A stadiometer was used to measure the participants' height. The stature was measured using a portable Stadiometer (HM200P). It has a height of 78 inches and 200 cm in inches and centimeters. Participants take off their shoes. Stand with their back to the wall and their feet flat on the ground.

One of the study's primary objectives was to produce data that might be used to investigate the link between fast food intake and weight gain or obesity. To compute the BMI, anthropological measurements are required to analyze the correlations between dietary frequency and food quantity and BMI. BMI was computed by dividing weight in kilograms by height in meters squared. (CDC, 2010). BMI categories are given below (Table 1) for a better understanding.

**Table 1: BMI Categories**

| Classification | BMI | Health Risk |
|---|---|---|
| Under Weight | $\leq$ 18.5 | Minimal |
| Normal | 18.5 - 24.9 | Minimal |
| Overweight | 25 - 29.9 | Increased |
| Obese | 30 - 34.9 | High |
| Severely Obese | 35 - 39.9 | Very High |
| Morbidly Obese | $\geq$ 40 | Extremely High |

A digital sphygmomanometer was utilized to measure the participants' blood pressure. A sphygmomanometer is a blood pressure-measuring instrument used by doctors and nurses. The arterial pressure is measured with a sphygmomanometer, which uses the height of a mercury column to read the circulating pressure in millimeters of mercury (mmHg). For more accuracy and convenience, a Digital Sphygmomanometer was used.

**Table 2: Blood Pressure Categories**

| Blood Pressure Categories | Systolic BP (mm Hg) | Diastolic BP (mm Hg) |
|---|---|---|
| Normal | $\leq$ 120 | $\leq$ 80 |
| Prehypertension | 120-139 | 80-89 |
| Hypertension-I | 140-159 | 90-99 |
| Hypertension-II | $\geq$ 160 | $\geq$ 100 |

The new improvised Food Frequency Questionnaire (FFQ) is the Diet History Questionnaire (DHQ). On absolute nutritional intake, compared to DHQ and FFQ, the DHQ proves to be a better tool to understand the participants' food intake. The portion size assessment was missing in the Willets questionnaire, which made this less accurate for the current study. The DHQ is as excellent as or better than the other FFQs for gathering data in this research. The DHQ was thought to be more useful in various other studies according to the American Heart Association (Subar et al., 2001).

Data were collected from the Human Research Ethics Committee, University of Sialkot, after approval was obtained for the research. A permission letter was submitted to the Ethical Review Committee for granting permission to invite the university students to participate in the research. After obtaining permission, USKT and UMT research participants received (a) a letter describing the study,

[Citation: Naeem, W., Ashraf, S., Tahir, A., Shabbir, A., Awais, M. (2023). Association between obesity induced hypertension and consumption of junk food among university students of district Sialkot. *Biol. Clin. Sci. Res. J.*, **2023***: 635*. doi: https://doi.org/10.54112/bcsrj.v2023i1.635]

requesting them to participate, explaining what their involvement would entail, and assuring them of confidentiality, as well as (b) an informed-consent form to sign. The FFQ was delivered to the participants around a week later. Participants were assigned a code number to maintain secrecy.

Diet History Questionnaire (DHQ) survey and wellness screening techniques and tools were used to collect data. A questionnaire and survey analysis assessed the participants' opinions on their eating habits. The survey and anthropometric data were entered into the computer using SPSS version 26. Randomly selected sample subjects were given informed consent.

The Food Frequency Questionnaire (FFQ) is a tool for determining preprocessed food frequency (once per week to once a day) and wellness screening, including basic anthropometric measurements (weight, height, and blood pressure). DHQ inquired about participants' regular eating habits or frequency throughout the course of the year. Food frequency is divided into seven categories, ranging from never to once a week to more than once a day. The proportion and duration formats are included in this closed-ended questionnaire (NHI, 2021). A digital sphygmomanometer was utilized to assess blood pressure. The SECA height gauge stadiometer was used to measure stature (height), and the balance beam scale was used to measure weight; both were used to determine the BMI. A tape measure was used to measure waist circumference; a wider waistline (men > 40 inches) is a promising symptom of developing cardiometabolic health concerns.

