T.C.
YEDITEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF PUBLIC HEALTH

KNOWLEDGE, ATTITUDE, AND CONSUMPTION PATTERNS OF TRANS FATS AND SUGAR SWEETENED BEVERAGES AMONG UNIVERSITY STUDENTS IN PUNJAB, PAKISTAN

MASTER OF PUBLIC HEALTH THESIS

Gull .e. Rana Khan

İstanbul-2022

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SUPERVISOR

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APPROVAL

This thesis has been deemed by the jury in accordance with the relevant articles of Yeditepe University Graduate Education and Examinations Regulation and has been approved by Administrative Board of Institute with decision dated ..... and numbered .....

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Director of Institute of Health Sciences

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

Date

Signature

Gull .e. Rana Khan

DEDICATION

This thesis is dedicated to my family with love and especially to my beloved mother, who was always proud of me, as I was of her and would always be. May Her Soul Rest In Peace.

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First of all, I am deeply grateful to Allah Almighty for giving me the strength, wisdom, peace of mind, and good health to complete this research

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LIST OF SYMBOLS AND ABBREVIATIONS

AHA	American Health Association
BMI	Body Mass Index
CHD	Coronary Heart Disease
CLA	Conjugated Linoleic Acid
EASD	European Association for the study of Diabetes
HFCS	High-Fructose Corn Syrup
iTFAs	industrial Trans Fatty Acids
KAP	Knowledge, Attitude and Practice
NAFLD	Non-Alcoholic Fatty Liver Damage
NCDs	Non-communicable diseases
PSQCA	Pakistan Standards and Quality Control Authority
PFA	Pakistan Food Authority
SSBs.	Sugar Sweetened Beverages
SES	Socio-Economic Status
SPSS	Statistical Package for Social Science
TFAs	Trans fatty Acids

ABSTRACT

Gull.e.Rana Khan (2022). Knowledge, Attitude, and Consumption Patterns of Trans Fats and Sugar-Sweetened Beverages among University Students in Punjab, Pakistan. Yeditepe University, Institute of Health Science, Department of Public Health, MPH thesis, İstanbul.

Unhealthy diets rich in trans fats (TFAs) and sugar sweetened beverages (SSBs) are risk factors for non-communicable diseases, including non-alcoholic fatty liver disease, metabolic syndrome, cardiovascular diseases, and type 2 diabetes. In Pakistan, scientific research on trans fats and SSBs are significantly scarcer, particularly among university students, so the aim of this study is to describe the knowledge, attitude and consumption patterns regarding trans fats and sugar sweetened beverages among undergraduate students. The study is an online cross-sectional survey and data were collected from a sample of 855 students studying at different universities in Lahore and Multan, Punjab, Pakistan, using an online Google form. Questionnaire included socio-demographic characteristics, level of knowledge, attitude and consumption patterns of TFAs and SSBs, weight, height and physical activity levels. Descriptive statistics, Chi-square test, Independent Sample T-test, and Mann-Whitney U test were used to analyze the data using SPSS, version 25. Almost 42.50% of students had heard about trans fats while more than half of the overall survey participants were unaware of their properties, food items containing trans fats and the health consequences. Liquid oil (43.6%) and vanaspati ghee (43.6%) were the most frequently consumed edible oils at home for cooking meals. French fries were frequently eaten (33.5%) on a weekly basis. Only 15.50% of respondents were confident in their knowledge of the amount of sugar consumed in beverages without health concerns. 41.20% had a similar trend towards SSBs consumption as were in the past. 42.6 % consumed cola 1-2 times a day. Knowledge is insufficient and consumption patterns of foods rich in trans fats and SSBs were also not satisfactory for participants. Therefore, the study emphasizes the need for nutritional education and interventions in order to promote healthy dietary practices among university students.

Key words: Trans fats**,** Sugar-sweetened beverages, knowledge, attitude, Consumption patterns, university students, Pakistan.

ÖZET

Gull.e.Rana Khan (2022). Üniversite öğrencilerinin trans yağ ve şekerli içecekler konularındaki bilgi ve tutumları ile tüketim özellikleri, Pencap-Pakistan. Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Halk Sağlığı Anabilim Dalı, Yüksek Lisans Tezi, İstanbul.

Trans yağ ve şekerli içecekler, non-alkolik yağlı karaciğer hastalığı, metabolik sendrom, tip 2 diyabet ve kalp hastalıkları gibi bulaşıcı olmayan kronik hastalıklar için risk faktörleridir. Pakistan'da bu risk faktörleri konusunda özellikle üniversite öğrencileri arasında yapılmış çalışmalar azdır. Bu çalışma, üniversite öğrencilerinin trans yağ ve şekerli içecekler konularındaki bilgi, tutum ve tüketim özelliklerini tanımlamayı amaçlamıştır. Kesitsel bir anket çalışması olarak tasarlanan çalışmaya Lahor ve Multan şehirlerindeki üniversitelerin öğrencileri dahil edilmiştir. Gerekli etik kurul onayı alınmasını takiben anket soruları bir Google formuna uygulanarak çevrim içi (online) olarak öğrencilere ulaştırılmıştır. Üniversite öğrencileri değişik yollarla anketi cevaplamaya davet edilmişlerdir. Cevaplamaya gönüllü olan ve onam vermiş öğrenci sayısı planlanmış örnek büyüklüğüne ulaşıldığında (n=855) veri toplama aşaması durdurulmuştur. Çalışma toplanan veriler SPSS yazılım programıyla bilgisayara girilmiş ve analiz edilmiştir. İstatistik analizde önemlilik düzeyi p=0.05 esas alınmıştır. Öğrencilerin % 42.5'i trans yağ kavramını duymuş olduklarını bildirmiştir. Bu oran tıp ve sağlık bilimleri öğrencilerine %79 iken diğer öğrencilerde %11 ($p<0.001$) olarak bulunmuştur. Öğrencilerin yarıdan çoğu trans yağın önemli özellikleri, gıdaların trans yağ içerme durumları ve trans yağın sağlık etkileri konusundaki sorulara, bu konuların farkında olmadıklarını gösteren yanıtlat vermişlerdir. Trans yağ alımına önemli katkı sağlayan bitkisel katı yağın evde yemekte kullanımı oranı %43.6 olarak saptanmıştır. Öğrencilerin %33.5'i haftada en az beş kez restoran veya kafeteryalar patates kızartması yediğini ifade etmiştir. Öğrencilerin ancak % 15,5'i, şekerli içeceklerin içindeki şeker miktarını kendinden emin olarak bildiğini ifade etmiştir. Öğrencilerin %41'i şeker kullanım özelliklerinde bir değişim olmadığını, %46.9'u her gün en az 200 ml kola içtiğini ifade etmişlerdir. Obezite oranı %6.5 (kızlarda %11.2, erkeklerde %2.2, $p<0.001$) olarak bulunmuştur. Öğrencilerin bu konulardaki bilgileri ve kullanım özellikleri sağlık yönünden tatmin edici düzeyde olmayıp ivedi bir eğitim ihtiyacını göstermektedir.

Key words: Trans yağ**,** şekerli içecekler, gıda tüketimi, üniversite öğrencileri, Pakistan

1.INTRODUCTION and PURPOSE

1.1. Background

Overconsumption of food rich in sugar, salt, saturated fats and trans-fatty acids with low nutritional quality is a key modifiable behavioral risk factor for diet-related non-communicable diseases (NCDs), mainly in young people[1] [2]. Therefore, NCDs contribute to the occurrence of a cluster of diseases including Non-alcoholic fatty liver disease, metabolic syndrome (abdominal obesity, hypertension, dyslipidemias), Type 2 diabetes, Cardiovascular diseases, Cancers and Dementia[1,3,4]. University students are considered a vulnerable population in several aspects, including nutrition[3]. Their unhealthy dietary habits, such as high consumption of fast food and Sugar-Sweetened Beverages (SSBs), provide large amounts of trans fats and simple sugars[3,5]. These edible products containing Trans fats and Sugar-sweetened beverages (SSB) fall into the category of foods that add calories to the diet but are void of essential vitamins and minerals, thus increasing the risk for NCDs mainly if adopted during the early years of adulthood[4–6].

Trans Fatty acids are unsaturated fatty acids that contain one or more unconjugated double carbon-carbon bonds in the trans configuration. [7] Whilst some trans fatty acids are produced in the rumen of ruminant animals during fermentation, most trans fatty acids are generated through partial hydrogenation of vegetable oils containing large amounts of Polyunsaturated fatty acids (PUFAs) in industrial processing. [8,9]A significant number of researches have been done on the subject since 1991, which show the correlation between NCDs (non-communicable diseases) and higher intakes of industrial TFA's (consumption amounts exceeding 0.5% of total energy intake). These researches demonstrate that such individuals are at an increased risk of coronary heart diseases, gallstone formations, infertility, diabetes, cancer, endometriosis, and Alzheimer's disease.[6] Increased intake of Trans fatty acids is associated with an estimated 537,000 deaths around the world in 2010 from CVD.[5,10] TFA's daily consumption is therefore limited to 1% of total daily energy intake or less than 2% of total fat from all food products according to WHO.[7]

It's alarming that WHO's Eastern Mediterranean Region has TFA intake, which leads global numbers Egypt being the first on this list and Pakistan comes at the second spot.[7] The region's TFA intake exceeds WHO recommendation of 1% and is estimated at 1.9% of total daily energy intake.[11] Egypt has 6.5% TFA intake of total energy intake, followed by Pakistan i.e; 5.7% of total energy intake in WHO, EMRO region. [6,11] Pakistan accounts for a total burden of approximately 8 percent of TFA affected globally in 2010, making it the fifth biggest country for total deaths globally attributed to TFA.[5,11] In 2010, the mean TFA intake was 5.7 percent, and an approximate 40.9% of CHD-related deaths were inflicted by intakes of high TFA.[5] About 98% of trans fat sources in Pakistan are found in margarine, bakery products, and edible oil and are produced locally.[12] Being the sixth-largest volume of PHOs market in the world and the largest in the Eastern Mediterranean, the estimated market volume was 520,000 tons in 2017, around 40% of total EM's PHO market volume.[13]

Vanaspati ghee was found to be a significant contributor to trans fat consumption in a review of research on TFA content in Pakistan's industrial food manufacturing. Vanaspati ghee contains around 14.2% to 34.3% TFA, while margarines, with TFA percentages of 11.5% to 34.8%; and bakery shortening, with 7.3% to 31.7% TFA percentages.[12] Trans-fat levels higher than advised by WHO in common Pakistani foods ranging from biscuits, chocolates, pastries, breakfast cereals, and French fries is due to the wide use of the above-mentioned products in baking and cooking purposes.[12]

Research conducted in 2016 in the Faisalabad region shows higher TFA contents in products such as cakes, poori, parathas, and multiple other traditional and highly consumed Pakistani products, and found 38.69% TFA in doughnuts, 18.48% in poori, cakes 12.02%, and parathas having 11.01% TFA content. The lowest TFA content was found in puff pastry at 6.19%, making Pakistani diets higher in TFA[14]. Karim et al. found higher TFA levels in a study of fast food outlets in Karachi selling French fries. The range of TFA was 10-24% in samples collected from four setups; all the other outlets contained TFA lesser than 5%. A probable reason for the high-fat percentage in the French fries sample could be the overuse of frying oils.[15]

Moreover, the rapid change in lifestyle, population growth, and migration in urban areas has contributed to rapid growth in the beverage industry of Pakistan[16] Sugar-sweetened Beverages are being consumed to a great extent in the Pakistani population. [17]Sugar-sweetened beverages are any liquids with added sugars such as regular soda (not sugar-free), fruit drinks, sports drinks, energy drinks, and coffee and tea beverages with added sugars.[18]

Soda and soft drinks are SSBs that are majorly consumed in Pakistan[17]. According to Pakistan household income expenditure surveys, [19–22] carbonated drinks are 60-70 percent of the total beverage consumption of a household.[20] Gradual increase in production of carbonated drinks along with a decline in pricing has been seen over time in Pakistan.[21-22] Mass production and lower prices together contributed to affordability. A study shows that SSBs were more affordable in 2016 as compared to 1990, due to a decrease in real price during this time by USD 3.84 [22,23] Besides soft drinks, fruit juices and hot beverages such as coffee and tea are also consumed in Pakistan, most people prefer consuming beverages along with meals. Tea is more popular compared to coffee due to availability and affordability [17]. Pakistan is the 3rd biggest importer of tea globally and imports more than 140 tons of tea.[24] Almost one kg of tea per capita is consumed in Pakistan per year.[24] According to a study conducted among female medical students in Lahore, 42.3% of students preferred fruit juices, 38.3% preferred Coca-cola/Pepsi, 19.0 % and 3.0% preferred tea and other drinks, respectively.[26]

According to the WHO, adults and children should limit their daily intake of free sugars to less than 10% of their total energy intake [27] These include all monosaccharides and disaccharides added to foods by the manufacturer, cook, or consumer, plus sugars naturally present in honey, syrups and unsweetened fruit juices [27] However, the daily intake of free sugars is much exceeding the suggested limits. The American Heart Association recommends that most women consume no more than 100 calories per day (about 6 teaspoons or 24 grams of sugar), and most men consume no more than 150 calories per day (about 9 teaspoons or 36 grams of sugar). In contrast, the average American consumes 22 teaspoons of added sugar per day, amounting to an additional 350 calories.[28].

Nowadays, beverages are additional liquid calories dose of our dietary consumption and affect health in various ways.[25] There is sufficient scientific evidence that Obesity and other noncommunicable diseases (NCDs) such as hypertension, cardiovascular diseases, type 2 diabetes, kidney disease, liver disease, gout, dental erosion, and dental caries are linked to an increase in SSBs consumption in our diet. [29-34] Unfortunately, sugary beverages are a regular drink of choice for millions around the world and a major contributor to the obesity epidemic. A large number of various types of studies confirm that weight gain is directly correlated with SSB consumption and total adiposity in adolescents.[26]

Moreover, consumption of food items containing trans fats and SSBs has been growing with time in middle and low incomes countries, and this has a direct correlation with NCDs. Every year forty-one million people die due to NCDs, 71% of all global mortalities, of which 85% belong to middle and low-income countries[5,10].In 2016, NCDs were responsible for 58% of deaths in Pakistan; 25% of those are considered premature between the ages of 30 and 70 years.[12] Cardiovascular diseases are considered the major cause of death among these NCDs, i.e. 29%.[12]. Also, the epidemic of diabetes is emerging rapidly in Pakistan. A recent study shows 11% prediabetes and 17% type 2 diabetics in the population aged more than twenty in Pakistan.[35]Additionally, a growing health problem of obesity has been observed in Pakistan; obesity is also considered the main driver of diabetes prevalence and metabolic syndrome[37]. One in every four adult males who are older than 20 years and one in three adult females of the same age are obese; Pakistan is ranked 9th number in obesity[36]

The framework of regulations of the commercial food and beverage industry in Pakistan has largely been neglected due to a lack of states' capacity and twisting of regulations by leading food industries. A lack of capacity and control in different regions by the government is largely responsible for this flaw of regulation. The fight against TFA and beverage producers in Pakistan has been largely constrained due to the lack of ability of government institutions.[11,37] Authentic nutrition fact tables are absent and limited knowledge and research errors in ingredient values, especially TFA and added sugars in nutrition fact lists. Knowledge of high TFA and Sugar-Sweetened Beverages intake and its risks is not common

among the general public, policymakers, and retailers, being one of the most important hindrances in action toward TFA and Sweetened Beverages limitation and elimination.[11, 38]

There is very limited research on the subject that confines the true understanding of TFA and SSBs intake effects, particularly in young adult population groups in Pakistan. Yet to our understanding, it is not well established what are Pakistani students' nutrition knowledge and attitude toward TFA and sugar-sweetened beverages consumption, and no study have explored the consumption pattern of TFA and SSBs among university students in Pakistan. Thus this study aims to assess the Pakistani students' level of knowledge, attitudes, and behaviors towards TFA and Sugar-Sweetened Beverages Consumption. Therefore, public awareness and policy interventions about the subject require data collection to act as a baseline for TFA and Sweetened Beverages reduction and elimination in Pakistan. This will help researchers better understand the social, psychological, and behavioral determinants of the nutritional status of Pakistani young adults where policymakers can develop further investigation and implement appropriate nutrition prevention policies.

1.2. Purpose of study

The purpose of this study is to describe the knowledge, attitudes, consumption patterns, and related factors regarding Trans fats and Sugar-Sweetened Beverages among undergraduate university students in the cities of Lahore and Multan, Punjab, Pakistan.

1.3. Significance of the study

The findings of this study can be used to predict university students' knowledge, attitudes, and behaviors regarding trans fats and sugary beverage consumption. Further analysis of students' eating patterns may assist us in understanding the community's nutritional state. There is still insufficient knowledge about trans fats and sugar reduction. As a result, young individuals have a greater rate of morbidity, disability, and mortality than the general population due to various developmental, behavioral, and environmental risk factors. There haven't been many studies in Pakistan on trans fats and sugary beverage consumption. Scientific research is significantly scarcer among young adults. This research contributes to

bridging that gap. Therefore, the findings of this study could be used to develop effective interventional strategies to promote healthy eating besides overcoming the identified barriers and, in the long run, to prevent the emergence of new cases of NCDs related to nutrition.

2.LITERATURE REVIEW

The literature review is discussed in various sections, including the definition of Trans fats, sources, edible oils, food items containing trans fats, and health risks related to trans fats. The definition of SSBs and the potential health effects associated with excessive consumption is also included in this section.

2.1. Definition of Trans fats (TFAs)

Trans Fatty acids are unsaturated fatty acids that contain one or more unconjugated double carbon-carbon bond in the trans configuration[7]. Whilst some trans fatty acids are produced in the rumen of ruminant animals during fermentation, most trans fatty acids are generated through partial hydrogenation of vegetable oils containing large amounts of Polyunsaturated fatty acids (PUFAs) in industrial processing. [8,9]

2.2. Sources of Trans fats (TFAs)

TFAs can be obtained from human diet through four main sources i.e. industrial in which partial hydrogenation of vegetable oils is done, through heat processes, occur naturally in ruminant sources, and TFAs synthesis through diet.[39]

2.2.1. Industrial or Artificial TFAs

Through partial hydrogenation of liquid vegetable or fish oils which contain unsaturated fatty acids industrial or artificial TFAs are produced. During this process, the isomerization process converts cis double bonds into trans-double bonds with the help of a metal catalyst and produces trans-fat from unsaturated fat.[40,41] The major trans isomer in iTFAs is elaidic acid.[42]

Partially hydrogenated oils (PHOs) contain almost 60% of total fatty acids.[42] The iTFA production through partial hydrogenation of liquid oil has commercial importance due to 2 main reasons: increased shelf life due to improved oxidation capacity, cost-effective and good plasticity.[43] Various foods, including margarine, vegetable shortening, fried foods, baked goods, and vanaspati ghee, contain artificial TFAs. Industrially produced trans-fat is often found in fried street & restaurant foods.[44,45]

2.2.2. Natural TFAs:

Through the bacterial transformation of unsaturated fatty acids nTFaS is produced by rumen of ruminant animals e.g., cows, sheep, and goats. Poultry and Pork fat also contain a small amount of TFAs.[46, 47,48] nTFAs are produced by partial hydrogenation in the oxidation process with the help of catalyst.[11,40,41] Milk and meat contain predominant nTFA, which is vaccenic acid (VA) (C18:1 trans-11).[41,42] Naturally occurring TFAs in meat and dairy products are produced as a result of anaerobic fermentation in the gut and are not detrimental to human health.[42]

2.2.3. TFAs produced during heat processes

Frying of oils at high temperatures also produces some TFAs. Variation in thermal TFAs is evident due to fatty acid composition, antioxidants in fried products and many factors associated with frying process.[49]

2.3. Food items containing Trans fats (TFAs)

Various foods, including margarine, vegetable shortening, fried foods, baked goods and vanaspati ghee contain artificial TFAs. Industrially produced trans-fat is often found in fried street & restaurant foods.[44,45] This fat has been a key contributor in industry and has been used widely since 1960's due to various functional factors associated with it, which may include plasticity, emulsion stability, and low cost.[46,47,48]

Animal products like milk, butter, cheese, and beef contain low amounts of nTFAs and also contain natural trans fatty acids (nTFAs)[41]

2.4. Health outcomes of artificial Trans fats

2.4.1. Cardiovascular disease (CVD)

TFAs can increase the risk of CVDs to an equal level or even greater than SFAs.[56, 57] In industries, iTFAs are mainly produced from hydrogenated vegetable oils (PHVOs) and are considered as a major health concern of Chronic Heart Disease.[52,39] When the adverse effects of SFAs, including increased blood cholesterol and CVD risk, became known TFAs were called a healthier replacement for saturated fatty acids (SFAs). Nevertheless, evidence suggests that TFAs are even more harmful than SFAs and provide no nutritional benefits.

Increasing TFA consumption particularly of hydrogenated oils, disturbs the synthesis of essential fatty acids and alters the phospholipids composition of major vessels, thus increasing the CVD risk [40,41,52,53,54] Therefore, TFAs affect vessels mainly by increasing LDL and decreasing HDL levels in the blood. [52,53,55-58] The risk of cardiovascular disease can be increased by 29% due to per day intake of 5-gram TFAs. [44] Similarly, a 2% rise in energy intake from trans-fat has been linked with a 23% increase in risk of coronary heart disease (CHD).[52,57] Conferring to the WHO report, due to the intake of TFAs from industrial sources about 540,000 deaths occurred.[59]

The Nurses' Health Study, showed a significant, positive association between the intake of iTFAs and heart disease risk.[60] Major source of TFAs i.e., margarine could lead to increased risk of heart disease as seen by Framingham study.[61] Moreover, another study also suggested that the increased risk of cardiac death is positively associated with the intake of total TFAs as well as elaidic acid.[62] The consumption of iTFAs has adverse effects on plasma lipids. E.g., proinflammatory effects e.g.; higher levels of tumor necrosis factor-α activity, higher interleukin-6, and higher C-reactive protein and endothelial dysfunction and higher LDL cholesterol, lower HDL cholesterol, and higher total/HDL cholesterol ratio.[63].