The first research hypothesis investigates the link between frequent consumption and being overweight or obese, while the second hypothesis looks at the link between eating processed salty fast food and having high blood pressure. The statistical power increases from 0.80 to 0.95 when the sample size is increased from 280 to 300. G* Power 3 calculated that 300 university students chosen randomly out of a total of a thousand students would be sufficient to meet the criterion. The analysis follows the hypothesis.

The frequency by which university students consume fast food heavy in salt, Tran's fat, and sugar was assessed using the FFQ to see if there is a link between frequent intake of an unhealthy diet and high blood pressure over time. Participants' blood pressure was tested and recorded to identify high-risk university students and see if there is a statistically significant link between the frequency of eating junk food and the pervasiveness of elevated blood pressure. SPSS version 26.0 was used to analyze the statistical analysis of the collected and recorded research data.

The Research Hypothesis was assessed using Pearson product-moment correlation for the elevated blood pressure and obesity levels. The correlational method did not change the variables but looked for connections (correlations) between fast food consumption and obesity and between fast food consumption and blood pressure levels. Correlation is used to assess the relation among the measured study variables. The analysis provided essential summaries of the sample, measurements, and research hypothesis aspects of the data. The averages and standard deviation were all examined. The statistical program used to analyze the data was Statistical Package for the Social Sciences (SPSS) 26.0.

The purpose of this study's data analysis was to organize and discover links among the data and test the significance of the findings. Data was recorded in Excel before being exported to SPSS version 26 for Windows. Descriptive statistics were used to characterize the demographic factors in the sample. Statistical significance was determined at the 0.05 level. Correlation and regression analysis techniques were used to test the hypothesis to see if the association among the variables was significantly strong.

**Results**

This study enlisted the participation of 300 university students, all of whom were cooperative during the wellness screening. The objective was to (a) determine the link between frequent junk food intake and obesity and (b) investigate the link between obesity and high blood pressure or hypertension.

Three hundred and fifty individuals signed the Informed Consent Forms (ICFs). Three hundred people completed and returned the survey of 350 that were distributed. A total of fifteen DHQs were returned uncompleted, and 35 DHQs were not returned.

**Table. 3: Demographic Characteristics (N=300)**

| Gender | Variable | Category | n | % |
|---|---|---|---|---|
| Male | Locality | Urban | 216 | 72% |
| | | Rural | 84 | 28% |
| **Total** | | **300** | | |

Table 3 portrays the demographic characteristics of 300 participants. Out of three hundred research participants, 72% (n = 216) belonged to urban areas, and 28% (n =84) belonged to rural areas. All the research participants were male. Students from urban areas were the largest portion of the sample participants (65%).

Table 4 displays the weight categories of 300 participants. As it shows, 18% (n =39) students are average in weight (BMI: 18.5-24.9), 55.6% (n =120) are overweight (BMI: 25-29.9), and 26.4% (n =57) are obese (BMI: >30) belonging to urban areas, whereas approximately 14% (n =12) students are average in weight (BMI: 18.5-24.9), 64% (n =54) are overweight (BMI: 25-29.9) and 21% (n =18) are obese (BMI: >30) belonging to rural areas. Here, it is considerably notable that students belonging to urban areas are comparatively more overweight and obese.

Table 5 presents the systolic blood pressure categories of 300 participants. Approximately 10% (n =21) students have an average SBP (<=120 mm/Hg), whereas 90% (n =195) students belonging to urban areas have slightly higher SBP levels than the average (120-139 mm/Hg) which is clear sign of prehypertension, furthermore approximately 14% (n =12) students have average SBP (<=120 mm/Hg), whereas 86% (n =72) students have SBP to hypertension level. Here, it is considerably notable that students belonging to urban areas comparatively have slightly higher SBP levels than students belonging to rural areas, which is due to the prominent and easy accessibility of processed and junk food o students inhibiting city areas, where the number of fast food restaurants is considerably higher than the rural areas.