2.4.2. Obesity

In noncommunicable diseases due to comorbidities associated with it such as dyslipidemia, hypertension and insulin resistance obesity is seen as an important public health problem. Diets rich in trans fatty acid can lead to obesity. An expectant connection between obesity and consumption of iTFA has been depicted in different studies. iTFA intake has increased possibility of affecting genes associated with obesity and can have influence on human metabolism by changing BMI and weight.[64] The intake of double amount of elaidic acid could lead to decreased risk of weight loss according to a study.[65] Similar results were found in 4- to 5-year-old children in the Spanish study. The consumption of >0.7 g/day iTFA has major contribution in being obese.[66] In people who did not follow the recommended level of iTFA 5-fold increase of central adiposity was evident.[67]

2.4.3. Insulin Resistance

Insulin resistance in the body is seen in type 2 diabetes. High intake of fats and saturated fatty acids lean towards increases the chances of getting type 2 diabetes. Increased insulin resistance can be the result of high intake of TFAs.[68] In overweight or diabetic individuals and those with preexisting insulin resistance TFAs can aggravate insulin resistance. An evident from a study, which included 183 individuals (127 individuals without insulin resistance and 56 with insulin resistance) reported that Trans fats impair sensitivity of insulin by modifying the insulin receptors.[69]

2.4.4. Cancer

Worldwide, estimated 9.6 million deaths have been reported due to Cancer. Cancer starts due to uncontrolled growth of cells in body. Increased risk of breast and large intestine cancer is linked with TFA intake according to research.[60,73] A encouraging relationship between the risk of large B cell lymphoma and TFA levels in red blood cells, especially for elaidic and vaccenic acid was recently found by Ardisson Korat and colleagues[70.] Furthermore, European Prospective Investigation into Cancer and Nutrition (EPIC) also suggested link between industrial trans elaidic acid with ovarian and rectal cancer.[71,72] The concentration of plasma of elaidic acid is seen in higher concentration in patients with colon adenomas and elaidic acid enhances the metastatic potential of colorectal cancer cells.[73,74,75] According to a cohort study in the Netherlands, a weak relationship was found between Conjugated linoleic acid CLA intake and breast cancer. In addition, CLAs can also lead to colon cancers.[76, 77.]

2.4.5. Inflammation

The leading cause of death, which can cause systemic inflammation is highly linked with neurodegenerative disorders, CVDs, cancer, nonalcoholic fatty liver disease, chronic kidney disease, and diabetes mellitus. This systemic inflammation is highly linked with intake of TFA.[78, 79] Constructive relations between increased levels of inflammatory markers and iTFAs is seen. In a trial involving obese humans with no comorbidities, supplementing with 6.4 g of conjugated linoleic acid CLA for 12 weeks boosted lean body mass along with inflammatory markers like C-reactive protein and interleukin-6.[80] Another in vitro survey

revealed that elaidic acid, linoelaidic acid, and vaccenic acid, increase the extracellular ATP-induced apoptosis which can lead to typically TFA-related atherosclerosis, cell death and inflammation.[81].

Likewise, the National Health and Nutrition Examination Survey found that elaidic acid, linoelaidic acid, and vaccenic acid all played a role in raising inflammation markers.[82] TFAs cause vascular disorders by enhancing inflammation of vascular endothelial cell and apoptosis. Therefore, increased TFA intake is a substantial risk factor for various inflammatory diseases.[83]

2.5. Trans fats in Pakistani Food supply chains

In Pakistan, iTFA is mainly consumed in the form of Vanaspati ghee and processed food from margarine.[12] The major source of ITFAs in Pakistan is vegetable ghee. Desi Ghee (semi-liquid product) which is obtained from butter/milk is mainly used in the country, and it can be stored easily. As a substitute to Desi ghee, Vanaspati ghee was introduced and is consumed frequently in cooking.[84]

2.5.1. Major dietary sources of Trans-fat in Pakistan

2.5.1.1. Levels of iTFA in Oils and Fats in Pakistan

According to WHO, the levels of iTFA in vanaspati ghee are generally above the safe limit. Industrial margarine and vanaspati ghee have a high level of iTFA, while lower level of iTFA is found in butter, cooking oil, and table margarine[85]

According to Heart file survey analysis, the proportion of TFAs is Vanaspati ghee 14.2% - 34.3% Margarines 11.5% - 34.8% Shortenings 7.3% - 31.7% & Cooking oil 0.4% - 1.8%.[12] A study conducted in 2012 showed 5 famous brands of vanaspati ghee contain significant higher amounts of iTFAs.[86]

Refined oil products are more expensive than vanaspati ghee, and no effective campaign has been launched yet against Vanaspati ghee,[84] the average price of cooking oil was 5% higher as compared to vanaspati ghee in June 2019.[88] Therefore, consumers prefer vanaspati ghee.

Pakistani population has low-income status, and this analysis requires the need for affordable replacement solutions for iTFA products here.[84, 85]

2.5.1.2. Margarines In Pakistan

Partially hydrogenated vegetable oils produce industrial margarine which contains high levels of iTFA. Pakistan imports US $15 million annually, and an increase in the import of margarine up to 88% has been seen.[85] Awareness of key differences between margarine and butter is highly important as people are unaware of this.[84, 85]

2.5.1.2. Butter

Butter has, on average, a bit less than 5g of artificial TFA per 100g of fat and it is available in the country commercially.[87]

2.5.1.3. Cooking Oil

In cooking oil, artificial TFA has been reported at low levels i.e. (between 0.4 and 1.8g) per 100 grams of fat content.[90]

2.5.1.4. Trans-fat levels in major food products:

Various kinds of fats and oils are consumed by food manufacturers, which contain different proportions of TFAs. According to Heart file report, the major food products contain different levels of TFA. For example, Biscuits 9.3% - 34.9% Chocolates 4.56% - 8.49% Pastries 3.92% - 10.97% Parathas 11% Cakes 12% French fries 0.11% - 24% Breakfast cereals 14.4%.[12 ,85]

Biscuits and cakes: a study conducted to see the level of iTFAs in biscuits showed that they contain an increased amount of iTFAs, which range from 9 to 35g per 100g of fat with more levels of iTFAs seen specially in commercial biscuits.[12] Various snack items e.g., puri, samosa, paratha etc. have high content of iTFA according to data collected by previous research programs. Poori had up to 19g per 100g of fat and doughnuts sample have up to 39g per 100g of fat and high levels of iTFA.[12,85]

2.5.2. Regulations for TFAs in Pakistan

Recently established limits for TFAs in a few products by the federal and provincial food authorities are not in line with global best practices.

The main organizations in charge of food safety regulation in the country include the Pakistan Standards and Quality Control Authority (PSQCA) and the provincial food authorities. While PSQCA has adopted restrictions for only vanaspati ghee, institutions in Punjab and Khyber Pakhtunkhwa have introduced mandatory TFA limits for many food products. By 2020 the Punjab Food Authority (PFA) aims to ban vanaspati ghee. The other provinces, including Sindh and Baluchistan are incompetent in regulations of TFAs and have not yet launched any policies.[85, 86]

2.5.3. Efforts to reduce TFAs in Pakistan

The per capita consumption of iTFA in Pakistan is concerning because of the increased mortality associated with it. The key challenges in Pakistan for iTFA replacement include the following: high consumption of foods that contain iTFAs (especially vanaspati ghee), little knowledge to companies about side effects of fat and oil frying at very high temperatures, limited infrastructure, and inadequate iTFA replacement solutions, lack of laboratory facilities, low demand for iTFA free products due to unawareness in country.[85, 86]

WHO Pakistan, in collaboration with the Ministry of Health Services, Regulations and Coordination of Pakistan, has launched the first action of the REPLACE package's activities on the review of iTFA's dietary sources. Furthermore, a pilot project is also started based on 2nd packaged activity and will be beneficial in suggestions about replacing iTFAs present in food.[84, 86]

2.5.4. Challenges to replace iTFAs in Pakistan

Limited knowledge of local companies about the negative impact of fat and oil frying at very high temperature, high demand for food items containing vanaspati ghee, and heterogeneity of current iTFA compliance in the country which creates ambiguity for the industry's lack of laboratory facilities for iTFA assessment and low demand for iTFA free products due to low

level of consumer awareness are the main challenges for iTFA replacement in Pakistan.[85, 86] Therefore, food products containing artificial trans fats has gradually increased in Pakistan over the past few decades. The report advised four key recommendations that would help the industry to replace iTFAs in Pakistan by 2023, i.e., Implement regulations and provide technical support to the industry around iTFA elimination. Support consumer education and demand for free iTFAs products.[84]

2.6. Definition of Sugar-Sweetened Beverages (SSBs)

Sugar-sweetened beverages are any liquids that are sweetened with various forms of added sugars like brown sugar, corn sweetener, corn syrup, dextrose, fructose, glucose, high-fructose corn syrup, honey, lactose, malt syrup, maltose, molasses, raw sugar, and sucrose. Examples of SSBs include, but are not limited to, regular soda (not sugar-free), fruit drinks, sports drinks, energy drinks, sweetened waters, and coffee and tea beverages with added sugars.[18]

2.7. Health effects of increased SSBs

Health can be compromised due to the intake of a high amount of sugar-sweetened beverages. The hazards may vary from simple problems like tooth decay to life-threatening conditions like cardiovascular disease. It can also cause difficulties with blood sugar levels, which can lead to diabetes[91] According to epidemiological studies, sweetened beverage consumption is linked to increased energy consumption, increased abdominal fat, and increased body weight, which exacerbate metabolic and cardiovascular problems.[92]

2.7.1. Obesity

Being overweight and obese is the fifth major risk of global mortality. Weight gain is a medical condition where BMI ranges between 25 and 29.9 and obesity is a condition where BMI is 30 or higher.[93] Obesity is mainly linked with high intake of sugary products. Diabetes is mainly noticed in those women who take sugar beverages regularly or more than one in quantity as compared to those who consume them on and off. Added sugars and cardiovascular diseases have strong relation as it was being confirmed in the western obesity epidemic [94] Sugar beverages not only lead to weight gain but are also prone to be addictive

as revealed by some researches. This addictive nature of sugar is explained by the neurochemical hypothesis. SSBs may result in weight gain due to repeated intake of these products, which is due to the phenomena of incomplete statiety that is associated with liquid diet as compared to solid food.[95] Solid sugar-containing foods are generally (but not always) high in energy, and frequent and substantial energy-dense food consumption is linked to excess weight gain and other adiposity measures[96]. Sugar-sweetened beverages mainly fructose is associated with the deposition of fat in different visceras[96]. Fructose is like alcohol; according to Lustig, it is metabolized straight into fat – not cellular energy, like glucose.[97] This implies that nutritional fructose can heavily boost the transformation of surplus carbohydrates into fatty acids known as "lipogenesis."