Table 6 presents the distribution of BMI categories among various age groups of 300 participants. Approximately 24% (n=39) students are average in weight (BMI: 18.5-24.9), 58% (n=96) are overweight (BMI: 25-29.9) and 18% (n=30)

are obese (BMI: >30) of 25-30 year age group, whereas approximately 9% (n =12) students are average in weight (BMI: 18.5-24.9), 60% (n=78) are overweight (BMI: 25-29.9), and 30% (n=39) are obese (BMI: >30) from 31-35 year age group, and rest of 100% (n=6) belonging to 36-40 year age group are obese.

Table 7 presents the distribution of SBP level categories among various age groups of 300 participants. Approximately 15% (n=24) students have average SBP level (<=120 mm/Hg) and 85% (n=141) have slightly hypertensive or prehypertensive SBP (120-139 mm/Hg) of 25-30 year age group, whereas approximately 7% (n=9) students have average SBP level (<=120 mm/Hg) and 93% (n=120) have slightly hypertensive SBP (120-139 mm/Hg) from 31-35 year age group, and rest of 100% (n=6) belonging to 36-40 year age group all have prehypertensive or elevated SBP (120-139 mm/Hg).

Tables 8-A and 8-B display descriptive statistics of junk food consumption frequency and increased BMI. Table 3.6.2 shows the Pearson Correlation value among junk food consumption frequency and increased BMI levels among research participants. The Sig. (2-tailed) value is $p<0.05$ (0.00) and correlation vale r=.818.

Tables p-A and 9-B display descriptive statistics of junk food consumption frequency and increased SBP levels. Table 3.7.2 shows the Pearson Correlation value among junk food consumption frequency and increased SBP levels among research participants. The Sig. (2-tailed) value is $p<0.05$ (0.00) and correlation vale r=.562.

**Table. 4: Body mass index of the Participants by Locality (N=300)**

| **Weight Categories** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Demographic Characteristics** | **Under weight** | | **Normal** | | **Overweight** | | **Obese** | | **Total** | |
| | **<18.5** | | **18.5-24.9** | | **25-29.9** | | **>30** | | | |
| Locality | n | (%) | n | (%) | n | (%) | n | (%) | n | (%) |
| Urban | 0 | 0 | 39 | 18% | 120 | 55.6% | 57 | 26.4% | 216 | 72% |
| Rural | 0 | 0 | 12 | 14% | 54 | 64% | 18 | 21% | 84 | 28% |
| Total | 0 | 0% | 51 | 17% | 174 | 58% | 75 | 25% | 300 | |

**Table. 5: Blood Pressure of the Participants by Locality (N=300)**

| **Blood Pressure Categories** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Demographic Characteristics** | **Normal** | | **Pre hypertension** | | **Hypertension Stage 1** | | **Total** | |
| Locality | <=120 mm/Hg | | 121-139 mm/Hg | | 140-159 mm/Hg | | | |
| | n | (%) | n | (%) | n | (%) | n | (%) |
| Urban | 21 | 10% | 195 | 90% | 0 | | 216 | 72% |
| Rural | 12 | 14% | 72 | 86% | 0 | | 84 | 28% |
| Total | 33 | 11% | 267 | 89% | 0 | | 300 | |

**Table. 6: Body mass index of the Participants by Age Groups (N=300)**

| **Weight Categories** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Demographic Characteristics** | | Underweight | | Normal | | Overweight | | Obese | | **Total** | |
| | | <18.5 | | 18.5-24.9 | | 25-29.9 | | >30 | | | |
| **Gender** | **Age** | n | (%) | n | (%) | n | (%) | n | (%) | n | (%) |
| Male | 25-30 | 0 | - | 39 | 24% | 96 | 58% | 30 | 18% | 165 | 55% |
| | 31-35 | 0 | - | 12 | 9% | 78 | 60% | 39 | 30% | 129 | 43% |
| | 36-40 | 0 | - | 0 | - | 0 | - | 6 | 100% | 6 | 2% |
| | 41-45 | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| **Total** | | 0 | 0% | 51 | 17% | 174 | 58% | 75 | 25% | 300 | |

[Citation: Naeem, W., Ashraf, S., Tahir, A., Shabbir, A., Awais, M. (2023). Association between obesity induced hypertension and consumption of junk food among university students of district Sialkot. *Biol. Clin. Sci. Res. J.*, **2023***: 635.* doi: https://doi.org/10.54112/bcsrj.v2023i1.635]

**Table 7: Blood Pressure of the Participants by Age Groups (N=300)**

| Blood Pressure Categories | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Demographic Characteristics** | | **Normal** | | **Pre hypertension** | | **Hypertension Stage 1** | | **Hypertension Stage 2** | | **Total** | |
| **Age** | | <=120 mm/Hg | | 121-139 mm/Hg | | 140-159 mm/Hg | | >160 mm/Hg | | | |
| | | n | (%) | n | (%) | n | (%) | n | (%) | n | (%) |
| | 25-30 | 24 | 15% | 141 | 85% | 0 | - | 0 | - | 165 | 55% |
| | 31-35 | 9 | 7% | 120 | 93% | 0 | - | 0 | - | 129 | 43% |
| | 36-40 | 0 | 0% | 6 | 100% | 0 | - | 0 | - | 6 | 2% |
| | 41-45 | 0 | | 0 | | 0 | - | 0 | - | 0 | - |
| Total | | 33 | 11% | 267 | 89% | | | | | 300 | |

**Table 8-A Descriptive Statistics**

| Descriptive Statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. Deviation** | **N** |
| **Junk Food Consumption** | 3.4500 | 1.04458 | 300 |
| **BMI of the Participants** | 27.2650 | 2.54055 | 300 |

**Table 8-B: Pearson Correlation among Junk Food Consumption and BMI**

| Correlations | | | |
|---|---|---|---|
| | | **Junk Food Consumption** | **BMI of the Participants** |
| **Junk Food Consumption** | Pearson Correlation | 1 | .818** |
| | Sig. (2-tailed) | | 0.000 |
| | Covariance | 1.091 | 2.171 |
| | N | 300 | 300 |
| **BMI of the Participants** | Pearson Correlation | .818** | 1 |
| | Sig. (2-tailed) | 0.000 | |
| | Covariance | 2.171 | 6.454 |
| | N | 300 | 300 |
| **. *Correlation is significant at the 0.01 level (2-tailed).* | | | |

**Table 9-A: Descriptive Statistics**

| Descriptive Statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. Deviation** | **N** |
| **Junk Food Consumption** | 3.4500 | 1.04458 | 300 |
| **SBP of the Participants** | 121.9400 | 1.22532 | 300 |

**Table 9-B: Pearson Correlation among Junk Food Consumption and SBP**

| Correlations | | | |
|---|---|---|---|
| | | **Junk Food Consumption** | **SBP of the Participants** |
| **Junk Food Consumption** | Pearson Correlation | 1 | .562** |
| | Sig. (2-tailed) | | 0.000 |
| | Covariance | 1.091 | 0.719 |
| | N | 300 | 300 |
| **SBP of the Participants** | Pearson Correlation | .562** | 1 |
| | Sig. (2-tailed) | 0.000 | |
| | Covariance | 0.719 | 1.501 |
| | N | 300 | 300 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

[Citation: Naeem, W., Ashraf, S., Tahir, A., Shabbir, A., Awais, M. (2023). Association between obesity induced hypertension and consumption of junk food among university students of district Sialkot. *Biol. Clin. Sci. Res. J.*, **2023***: 635*. doi: https://doi.org/10.54112/bcsrj.v2023i1.635]

**Discussion**

University students frequently consume fast food. When fast food is consumed more frequently, especially in larger quantities, it leads to obesity, which further puts their health at risk by causing various cardiovascular diseases. Hypertension is exacerbated by frequent fast-food consumption. Fast food is served in larger quantities in restaurants, which exceeds the FDA serving standards in the country. While considering portion size is the amount of food brought to your table in one serving (CDC, 2010).