A study revealed that enhanced consumption of soft drinks is linked with being obese.[98] Serious health problems e.g., diabetes type 2, increased blood pressure, respiratory problems, liver diseases, psychological effects, and sleep disorders, are reported mainly in the Young generation who are obese and overweight.

2.7.2. Diabetes and Insulin Resistance

Insulin resistance is a state when a normal biological response to insulin is impaired due to decrease sensitivity to its receptors. Insulin resistance can lead to many comorbidities e.g hypertension, dyslipidemia and CVDs collectively known as insulin resistance syndrome[99]
Majority of people suffer from type 2 diabetes. One-third of US adults are prediabetic, and their risk of being diabetic will increase to 10% if no proper intervention is done timely[100].
This a metabolic disease in which sugar levels in the blood are elevated. Malnourishment and poor diet are highly linked with intake of sugar-sweetened beverages[100, 101] According to a study presented at the European Society for the Study of Diabetes (EASD), high consumption of sugar sweetened beverages was noticeably associated with a decrease in eating foods that were generally considered healthy[102]
American diets mainly Soft drinks are highly loaded with sugars[103] In 2013, Romaguera et al collected information on the consumption of sugary soft drinks and soft drinks gathered by eight European organizations to study the link between the consumption of sugar

sweetened drinks and type 2 diabetes and found that intake of one serving of sugar-sweetened soft drinks a day increases the risk for type 2 diabetes by 22 percent[97]

A serving of 330ml of carbonated soft drink contains about **10 teaspoons** of sugar. Therefore, excessive consumption leads to a sustained increase in blood sugar level, which exceeds the limit recommended by WHO by 10% of the calories of added sugars which eventually leads to type 2 diabetes. Sugar causes red blood cell aggregation. As a result, the flow of oxygen into the cells is blocked and thus removes carbon dioxide from the cells leading to the accumulation of waste[98]

2.7.3. Cardiovascular diseases

People who consume sugar beverages are likely to have a short life span due to the increased risk of cardiovascular diseases associated with these beverages. Those who take 2 or more servings in a day also had an increased risk of dying from CVDs, almost 31%. The key factor responsible for diseases associated with CVDs is a diet rich in triglycerides.[104] In 2013, the American Heart Association (AHA) stated that globally the number of deaths would be around 180,000 every year due to intake of sugar-sweetened beverages, including soft drinks, sports drinks, and fruit drinks.[102]

In the human body, SSBs cause a rise in blood glucose levels with an increase in C reactive protein and hence contribute to being one of the leading causes of deadly problems e.g. coronary heart disease (CHD) and diabetes.[105]

As a result of CVDs reactive oxygen species (ROS) are produced in the body by different sources e.g. mitochondria, nicotinamide adenine dinucleotide phosphate-oxidase, end products of glycation, insulin, and uric acid, which ultimately leads to oxidative stress in the body.[106]

2.7.4 Dental Diseases

Many factors contribute to the cause of Dental caries. Enamel which is a protective layer of teeth, gets prone to destruction due to low levels of calcium, and ultimately, cavities are produced. [107]Sugars in soft drinks are also one of the leading cause of forming cavities by

decreasing pH107, reducing mineral content, and producing acids metabolized by microorganisms that further destroy enamel. Improper mouth hygiene also contributes to dental caries[108] Oral bacteria, especially "Streptococcus mutans" produce acidic environments by fermentation of sugars. Sugars in soft drinks cannot wash through saliva in the mouth and hence need proper cleaning to prevent tooth decay. Persons who take 3 or more sugary drinks per day had an increased rate of 17- 62% tooth decay[109]

Erosion of teeth is associated with an acidic environment in the mouth which damage the teeth surface slowly[110] Carbonated soft drinks are more dangerous because they are more likely to produce an acidic environment in the mouth than non-carbonated soft drinks[107] Important factors that contribute to the erosion of teeth include the amount, type, severity of the acid level, the buffering capacity of the beverage and the concentration of phosphate, calcium, and fluoride in beverages[111] Gingivitis and gum diseases are also produced by sugary products due to their capacity to appeal small bacteria. Ultimately the supporting tissue of teeth, ‘’gums’’ get weak, and their teeth holding capacity is reduced to a greater extent[111]

2.7.5. Bone Disease

An increased blood glucose level worsens the formation of the bone process by affecting its quality and mass. Hormonal changes associated with the aging process decrease calcium and vitamin D levels in the body and may contribute to a process known as Osteoporosis[107] Strong bones need a balanced amount of phosphorus and calcium in the blood. Carbonated soft drinks enhance phosphorus in the blood to a large extent. Moreover, the loss of important minerals, e.g., calcium, magnesium, chromium, copper, zinc, and sodium, through urine is also seen with the intake of sugar-containing soft drinks. The loss of calcium in the blood triggers thyroid hormone (PTH), which extract from the bones to maintain balance. With time, the process leads to poor bone structure (osteoporosis). The increased levels of calcium in the blood are removed from the body through urine excretion, joint deposition (causing osteoarthritis, bursitis, gout), in the form of kidney stones, and deposition in arteries (calcified plaque**)** [107] Hence bones become more fragile due to decrease levels of calcium. Phosphoric acid in the soda drink is also toxic due to its potential to produce aluminum which

contributes to bone fractures by causing loss of the excess amount of calcium in urine[111] An epidemiological analysis was performed in 2016 to distinguish the relationship between sugar-sweetened beverage consumption and the risk of prediabetes and insulin resistance. An evaluation showed that individuals who frequently eat sugar-sweetened drinks have a 46% greater chance of becoming prediabetic than those who consume fewer drinks. The elevated consumption of sugar-sweetened drinks is a major risk factor for developing type 2 diabetes.[112]

2.7.6. Non-Alcoholic Fatty Liver Disease (NAFLD)

Non-alcoholic fatty liver disease is a condition in which fat is deposited in liver cells due to the intake of high sugary drinks.[107] NAFLD is such a silent disease that triglycerides accumulation slowly kills the liver cells in a person who is not even an alcoholic. In the early stages, the disease is symptomless as seen in around 25 percent of Americans[113] Obese and overweight people are more prone to develop NAFLD, which ultimately leads to the development of chronic disorders e.g CVDs and diabetes.[113] Soft beverages contain fructose that is easily absorbed by the liver and is transformed into glucose, glycogen, lactate and fat. This fructose, if taken in excess amount, can derange lipid profile and can affect the sensitivity of hepatic receptors of insulin, ultimately leading to a condition called ‘’fatty liver’’. Increased risk of developing fatty liver with cirrhosis is more common in people who take more than 2 servings of soft drinks daily[107] Diet drinks which are generally considered safe, also contain small doses of aspartame and sodium preservatives that can be the source of liver cell damage[113] Jiantao et al. found a relationship between excess sugar intake and NAFLD. According to which NAFLD is more common among people who take more than one soft drink a day as compared to those individuals whose intake of sugar-sweetened beverages is minimal[113]

2.7.7. Cancer

Sweeteners used in industries e.g, saccharin and caramel colorings in drinks, have a carcinogenic effect on human health. The most notorious cancer,‘’ pancreatic cancer ‘’, is highly associated with the intake of these products as they become a source of increasing the

levels of insulin which promote the growth of metastatic cells. People who consume carbonated soft drinks frequently are more prone to developing this cancer[98] Some studies have revealed an association between excess sugar consumption with cancers of GIT tract, and this association was also tested by Fox et al., in which recurrence of cancer and mortality in stage 3 patients was more in those who take excess sugars[114]. Another study by Wong et al. found an increased risk of breast cancer associated with the intake of sugary beverages, and it was noticed that the incidence of breast cancer is more in women who take more than 0.5 servings of regular soft drinks daily. Diets with high glycemic index are also notorious for developing breast cancer[115] Endometrial cancers are also known to be associated with intake of high-sugar foods[116] In addition to it, ovarian cancers are also considered to have the same origin. The consequences of these results recommend that diets low in sugar can prevent the incidence of developing breast, endometrial and ovarian cancer [117]

2.7.8. Dietary Fructose improves intestinal cell survival and absorption of nutrients

The metabolism of dietary fructose begins in the epithelium of the small intestine, where fructose is transported by glucose transporter type 5 (GLUT5) and phosphorylated by ketohexokinase to form fructose 1-phosphate, which accumulates to high levels in the cell [98]. This pathway has been linked to obesity and tumor growth, but the exact mechanism is unknown.

According to a study, in many mouse models the, dietary fructose helps to improve survival of the intestinal cell and tends to increase the length of intestinal microvilli. In mice fed a high-fat diet, increasing villus length increases the surface area of the gut and also continues to increase absorption of nutrients and adiposity. Fructose 1-phosphate promotes the cell survival by inhibiting the M2 isoform of pyruvate kinase in hypoxic cells of intestine [107] The genetic ablation of ketohexokinase or stimulation of pyruvate kinase prevents villus elongation . It also abolishes absorption of nutrients and growth of tumor-induced by high-fructose corn syrup feeding in mice. The ability of fructose to promote survival of cell via an allosteric metabolite provides insights into excess adiposity caused by diet and promotion of growth of the tumor by high-fructose corn syrup [119]

2.7.9. Chronic Kidney Disease

SSB and SSSD consumption of more than four servings per week is linked to a higher prevalence and incidence of CKD[107] Chronic renal disease is characterized by a steady decline of kidney function over months or years. High consumers of artificially sweetened drinks are likely to experience a decrease in renal function. Carbonated drinks can cause increased calcium decomposition in bones, which can contribute to the production of calcium insoluble kidney stones. High fructose corn syrup, which is used to desalinate soft drinks, can cause hyperuricemia, which can lead to uric acid crystal development in the kidneys. The consumption of three servings of soda per week can increase the risk of kidney stones by 15% [98]

2.8. Factors predicting the consumption of SSBs among young adults

Early adulthood is a key time of life-cycle development in which many health and nutritional habits are created. The adult population has some of the unhealthiest eating habits of all age groups, including inadequate intake of fruits and vegetables, and excessive intake of fast food and sugary beverages.

2.8.1. Personal Factors

2.8.1.1. Taste Preferences

Sweet taste is the strongest indicator of consuming soft drinks. Due to preferences, the demand is increased, and choices are influenced by various characteristics such as age, gender, and knowledge, with teenagers preferring soft drinks and children preferring fruit juices. Regular soft drinks are generally preferred by boys, while diet soft drinks are favored by girls[119] Obese people consume in high amounts than non-obese and young men had a higher liking for sweet taste as compared to women of the same age. Leptin is the hormone that controls satiety, modifies the perception of sweet taste, and causes obese individuals to consume excessive quantities of high foods[120]

2.8.1.2. Knowledge and Health literacy

Knowledge plays a significant impact on a person's decision to consume, which is beneficial to their health because it leads to basic health information and a better understanding of health

decisions[121] People who lack sufficient knowledge about calories are unable to make proper health and diet decisions[122] According to Park et al., knowing about the negative effects of SSBs was associated with SSB consumption and reduced added sugar intake. Knowledge is also linked to a parent's social and economic condition.[107, 122]

2.8.1.3. Lack of awareness

Another aspect that influenced the outcome was a lack of awareness. According to studies, many of them are ignorant of considerable calorie intake. The majority of the negative impressions of sugar-sweetened beverages focused on the negative health impacts of sugar and the chemical ingredients in soda[123] Young folks are more likely to consume excessively much sugar. The first step toward reducing sugar consumption may be raising awareness. According to university students, informational messaging could be an effective way to address this issue.[123]

2.8.1.4. Lifestyle characteristics and fast food purchasing habits

Long hours of watching television or working on the computer have been linked to sedentary behavior. People spend more time on computers, TVs, and playing video games due to a lack of physical activity, contributing to an unhealthy lifestyle.[124] Also, Fast food is consumed more frequently, and soft drinks are frequently purchased[119]

2.8.2. Socio-Environmental factors

2.8.2.1. Easy availability and affordability of soft drinks

Social environments like homes and universities are the easiest sources of soft drinks because, in homes and universities, they are easily available, which proves that there are no restrictions and consumption is increased, which leads to an unhealthy lifestyle for students.[125]

Moreover, Price was a key factor, according to a study conducted in six colleges, to describe the factors that affect the intake of sugar-sweetened beverages among students.[123]

2.8.3. Sociocultural factors

The consumption of sugar-sweetened beverages among young people is largely related to family and friends because sweetened drinks can be served as snacks in fast-food restaurants and with friends in universities and homes. Moreover, social media and social life have a major impact on food and drink options by doing intensive marketing campaigns to promote soft drinks[126]

2.8.3.1. Socio-Economic factors

Socioeconomic status (SES) is a complex assessment that is calculated on the basis of income, education, and occupation.[127] Many complex factors involving the education of parents, current occupation, net income, and household income influence lifestyle and health, such as diet. Occupation and personal autonomy as important health factors, especially through the stresses associated with low social status and low autonomy. Stress-related to a person's social and economic situation may affect his or her health.[128]

3. MATERIALS and METHODS

This chapter focuses on methodology, study design, study population, and sample size. The method of data collection, analysis of data and the ethical considerations in this section have been elaborated.

3.1. Study Design

This study is an online cross-sectional survey among undergraduate university students in the cities of Lahore and Multan, Punjab, Pakistan.

3.2. Study Population

The study population was undergraduate students aged 18-25 years studying at different universities (both public and private universities) in the cities of Lahore and Multan, Punjab, Pakistan. The total number of participants in the targeted population were 855.

Inclusion criteria: The study included students (both boys and girls) who were undergraduate university students, age group 18- 25 years, from different universities in the cities of Multan and Lahore, Punjab, Pakistan.

Exclusion criteria: Participants who were not undergraduate university students. Students under the age of 18 and older than 25 years and students from cities other than Lahore and Multan were excluded from the study

3.3. Sampling

The sampling technique used in this study was ‘Representative sampling’, and all students willing to answer this online questionnaire were included. Given α, power, and effect size as 0.05, 0.80, and 0.12, respectively, with 4 Df, the required sample size is obtained (n= 829), and a total of 855 students volunteered to take part in the online survey, studying at different universities of Lahore and Multan.

Given α , power and effect size as 0.05, 0.80 and 0.12 respectively with 3 Df, 2 Df and 1 Df the required sample size is obtained correspondingly (n= 758 , n=760, n = 546) . Given α , power and effect size as 0.05, 0.80 and 0.15 respectively with 4 Df, the required sample

size is obtained (n= 534) .While, given α , power and effect size as 0.05, 0.80 and 0.15 respectively with 3 Df, 2 Df and 1 Df the required sample size is obtained correspondingly (n= 485 , n=429, n = 349)

The survey was made available 'online' and optimized for all devices, including desktop PCs (personal computers) and mobile devices, to provide maximum accessibility to the study population.

Before the release date, the members of student services groups widely advertised it on their university's communications portals e.g. electronic notice boards. Also, initial invitation emails were sent to students completing the survey form with an active and direct hyperlink to the questionnaire and two follow-up e-mails. Group messages were also distributed via official social media communication channels reminding students about the start and end dates of the survey.

Before the survey, a pre-survey was conducted on a convenient sample of 50 undergraduate students as a pilot study which was conducted a month prior to the study in order to explore the feasibility of the questionnaire for the participants. As a result of this pretest, some of the items on the questionnaire were discarded because a few of the questions were lengthy.

3.4. Data Collection

The data were collected by an 'online questionnaire' that was prepared in English (as a language of instruction is English in all institutes in Pakistan) by using an online Google form. The online questionnaire was optimized to all devices e.g. desktop PCs (personal computers) to mobile devices providing optimum accessibility and exposure to the student population who were studying in medical as well as non-medical faculties.

An information sheet comprising 'electronic consent' of a participant was provided on the access page of an online survey, in which respondents had been informed that participation was voluntary and they had the choice to withdraw before submitting their questionnaire form. If the survey is completed, consent to participate is implied.

Participating students completed an online questionnaire designed to obtain socio-demographic characteristics, level of knowledge, attitude, and consumption pattern of trans fats and sugar-sweetened beverages (SSBs). The questionnaire was structured in a comprehensive way to cover the specific objectives of the study. The questionnaire employs a variety of dichotomous, multiple-option and checklist response formats. Questionnaire has three sections.

- The first section includes questions about demographics that include age, gender, grade, perceived household economic status, fathers' and mothers' education, along with participants' lifestyle behavior, i.e., Physical activity. BMI was calculated using self-reported weight and height.
- The second and third sections include variables relating to participants' knowledge, attitude, and consumption patterns of Trans fats and SSBs.

The data collection period was completed in three months, between November 2020 and January 2021.

Measurement of variables

Independent Variables:

The socio-demographic variables included in the study were age (years), gender (male/ female), City (Multan/ Lahore), and study program (non-medical/ medical and allied health sciences). Additionally, years of the program were also included as a socio-demographic variable and were measured by asking respondents the year of a program they were studying (range of 1 – 5). University type (public/ private), father's education (No formal schooling or primary/ intermediate/ university), mother's education (No formal schooling or primary/ intermediate/ university), family income per month in Pakistani rupees (less than 30,000/ 30,000 – 150,000/ 150,001 – 500,000/ More than 500,000), were also included as socio-demographic variables in the study. Body Mass Index (BMI) (underweight/ normal/ overweight/ obese), physical activity (No/ Less than 30 minutes a day/ 30 – 59 minutes a day/ 60 – 99 minutes a day/ 100 or more minutes a day), and information seeking using food labels (No/ Yes) were also included as independent variables in the study.

Outcome variables:

The dependent variables included in the study were: (i), knowledge of Artificial Trans Fats which was measured using 31 items that assessed the information that participants had related to utility (benefits/ hazards) of artificial Trans Fats in dietary products; (ii), knowledge of Sugar Sweetened Beverages was measured using 10 items that assessed the information that participants had related to quantity of sugar present in sweetened beverages and the utility of such beverages; (iii), attitude towards Sugar Sweetened Beverages was measured using 3 items to assess respondents' favorable/ unfavorable dispositions towards sweetened beverages as participants were asked on how much they has modified their SSBs consumption behaviors and how often they were concerned about changing their consumption habits if being aware of health risks e.g. 'Could you compare your current consumption level 5 years ago and likely consumption level after 5 years ; (iv), practices related to consumption of artificial Trans Fats which was measured using 11 items that assessed the practices of respondents with respect to consumption of artificial Trans Fats in various food items; and (v), practices relating Sugar Sweetened Beverages consumption were investigated using 10 items that assessed participants' practices related to Sugar Sweetened Beverages consumption.

The participant's knowledge was evaluated using different statements e.g., if they knew about trans fats, different types of fats or edible oils, and food items containing trans fats, which were assessed by interrogative questions i.e. Yes, No or don't know. Of the questions related to health consequences (e.g., Cardiovascular diseases, high cholesterol, high blood pressure, and diabetes), they had to indicate the "correct responses" whether these statements were true, false, or don't know. Knowledge about SSBs was assessed by the information about the quantity of sugar present in SSBs and the utility of such beverages. Participants were also inquired about their beliefs and perceptions related to the good and bad health impacts of SSBs consumption (e.g. overweight/obesity, CVS, diabetes, and fatty liver disease).

Moreover, students' attitude towards SSBs was measured based on how much they had modified their past consumption behaviors and how often they were concerned about

stopping consuming SSBs if being aware of health risks. The respondents were required to indicate to what extent their consumption level varies e.g., 'Could you compare your current SSBs consumption level with consumption level 5 years ago and likely consumption level after 5 years from current SSBs consumption level'.

Participants were asked about their frequencies of consumption of different types of SSBs (regular cola or diet drinks, packaged fruit juices, sports or energy drinks, fused tea, flavored milk, and other similar) and hot beverages, including tea and coffee with added sugar, on a 5-point **scale** ranging from never to several times a day. For each question, response options were 'Never, less than 1 per day, 1-2 times per day, 3-4 times per day, 5 or more times per day'.

The amount of SSBs consumed daily was estimated using each student's daily consumption frequency. The amount of cold beverage consumed was measured based on a single serving of 250ml per cup/cane/bottle. The consumption of beverages with added sugar e.g. hot beverages such as tea and coffee, was measured by the number of cups consumed. Each cup is measured as 250ml.

The consumption frequency of each student is computed on the number of cups consumed on a daily basis. The amount of sugar in hot beverages (tea and coffee) was calculated by the number of sugar cubes added per cup. One cube contains 4 grams of sugar. The total sugar consumed was calculated by the number of sugar cubes in one cup of tea, coffee, and other drinks per day.

Respondents were asked about their consumption pattern of a certain type of food items taken in or withdrawing certain types of food from cafeterias and restaurants during the week (including the weekends). These consumption patterns measure specific dietary behaviors towards intake of particular food groups commonly consumed in the population weekly (e.g., Fried Potatoes, Commercial Fried food (fried chicken, Burgers, Pizzas, Beef), Commercial Baked Food (Doughnuts, Biscuits, Buns, Pastries, and Cakes), Street Fried Snacks (Samosa/Pakoras, poori, kachori), Paratha (sold outside), Packaged Breakfast Cereals, Packaged Snacks, Candies/Chocolates/Wafers, Packaged Ice Cream, Plain Yogurt, and Packaged sweetened Frozen Yogurt). A multi-answer grid was used to assess the frequency

of food consumption, in which respondents were asked to estimate how frequently a specific food item was consumed in a week. The frequency of consumption was calculated with a "never" option and options ranging from very rare to multiple times per week.