This study evaluated students' junk food intake and eating frequency with the DHQ. Research participants were asked: (a) "How often did you consume fast food?" Answers were to be selected from (a) Never, (b) Once a week, (c) 2-3 times per week, (d) 4-5 times per week, (e) 5-6 times per week, (f) 1 time per day, (g) More than once per day. In the data analyses, the DHQ responses were coded from 1 for Never to 7 for more than once per day.

University students consumed Fast food on average four or five times each week. According to the findings, junk food intake has a positive link with an increased adult body mass. Data from the anthropometric measurement (Table: 3.2) indicated that of 300 particpants17, % (n = 51) had normal BMI, 58% (n = 174) of sample persons had a BMI ≥ 25-29.9 or Overweight, and 25% (n= 75) were obese BMI >30. A diet rich in excessive amounts of salt and sodium is one of the leading risk factors for elevated blood pressure (Corsi & Subramanian, 2019).

Fast food with high calories and high sodium content leads to weight gain and prehypertension or elevated blood pressure among students. People get 7% salt or sodium from cooking, 13% from natural food (unprocessed food), 5% from table salt, and 75% from fast food (processed food) (Masa et al., 2021). Blood pressure screening results (Table: 3.3) revealed that 11% (n = 33) of the sample population have average systole blood pressure levels, and 89 % (n=267) have an elevated or pre-hypertension level of SBP. Age, race, family history, locality, sleeping pattern, smoking, being inactive, and sedentary lifestyles also contribute to hypertension.

**Conclusion**

This study's main focus was to assess university students' dietary patterns to understand the association of frequent consumption of junk food with obesity and the link between obesity and hypertension. It has been found during the study that there is a significantly strong positive correlation between junk food consumption and weight gain or obesity (rs = 0.818) and a moderately strong positive correlation between junk food consumption with elevated blood pressure or prehypertension ($r_s$ = 0.562). These correlations show the direct association of junk food consumption with obesity and hypertension among university students.

Junk food, which is rich in saturated fatty acids and salt content, is causing obesity and hypertension among adults, respectively. The high caloric processed food increases the energy intake. The number of calories consumed each day must not exceed the calories expended. Otherwise, this will lead to excessive weight gain, which further causes various health concerns like hypertension and diabetes. The study's findings will contribute to understanding the causes and prevalence of various cardiometabolic diseases among adults. The study outcomes will help to make the adult population aware of the health consequences of frequent junk food consumption so they might improve their lifestyles and dietary patterns.

**Declarations**

**Data Availability statement**
All data generated or analyzed during the study are included in the manuscript.
**Ethics approval and consent to participate**
Approved by the department Concerned.
**Consent for publication**
Approved
**Funding**
Not applicable

**Conflict of interest**

The authors declared absence of conflict of interest.

**Author Contribution**

***WAQAS NAEEM***
*Coordination of collaborative efforts.*
***SAIMA ASHRAF***
*Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript*
*Coordination of collaborative efforts.*
***ROMAIL FATIMA***
*Manuscript revisions, critical input.*
*Coordination of collaborative efforts.*
***AQSA MALIK***
*Data acquisition and analysis.*
***HAFIZ AAMIR ALI KHARL***
*Data entry and Data analysis, drafting article*
*Data acquisition and analysis.*
***ASAD SHABBIR***
*Review of manuscript.*

**References**

Ahmad, Alasmari, S., Alnomsi, S., & Alshehri, A. (2018). Relationship of body mass index to sleep duration, and smoking among university students. Electron Physician, 10, 7273–7278.