3.5. Ethical considerations:

To proceed with the study, formal approval was obtained from the 'Ethics Committee of Yeditepe University, Istanbul, Turkey. An information sheet comprising 'electronic consent' of the participant was provided on the access page of an online survey, in which respondents had been informed that participation was voluntary and they had the choice to withdraw before submitting their questionnaire. If the survey is completed, consent to participate is implied. The electronic consent form provided details of the research, including the purpose of the study, demographic information, nutrition knowledge, attitude, and practice questions. All participants were asked to click "I Agree" option at the start of the questionnaire, and no student was compelled; only those who agreed voluntarily took part in the study. The researcher kept their identities strictly confidential. All of the participants were told that the information they shared would be treated confidentially. Data from the study was kept in record and strictly used for research purposes only.

3.6. Data analysis:

The data was analyzed, and the results were generated using Statistical Package for the Social Sciences (SPSS, *v.* 25). The confidence level was set at 95% for all analyses. Data was checked for missing values and errors, and there were no missing values and errors found.
As part of descriptive statistics, frequency distribution, percentages, mean, standard deviation, and range were calculated for socio-demographic, independent, and dependent variables, respectively. Analyses of the dependent and independent variables were done by cross-tabulation and testing by Chi-square test. A statistical association is significant when the effect measure's null value comes within the confidence limit or a p-value less than 0.05. Both T-tests i.e. Independent sample t-test with "equal variances not assumed" and Mann-Whitney U test, were applied to assess mean differences of dependent variables (SSBs related knowledge) with respect to independent variables (gender and study program).

4. RESULTS

4.1. Descriptive statistics of Socio-Demographic characteristics:

The mean age of respondents in the study was 20.73 years, with a standard deviation of 2.19 years, which shows that majority of the respondents (roughly 68%) were between the age intervals of 18 – 23 years. 48% of the respondents were female, while 52% were male. 51.1% of the respondents belonged to Multan city. 53.8% of the participants were enrolled in non-medical programs, and 46.2% were of medical and allied health sciences programs. The mean program year in which the respondents were studying was 2.88 with a standard deviation of 1.34, which shows that majority of the respondents were studying in 2nd to 4th year. 60.5% of the respondents were studying in public sector universities and 39.5% in private sector universities. With respect to parental or family education 39.2% reported that their parents had attained tertiary education level. Regarding socio-economic status, 19.9% reported that their family income was less than PKR. 30,000 per month and 30.3% reported that their monthly family income was more than RKR. 150,000. The results are summarized in Table 4.1.

Table 4.1. Socio-demographic characteristics of university students in Pakistan (n = 855)

Characteristics	f	%	Mean	Std. Dev.	Range
Age (years)					
18 – 25			20.73	2.19	18 – 25
Gender					
Male	445	52.0			
Female	410	48.0			
City					
Multan	438	51.1			
Lahore	418	48.9			
Study Program					
Non-medical	460	53.8			
Medical	395	46.2			
Year of Program			2.88	1.34	1 – 5
1st	131	15.3			
2nd	276	32.3			
3rd	164	19.2			
4th	131	15.3			
5th	153	17.9			

University type					
Public	517	60.5			
Private	338	39.5			
Family education					
Primary education	198	23.2			
Secondary education	322	37.7			
Tertiary education	335	39.2			
Family Income (PKR/month)					
Less than 30,000	170	19.9			
30,000 – 150,000	301	35.2			
150,001 – 500,000	259	30.3			
More than 500,000	125	14.6			

4.2. Body Mass Index (BMI) and Physical activity status of study participants

4.2.1. The distribution of respondents by gender and BMI

The results of table 4.2 indicate that BMI is classified as underweight, normal weight, overweight, and obesity.

Table 4.2: The distribution of respondents by gender and BMI (n= 855, males= 445, females= 410)

Gender	**Body Mass Index**			
	Underweight	**Normal**	**Overweight**	**Obese**
Female	5 (1.2)	224 (54.6)	135 (32.9)	46 (11.2)
Male	2 (0.4)	339 (76.2)	94 (21.2)	10 (2.2)
Total	7 (0.8)	563 (65.8)	229 (26.8)	56 (6.5)

Chi-square = 53.917[a] **Df** = 3 & **P-value**= .000

The highest proportion of students (65.8%) belonged to the normal weight category. 26.8% of the participants were overweight, 6.5% were obese and 0.8% were underweight. Furthermore, based on the gender of the participants, the proportion of overweight among female respondents was high (32.9%) compared to the male students (21.1%). Similarly, the female respondents (11.2%) were found to be more obese than male (2.2%) according to the self-reported BMI. On the whole, a significant statistical difference (p = .000) was found between gender and body mass index.

However, 0.4% of the male participants were underweight, 76.2% were normal weight, and 21.1% were overweight, while only 2.2% were obese. Also, 1.2% of the female participants were underweight, while 54.6% had normal weight. This is probably due to the fact that females have more unhealthy lifestyle habits such as sedentary behaviors and consumption of energy-dense diets. Also, females have lower participation in physical or sports activities due to limited sports opportunities as well as physical and social environments, which could be the major barriers to female students being more active as compared to males.

4.2.2. Distribution of participants by gender and Physical activity

Table 4.3. The distribution of respondents by Gender and daily leisure time physical activity (walking, jogging, swimming etc) (n= 855, males= 445, females= 410)

Gender	Average, leisure time physical activity (walking, jogging, swimming etc daily				
	No leisure time Physical activity	**Less than 30 minutes a day**	**Equal or longer than 30 mins , but less than 1 hour**	**Equal or longer than 60 mins but less than 100 mins**	**Equal or longer than 100 mins**
Female	123 (30.0)	175 (42.7)	73 (17.8)	28 (6.8)	11 (2.7)
Male	86	166	118	52	23

	(19.3)	(37.3)	(26.5)	(11.7)	(5.2)
Total	209 (24.4)	341 (39.9)	191 (22.3)	80 (9.4)	34 (4.0)

Chi-square = 27.438 , Df = 4, P-value= .000

Table 4.3 illustrates the duration of respondents' engagement in different leisure-time physical activities daily. It indicated that the majority i.e. 39.9% of the total respondents, were engaged in activities for less than half an hour in a day while only 4.0% adopted a prolonged level of physical activity, which is equal to or longer than 100 minutes a day for a healthy lifestyle. 24.4% of the participants were not involved in regular exercise activity. This indicates that the prevalence of physical activity is low among university students. This could be due to the reason that the importance of regular exercising for a healthy and active lifestyle is underappreciated, and there are fewer sports and exercise facilities (gyms, sports centers, playgrounds, and parks) for youth in Pakistan. Secondly, most university students prefer to use the passive mode of transportation, which is also contributing to sedentary life patterns. Moreover, students used to spend more time on studying activities that is thought to be more meaningful than physical activities due to the highly competitive academic environment and less promotion of physical activity programs.

With respect to gender, the different time spans i.e. how long an individual involved in various types of daily physical activities, a significant statistical difference (p-value= 0.000) was found. Overall, female respondents had less involvement in daily physical activities as compared to male students. The females have less favorable individual characteristics that are related to exercising activities. Furthermore, females prefer to engage in indoor tasks and are more limited to their homes as compared to outdoor activities due to societal norms i.e. less social support.

4.3. Knowledge of Trans fats among study participants

4.3.1. The proportion of participants who have heard about the term 'Trans fats'

The results of participants who responded "Yes" to the statement "Have you heard a term called trans-fats" are summarized in Table 4.4

Table 4.4. The proportion of respondents who answered "Yes" to the following statement about Trans-fats (n= 855, males= 445, females= 410)

Gender	Medical / Allied Health Sciences program (n= 395)	Non-medical program (n=460)	Chi-Square test Df & P-value
Have you heard a term called Trans fat?			
Female	167/223 (74.8)	24/187 (12.8)	$\chi^2 = 157.394^a$ Df = 1 p-value= .000
Male	145/172 (84.3)	27/273 (9.8)	$\chi^2 = 246.404^a$ Df = 1 p-value= .000
	$\chi^2 = 5.185^a$ Df = 1 p-value= .023	$\chi^2 = .976^a$ Df = 1 p-value= .323	

74.9 % of female respondents from medical faculty were familiar with the term 'Trans fats', while only 12.8 % of the non-medical female participants had heard the term before. Likewise, more male participants (84.3%) in the medical category were aware of trans fats than non-medical participants (9.9%). Therefore, a statistically significant difference (p-value = .000) was found between medical and non-medical students, including female and male participants. Although the specific reasons for this difference in knowledge influencing the perceptions between two groups were not investigated, this could likely provide insight into whether or not a particular discipline, such as a Medical/Allied Health Sciences program, influenced students' knowledge of the subject matter. Moreover, overall, a vast majority of participants lack health literacy, and the awareness level is also very low among the common masses because in Pakistan, regulations about trans fats reduction and elimination are still in premature form, and there is also a lack of awareness campaigns about this serious issue.

4.3.2 The frequency distribution of knowledge of participants regarding trans fat properties and health risks

The proportion of respondents who were aware of the properties and health hazards associate with consumption of artificial trans fats is shown in table 4.5.

Table 4.5. Frequency distribution of participants' knowledge regarding trans fat properties and health risks. (n= 855)

Participants' perceptions about artificial trans fats	True	False	Don't know
	f	f	F
Artificial Trans fats enhance taste and texture of food	342 (40.0)	59 (6.9)	454 (53.1)
Artificial Trans fats enhance shelf life of food	248 (29.0)	153 (17.9)	454 (53.1)
Edible oils or fats containing artificial trans fats are cheaper	318 (37.2)	120 (14.0)	417 (48.8)
Oils with artificial trans fats can be used many times in commercial fryers	252 (29.5)	170 (19.9)	433 (50.6)
Edible oils or fats containing artificial trans fats are made by heating liquid vegetable oils, in a process called Hydrogenation.	309 (36.1)	121 (14.2)	142 (49.7)
Edible oils or fats containing artificial trans fats can cause Type 2 diabetes and Fatty liver disease	303 (35.4)	106 (12.4)	446 (52.2)
As fats containing trans fatty acids are plant (vegetable) based they can be protective against Cardiovascular diseases (*correct response = false*)	130 (15.2)	300 (35.1)	425 (49.7)
Edible oils or fats containing trans fats can increase the level of high density lipoprotein (HDL) cholesterol that is protective against Heart disease (*correct response = false*)	128 (15.0)	295 (34.5)	432 (50.5)

According to results of table 4.5, the overall findings indicate that approximately one-half of the student population were unaware of the aforementioned statements about artificial trans fats. With respect to the properties of artificial trans fats (enhance taste and texture and cost-effective), a mediocre percentage of participants responded correctly i.e., 40% and 37.2%, respectively. A similar proportion of respondents i.e. 29% agreed that artificial trans fats enhance the shelf life of food and can be used many times in commercial fryers. 36.1% of respondents were aware that artificial trans fats are produced during the hydrogenation process.

Concerning about the health risks associated with consumption of edible oils/fats containing artificial trans fats, 35.4% agreed that artificial trans fats could cause type 2 diabetes and fatty liver disease.

When participants were asked if artificial trans fats increase the amount of high-density lipoprotein (HDL) cholesterol and also protect against cardiovascular disease because of plant-based origin, 34.5% and 35.1% of the students identified the right answers respectively.

4.3.3. The proportion of participants who had knowledge regarding edible oils and food items containing artificial trans fats

Table 4.6. Participants' knowledge about food items containing artificial trans fats (n=855)

Food Items	Include Trans fats	Not include Trans fats	Don't Know
	f	f	f
Commercial Fried foods (French Fries, Fried chicken and Beef)	405 (47.4)	65 (7.6)	385 (45.0%)
Commercial Baked foods (Cakes, Biscuits, Doughnuts, Pastries)	362 (42.3)	106 (12.4)	387 (45.3)

Packaged Snack foods (chocolates, wafers, chips, crackers)	325 (38.0)	121 (14.2)	409 (47.8%)
Packaged Breakfast cereals	216 (25.3)	198 (23.2)	441 (51.6)
Coffee creamers	204 (23.9)	229 (26.8)	422 (49.4)
Milk and Plain Yogurt	91 (10.6)	380 (44.4)	384 (44.9)
Meat (white or red or fish)	113 (13.2)	353 (41.3)	389 (45.5)
Nuts	87 (10.2)	371 (43.4)	397 (46.4)
Fruits and Vegetables	59 (6.9)	448 (52.4)	348 (40.7)

According to table 4.6, the overall findings demonstrate that most students were unaware of the aforementioned food groups containing artificial trans fats. Concerning commercially fried foods (French fries, fried chicken, and beef), 47.4% of the participants identified the presence of artificial trans fats, while nearly a similar proportion of respondents i.e. 45% were unaware.

Commercially baked foods (cakes, biscuits, doughnuts, and pastries) and packaged snack foods (chocolates, wafers, chips, and crackers) both items contained artificial trans fats, according to 42.3% and 38% of participants, respectively. However, a substantial proportion of participants i.e. 45.3% and 47.8% respectively, were aware of the presence of artificial trans fats in these food products.

Approximately one-half of the participants i.e. 49.4% were unable to identify, while only 23.9% agreed that coffee creamers contain artificial trans fats. Similarly, a large fraction of students 51.6% were unaware, whereas 23.2 % stated that packaged breakfast cereals contain artificial trans fatty acids.

A large majority of students, 44.9 % and 45.5 %, were unaware of the content of artificial trans fats in dairy food products such as milk and plain yogurt, as well as meat (white or red), respectively. Similarly, 46.4% of students could not identify the correct response about nuts

containing artificial trans fats. Concerning fruits and vegetables containing artificial trans fats, 52.4% of the respondents mentioned that these food items do not include trans fats

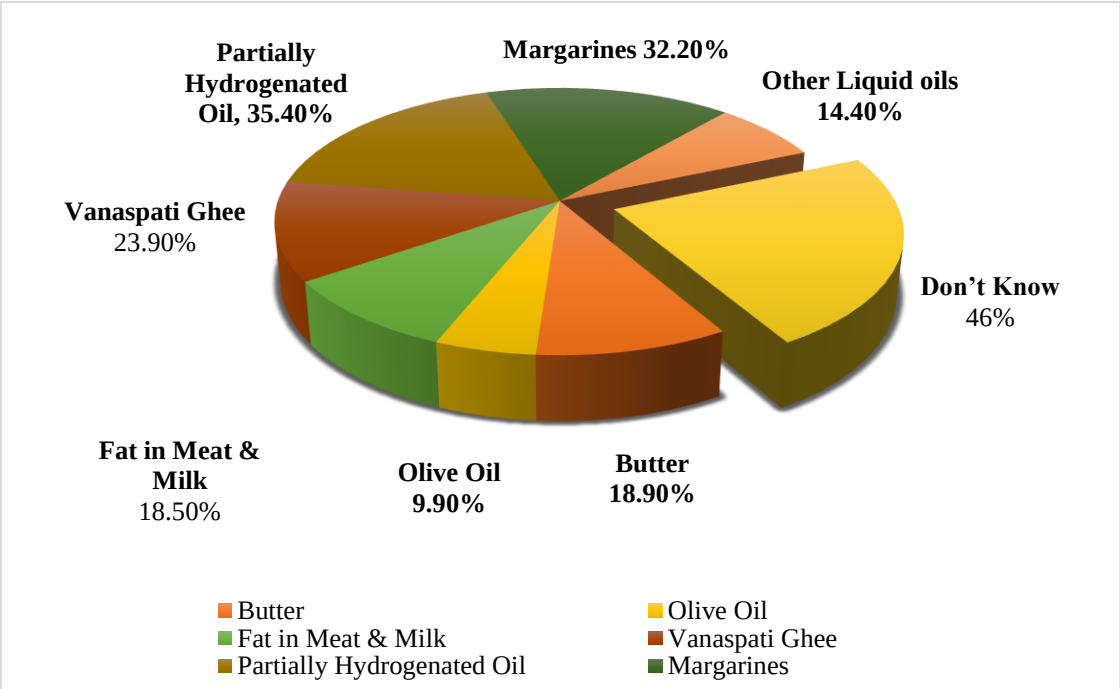

Figure 4.1. Frequency distribution of participants' responses about oils/fats containing artificial trans fats (n= 855)

Participants' knowledge about edible oils/fats containing artificial trans fats are listed in figure 4.1.

49% of the students have no idea about artificial trans fats in various types of edible oils and fats. Partially hydrogenated oil was the most frequently chosen option containing artificial trans fats 35.40% followed by margarines 32.2% and vanaspati ghee 23.9%. Around 18% of participants selected butter and fat in meat and milk as a source of artificial trans fats.

Olive oil was the least popular edible oil 9.9% and other liquid oils 14.4% were the second least considered item, containing artificial trans fats.

4.3.4. The proportion of respondents who were aware of the characteristics and health risks associated with trans fats by the study program

In order to determine respondents' knowledge related to artificial Trans fats, the participants were asked to identify the correct responses related to artificial trans fats. The correctly responded results to the statements are summarized in Table 4.7.

Table 4.7. The proportion of respondents who 'correctly' identified the following statements about the knowledge related to Trans-fats by study program and gender (n= 855, males= 445, females= 410)

Gender	Medical / Allied Health Sciences program (n= 395)	Non-medical program (n=460)	Chi-Square test Df & P-value
Artificial Trans fats enhance taste and texture of food			
Female	145/223 (65.0)	56/187 (29.9)	χ^2 =50.073[a] Df = 1 p-value= .000
Male	112/172 (65.1)	29/273 (10.6)	χ^2 =144.760[a] Df = 1 p-value= .000
Artificial Trans fats enhance shelf life of food			
Female	93/223 (41.7)	34/187 (18.2)	χ^2 =26.321[a] Df = 1 p-value= .000
Male	95/172 (55.2)	26/273 (9.5)	χ^2 =111.357[a] Df = 1 p-value= .000
Edible oils or fats containing artificial trans fats are cheaper			
Female	131/223 (58.7)	43/187 (23.0)	χ^2 =53.213[a] Df = 1 p-value= .000
Male	98/172 (57.0)	46/273 (16.8)	χ^2 =77.624[a] Df = 1 p-value= .000
Oils with artificial trans fats can be used many times in commercial fryers			
Female	99/223 (44.4)	43/187 (22.9)	χ^2 =44.805[a] Df = 1 p-value= .000
Male	67/172 (39.0)	43/273 (15.8)	χ^2 =30.527[a] Df = 1 p-value= .000

Edible oils or fats containing artificial trans fats are made by heating liquid vegetable oils, in a process called hydrogenation.			
Female	127/233 (54.5)	37/187 (19.8)	χ^2 =52.545[a] Df = 1 p-value= .000
Male	113/172 (65.7)	32/273 (11.7)	χ^2 =139.947[a] Df = 1 p-value= .000
Edible oils or fats containing artificial trans fats can cause type 2 diabetes and fatty liver disease			
Female	123/223(55.2)	55/187(29.4)	χ^2 =27.442[a] Df = 1 p-value= .000
Male	88/172(51.2)	37/273(13.6)	χ^2 =73.891[a] Df = 1 p-value= .000
As fats containing trans fatty acids are plant (vegetable) based they can be protective against cardiovascular diseases (correct responses)			
Female	117/223 (52.5)	34/187 (18.2)	χ^2 =51.387[a] Df = 1 p-value= .000
Male	110/172 (64)	39/273 (14.3)	χ^2 =116.875[a] Df = 1 p-value= .000
Edible oils or fats containing artificial trans fats can increase the level of high density lipoprotein (HDL) cholesterol that is protective against heart disease (correct responses)			
Female	130/223(58.3)	31/187(16.6)	χ^2 =74.227[a] Df = 1 p-value= .000
Male	97/172(56.4)	37/273(13.6)	χ^2 =92.030[a] Df = 1 p-value= .000

Concerning participants' awareness of the characteristics related to trans-fats i.e. enhancing taste and texture, shelf-life of food, and cost-effectiveness, a substantial proportion of female participants from medical faculty had better awareness than non-medical female students. Similarly, male medical students had higher knowledge and understanding than non-medical students. As a result, there was a statistically significant difference (≤ 0.05) between the knowledge of medical and non-medical students, including both female and male participants.

When participants were asked regarding repeated use of oil containing artificial trans fats for commercial frying purposes, 44.4% of females and 39% of males in the medical faculty correctly responded as compared to 22.9% of females and 15.8% of male participants in the non-medical program. Similarly, the majority of medical faculty participants correctly identified the statement that edible oils or fats containing artificial trans fats are produced by hydrogenating liquid vegetable oils in contrast to their non-medical counterparts.

Regarding knowledge about the health outcomes associated with the consumption of edible oils or fats containing artificial trans fats i.e. type 2 diabetes and fatty liver disease, medical responders, both male and female, were more likely to agree with the risks related to consuming edible oils or fats containing artificial trans fats i.e. 55.2% and 51.2% respectively. In comparison, respondents from the non-medical program had less awareness about the health hazards caused by artificial trans fats found in edible oils or fats.

When participants were asked if artificial Trans fats are protective against cardiovascular disease because of plant-based origin, only 18.2% of female non-medical students identified the right answers and were able to respond correctly. While among medical responders, both female and male participants had a higher proportion of appropriate responses i.e. 52.5% and 64%, respectively. Likewise, when non-medical students were asked if artificial trans fats are protective against heart disease by increasing the amount of high-density lipoprotein (HDL) cholesterol, only 16.6% of females recognized the accurate answer. In contrast, both female and male participants in the medical program had a substantial percentage of correct responses i.e. 58.3% and 56.4%, respectively. As a result, there was a statistically significant difference (p-value= .000) between the medical and non-medical students (both female and male) regarding awareness of the health risks associated with edible oils and fats containing artificial trans fats.