Ardissino, M., Moussa, O., Tang, A., Muttoni, E., Ziprin, P., & Purkayastha, S. (2019). Idiopathic intracranial hypertension in the British population with obesity. Acta Neurochir (Wien), 161(2), 239-246. doi:10.1007/s00701-018-3772-9

Belancic, A., Krpina, M., Klobucar Majanovic, S., & Merlak, M. (2019). Ocular hypertension secondary to obesity: cortisol, the missing piece of the pathophysiological puzzle? Int J Ophthalmol, 12(6), 1050-1051. doi:10.18240/ijo.2019.06.28

Bianchi, M. E. V., Cusumano, A. M., Torres, C., Rojas, N. G., & Velasco, G. A. (2019). [Prevalence of obesity and arterial hypertension and their relationship with age and gender in Resistencia, Argentina, in the years 2008-2014]. Hipertens Riesgo Vasc, 36(1), 14-20. doi:10.1016/j.hipert.2018.04.003

Binka, E., & Brady, T. M. (2019). Real-World Strategies to Treat Hypertension Associated with Pediatric Obesity. Curr

Hypertens Rep, 21(2), 18. doi:10.1007/s11906-019-0922-2

Castillo, J. J., Mulkey, F., Geyer, S., Kolitz, J. E., Blum, W., Powell, B. L., . . . Stone, R. M. (2016). Relationship between obesity and clinical outcome in adults with acute myeloid leukemia: A pooled analysis from four CALGB (alliance) clinical trials. Am J Hematol, 91(2), 199-204. doi:10.1002/ajh.24230

CDC. (2010). Tackling unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. Lancet, 376(9754), 1775-1784. doi:10.1016/S0140-6736(10)61514-0

Choi, J. I., Cho, Y. H., Lee, S. Y., Jeong, D. W., Lee, J. G., Yi, Y. H., . . . Park, E. J. (2019). The Association between Obesity Phenotypes and Early Renal Function Decline in Adults without Hypertension, Dyslipidemia, and Diabetes. Korean J Fam Med, 40(3), 176-181. doi:10.4082/kjfm.18.0139

Clark, L. R., Koscik, R. L., Allison, S. L., Berman, S. E., Norton, D., Carlsson, C. M., . . . Johnson, S. C. (2019). Hypertension and obesity moderate the relationship between beta-amyloid and cognitive decline in midlife. Alzheimers Dement, 15(3), 418-428. doi:10.1016/j.jalz.2018.09.008

Corsi, D. J., & Subramanian, S. V. (2019). Socioeconomic Gradients and Distribution of Diabetes, Hypertension, and Obesity in India. JAMA Netw Open, 2(4), e190411. doi:10.1001/jamanetworkopen.2019.0411

Dalmasso, C., Leachman, J. R., Ensor, C. M., Yiannikouris, F. B., Giani, J. F., Cassis, L. A., & Loria, A. S. (2019). Female Mice Exposed to Postnatal Neglect Display Angiotensin II-Dependent Obesity-Induced Hypertension. J Am Heart Assoc, 8(23), e012309. doi:10.1161/JAHA.119.012309

Dewey. (2018). The effectiveness of combination antihypertensive therapy in patients with arterial hypertension and additional risk factors: obesity and obstructive sleep apnea syndrome. Ter Arkh, 90(12), 28-33. doi:10.26442/00403660.2018.12.000005

Dlamini, Z., Hull, R., Makhafola, T. J., & Mbele, M. (2019). Regulation of alternative splicing in obesity-induced hypertension. Diabetes Metab Syndr Obes, 12, 1597-1615. doi:10.2147/DMSO.S188680

Dzikowicz, D. J., & Carey, M. G. (2019). Obesity and hypertension contribute to prolong QRS complex duration among middle-aged adults. Ann Noninvasive Electrocardiol, 24(6), e12665. doi:10.1111/anec.12665

El Midaoui, A., Fantus, I. G., Ait Boughrous, A., & Couture, R. (2019). Beneficial Effects of Alpha-Lipoic Acid on Hypertension, Visceral Obesity, UCP-1 Expression and Oxidative Stress in Zucker Diabetic Fatty Rats. Antioxidants (Basel), 8(12). doi:10.3390/antiox8120648

Ellulu, M. S. (2018). Obesity, Hypertension, and Type-2 Diabetes Mellitus: The Interrelationships and the Determinants among Adults in Gaza City, Palestine. Osong Public Health Res Perspect, 9(6), 289-298. doi:10.24171/j.phrp.2018.9.6.02

Fan, D., Su, C., Du, W., Wang, H., Wang, Z., Chen, Y., & Zhang, B. (2018). [Association of obesity indexes with hypertension and dyslipidemia in Chinese adults]. Wei Sheng Yan Jiu, 47(6), 875-882.

Farhadnejad, H., Darand, M., Teymoori, F., Asghari, G., Mirmiran, P., & Azizi, F. (2019). The association of Dietary Approach to Stop Hypertension (DASH) diet with metabolic healthy and metabolic unhealthy obesity phenotypes. Sci Rep, 9(1), 18690. doi:10.1038/s41598-019-55285-6

Faria, A. P., Ritter, A. M. V., Gasparetti, C. S., Correa, N. B., Brunelli, V., Almeida, A., . . . Moreno Junior, H. (2019). A Proposed Inflammatory Score of Circulating Cytokines/Adipokines Associated with Resistant Hypertension, but Dependent on Obesity Parameters. Arq Bras Cardiol, 112(4), 383-389. doi:10.5935/abc.20190032

Glanz, K., Resnicow, K., Seymour, J., Hoy, K., Stewart, H., Lyons, M., & Goldberg, J. (2007). How major restaurant chains plan their menus: the role of profit, demand, and health. Am J Prev Med, 32(5), 383-388. doi:10.1016/j.amepre.2007.01.003

Hajjar, I., & Kotchen, T. A. (2003). Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. JAMA, 290(2), 199-206. doi:10.1001/jama.290.2.199

Hossain, M. B., Khan, J. R., & Das Gupta, R. (2021). Role of hypertension in the association of overweight and obesity with diabetes among adults in Bangladesh: a population-based, cross-sectional nationally representative survey. BMJ Open, 11(7), e050493. doi:10.1136/bmjopen-2021-050493

Jeffery, R. W., & French, S. A. (1998). Epidemic obesity in the United States: are fast foods and television viewing contributing? Am J Public Health, 88(2), 277-280. doi:10.2105/ajph.88.2.277

Kaplinski, M., Taylor, D., Mitchell, L. E., Hammond, D. A., Goldmuntz, E., Agopian, A. J., & Pediatric Cardiac Genomics, C. (2019). The association of elevated maternal genetic risk scores for hypertension, type 2 diabetes and obesity and having a child with a congenital heart defect. PLoS One, 14(5), e0216477. doi:10.1371/journal.pone.0216477

Masa, J. F., Benitez, I. D., Javaheri, S., Mogollon, M. V., Sanchez-Quiroga, M. A., Terreros, F. J. G., . . . Spanish Sleep, N. (2021). Risk factors associated with pulmonary hypertension in obesity hypoventilation syndrome. J Clin Sleep Med. doi:10.5664/jcsm.9760

NHI. (2021). Obesity in patients with hypertension attending a medical outpatient clinic in a tertiary health facility in Enugu, Southeast Nigeria. Ann Afr Med, 20(2), 84-91. doi:10.4103/aam.aam_20_20

NHLBI. (2019). A Proposed Inflammatory Score of Circulating Cytokines/Adipokines Associated with Resistant Hypertension, but Dependent on Obesity Parameters. Arq Bras Cardiol, 112(4), 383-389. doi:10.5935/abc.20190032

Oyekale, A. S. (2019). Effect of Obesity and Other Risk Factors on Hypertension among Women of Reproductive Age in Ghana: An Instrumental Variable Probit Model. Int J Environ Res Public Health, 16(23). doi:10.3390/ijerph16234699

Park, S. K., Ryoo, J. H., Oh, C. M., Choi, J. M., Chung, P. W., & Jung, J. Y. (2019). Body fat percentage, obesity, and their relation to the incidental risk of hypertension. J Clin Hypertens (Greenwich), 21(10), 1496-1504. doi:10.1111/jch.13667

Phillips, S. M., Bandini, L. G., Naumova, E. N., Cyr, H., Colclough, S., Dietz, W. H., & Must, A. (2014). Energy-dense snack food intake in adolescence: longitudinal relationship to weight and fatness. Obes Res, 12(3), 461-472. doi:10.1038/oby.2004.52

Plantinga, L. C., Miller, E. R., 3rd, Stevens, L. A., Saran, R., Messer, K., Flowers, N., . . . Prevention Chronic Kidney Disease Surveillance, T. (2009). Blood pressure control among persons without and with chronic kidney disease: US trends and risk factors 1999-2006. Hypertension, 54(1), 47-56. doi:10.1161/HYPERTENSIONAHA.109.129841

Purba, E. N., Santosa, H., & Siregar, F. A. (2019). The Relationship of Physical Activity and Obesity with the Incidence of Hypertension in Adults Aged 26-45 Years in Medan. Open Access Maced J Med Sci, 7(20), 3464-3468. doi:10.3889/oamjms.2019.447

Ramon-Arbues, E., Martinez-Abadia, B., Gracia-Tabuenca, T., Yuste-Gran, C., Pellicer-Garcia, B., Juarez-Vela, R., . .

. Saez-Guinoa, M. (2019). [Prevalence of overweight/obesity and its association with diabetes, hypertension, dyslipidemia and metabolic syndrome: a cross-sectional study of a sample of workers in Aragon, Spain]. Nutr Hosp, 36(1), 51-59. doi:10.20960/nh.1980

Subar, A. F., Ziegler, R. G., Thompson, F. E., Johnson, C. C., Weissfeld, J. L., Reding, D., . . . Ovarian Cancer Screening Trial, I. (2001). Is shorter always better? Relative importance of questionnaire length and cognitive ease on response rates and data quality for two dietary questionnaires. Am J Epidemiol, 153(4), 404-409. doi:10.1093/aje/153.4.404

Swayze, S., Rotondi, M., & Kuk, J. L. (2021). The Associations between Blood and Urinary Concentrations of Metal Metabolites, Obesity, Hypertension, Type 2 Diabetes, and Dyslipidemia among US Adults: NHANES 1999-2016. J Environ Public Health, 2021, 2358060. doi:10.1155/2021/2358060

Tavares, Fonseca, S., Rosa, G., & Yokoo, E. (2012). Relationship between ultra-processed foods and metabolic syndrome in adolescents from a Brazilian Family Doctor Program. Pub Health Nut, 15, 82–87.

Westgate, C. S. J., Israelsen, I. M. E., Jensen, R. H., & Eftekhari, S. (2021). Understanding the link between obesity and headache- with focus on migraine and idiopathic intracranial hypertension. J Headache Pain, 22(1), 123. doi:10.1186/s10194-021-01337-0



[Citation: Naeem, W., Ashraf, S., Tahir, A., Shabbir, A., Awais, M. (2023). Association between obesity induced hypertension and consumption of junk food among university students of district Sialkot. *Biol. Clin. Sci. Res. J.*, **2023***: 635*. doi: https://doi.org/10.54112/bcsrj.v2023i1.635]