4.3.5. The proportion of respondents who were ‘unaware’ of the characteristics and health risks associated with trans fats by the Study program

Table 4.8 indicates the proportion of respondents who answered “I Don’t Know” when asked about their knowledge relating to artificial Trans-fats. According to the result findings, a

majority of the non-medical responders, including both female and male participants, were unaware of the information about artificial trans fats.

Table 4.8. The proportion of respondents that answered "I Don't Know" to the following statements about Trans-fats knowledge by study program and gender (n= 855, males= 445, females= 410)

Gender	Medical / Allied Health Sciences program (n= 395)	Non-medical program (n=460)	Chi-Square test Df & P-value
Artificial Trans fats enhance taste and texture of food			
Female	57/223 (25.6)	124/187 (66.3)	$\chi^2 = 68.496^a$ Df = 1 p-value= .000
Male	44/172 (25.6)	229/273 (83.9)	$\chi^2 = 85.344^a$ Df = 1 p-value= .000
Artificial Trans fats enhance shelf life of food			
Female	59/223 (26.5)	135/187 (72.2)	$\chi^2 = 85.344^a$ Df = 1 p-value= .000
Male	41/172 (23.8)	219/273 (80.2)	$\chi^2 = 138.101^a$ Df = 1 p-value= .000
Edible oils or fats containing artificial trans fats are cheaper			
Female	51/223 (22.9)	125/187 (66.8)	$\chi^2 = 80.281^a$ Df = 1 p-value= .000
Male	43/172 (25.0)	198/273 (72.5)	$\chi^2 = 96.005^a$ Df = 1 p-value= .000
Oils with artificial trans fats can be used many times in commercial fryers			
Female	70/223(31.4)	123/187(65.8)	$\chi^2 = 48.268^a$ Df = 1 p-value= .000
Male	37/172 (21.5)	203/273 (74.4)	$\chi^2 = 118.613^a$ Df = 1 p-value= .000
Edible oils or fats containing artificial trans fats are made by heating liquid vegetable oils, in a process called hydrogenation.			

Female	56/223 (25.1)	129/187 (69.0)	χ^2 =79.058[a] Df = 1 p-value= .000
Male	34/172 (19.8)	206/273(75.5)	χ^2 =131.719[a] Df = 1 p-value= .000
Edible oils or fats containing artificial trans fats can cause type 2 diabetes and fatty liver disease			
Female	52/223 (23.3)	120/187 (64.2)	χ^2 =69.706[a] Df = 1 p-value= .000
Male	58/172 (33.7)	216/273 (79.1)	χ^2 =91.921[a] Df = 1 p-value= .000
As fats containing trans fatty acids are plant (vegetable) based they can be protective against cardiovascular diseases			
Female	45/223(20.2)	125/187 (66.8)	χ^2 =91.256[a] Df = 1 p-value= .000
Male	42/172 (24.4)	213/273 (78.0)	χ^2 =123.920[a] Df = 1 p-value= .000
Edible oils or fats containing artificial trans fats can increase the level of high density lipoprotein (HDL) cholesterol that is protective against heart disease			
Female	47/223 (21.1)	116/187 (62.0)	χ^2 =71.232[a] Df = 1 p-value= .000
Male	52/172 (30.2)	217/273 (79.5)	χ^2 =107.073[a] Df = 1 p-value= .000

With respect to participants' awareness of the characteristics related to trans-fats i.e. enhancing taste and texture, shelf-life of food, and cost-effectiveness, a substantial proportion of female participants from non-medical faculty were unaware as compared to female medical students. Similarly, male non-medical students lack sufficient knowledge and understanding of medical students. Therefore, when students from the non-medical program were asked about repetitively using oils containing artificial trans fats for commercial frying, 65.5% of females and 74.4% of males said they didn't know. Likewise, the majority of non-medical participants couldn't identify the statement that edible oils or

fats containing artificial trans fats are produced by hydrogenating liquid vegetable oils in contrast to medical students. As a result, there was a statistically significant difference (≤ 0.05) in knowledge between medical and non-medical students, including both female and male participants.

With respect to the awareness about the health outcomes associated with the consumption of edible oils or fats containing artificial trans fats i.e., type 2 diabetes and fatty liver disease, a majority of non-medical responders, female (64.2%) and male (79.1%) had no knowledge about the risks related to consuming edible oils or fats containing artificial trans fats as compared to female and male medical students i.e. 23.3% and 33.3% respectively.

When participants were asked if artificial Trans fats are protective against cardiovascular disease because of plant-based origin, two-thirds of the female participants (66.8%) and (78%) of male students from the non-medical program couldn't identify the right answers as they were unfamiliar with the statement to respond. Likewise, when non-medical students were asked if artificial trans fats are protective against heart disease by increasing the amount of high-density lipoprotein (HDL) cholesterol, a high proportion of 62% of female and 79.5% of male non-medical students said they didn't know because they were unaware as compared to only 21.1% females and 30.2% males of medical faculty. Therefore, a statistically significant difference (p-value= .000) was found between the medical and non-medical students (both female and male) regarding awareness about the health risks associated with the consumption of edible oils and fats containing artificial trans fats.

4.3.6. The proportion of respondents who were aware of different food items containing trans fats by the study program and gender

In order to evaluate the respondents' knowledge related to food items containing artificial trans fats, the participants were asked to identify the "correct responses "related to food items that either contain or do not have artificial Trans fats. Table 4.9 summarizes the responses that were correctly answered.

Table 4.9. The proportion of respondents who 'correctly' responded to the following statements about Food items containing Trans fats by study program and gender (n= 855, males= 445, females= 410)

Gender	Medical / Allied Health Sciences program (n= 395)	Non-medical program (n=460)	Chi-square test Df & P-value
Commercial Fried foods (French Fries, Fried chicken and Beef)			
Female	167/223(74.9)	61/187(32.6)	χ^2 =73.610[a] Df = 1 p-value= .000
Male	125/172(72.7)	52/273(19.0)	χ^2 =126.680[a] Df = 1 p-value= .000
Commercial Baked foods (Cakes, Biscuits, Doughnuts, Pastries)			
Female	138/223(61.9)	60/187(32.1)	χ^2 =36.166[a] Df = 1 p-value= .000
Male	106/172(61.6)	58/273(21.2)	χ^2 =73.941[a] Df = 1 p-value= .000
Packaged Snack foods (chocolates, wafers, chips, crackers)			
Female	133/223(59.6)	45/187(24.1)	χ^2 =52.404[a] Df = 1 p-value= .000
Male	105/172(61.0)	42/273(15.4)	χ^2 =99.455[a] Df = 1 p-value= .000
Packaged Breakfast cereals			
Female	89/223(39.9)	37/187(19.8)	χ^2 =19.350[a] Df = 1 p-value= .000
Male	62/172(36.0)	28/273(10.3)	χ^2 =43.500[a] Df = 1 p-value= .000
Coffee creamers			
Female	104/223(46.6)	15/187(8.0)	χ^2 =73.623[a] Df = 1 p-value= .000
Male	59/172(34.3)	26/273(9.5)	χ^2 =41.926[a] Df = 1 p-value= .000
Milk and Plain Yogurt (Correct response = No)			
Female	146/223(65.5)	57/187(30.5)	χ^2 =10.850[a] Df = 1 p-value= .000
Male	113/172(65.7)	64/273(23.4)	χ^2 =78.648[a]

			Df = 1 p-value= .000
Meat (white or red or fish) (Correct response = No)			
Female	134/223(60.1)	50/187(26.7)	χ^2 =45.734[a] Df = 1 p-value= .000
Male	117/172(68.0)	52/273(19.0)	χ^2 =107.452[a] Df = 1 p-value= .000
Fruits and Vegetables (Correct response = No)			
Female	171/223(76.7)	66/187(35.3)	χ^2 =71.429[a] Df = 1 p-value= .000
Male	138/172(80.2)	73/273(26.7)	χ^2 =.121.099[a] Df = 1 p-value= .000
Nuts (Correct response = No)			
Female	153/223(68.6)	53/187(28.3)	χ^2 =.65.970[a] Df = 1 p-value= .000
Male	110/172(64.0)	55/273(20.1)	χ^2 =86.795[a] Df = 1 p-value= .000

With respect to the various food items containing artificial trans fats, such as commercially fried foods, commercially baked foods, packaged snack foods, packaged breakfast cereals, and coffee creamers, a significant proportion of correct responders, both male and female, were from medical faculty.

167 of the 223 female respondents from the medical group, which translates to a majority (74.9%) reported that artificial trans fats were present in commercially fried foods (French fries, fried chicken, and beef). While among non-medical disciplines, only 61 out of 187 (32.6%) female participants could accurately be identified. Likewise, more medical male responders (72.7%) correctly answered than non-medical male students (19%).

In terms of commercial baked goods, including (cakes, biscuits, doughnuts, and pastries), higher proportions of medical students, both female and male, i.e.61% responded correctly as compared to 32.9% females and 21.8% male participants of the non-medical program.

Likewise, a majority of female medical students (59.6%) reported that packaged snack products such as chocolates, wafers, chips, and crackers contain artificial trans fats. In

comparison to male non-medical respondents, 61% of male medical respondents chose the right answers. Also, a substantially similar proportion (66%) of female as well as male medical students correctly identified that artificial trans fats are present in coffee creamers. Therefore, a statistically significant difference (≤ 0.05) relating information about food items containing artificial trans fats was found in between medical and non-medical students, including both female and male participants.

Concerning participants' awareness about the food items that "don't contain artificial trans fats" such as dairy products (meat, milk and plain yogurt) nuts, fruits and vegetables, a substantial proportion of female participants from medical faculty identified correctly as compared to non-medical female students. Similarly, male medical students had more accurate responses than non-medical students.

Almost equal proportion (66%) of female and male medical respondents accurately identified that dairy products (meat, milk, and plain yogurt) don't contain artificial trans fats as compared to female (30.5%) and male students (23.4%) from non-medical faculty.

A considerably low percentage of females and males from non-medical faculty i.e. 35.5% and 26.7% respectively, replied correctly about artificial trans fats in fruits and vegetables than females (76.7%) and male medical students (80.2 %). Likewise, the percentage of right responses about nuts not having artificial trans fats was low in non-medical program participants, both female (28.3%) and male (20.1%).

4.3.7. The proportion of respondents who were 'unaware' of different food items containing trans fats by the study program

Table 4.10 represents the percentage of those who said "I don't know" when asked about artificial trans fats in various foods. According to the data, a significant proportion of non-medical students, both male and female, were unaware of the numerous food items containing artificial trans fats, such as commercially fried foods, commercially baked foods, packaged snack foods, packaged breakfast cereals, and coffee creamers.

Table 4.10. The proportion of respondents that answered "I Don't Know" to the following statements about Food items containing Trans fats by study program and gender (n= 855, males= 445, females= 410)

Gender	Medical / Allied Health Sciences program (n= 395)	Non-medical program (n=460)	Chi-Square test Df & P-value
Commercial Fried foods (French Fries, Fried chicken and Beef)			
Female	34/223(15.2)	115/187(61.5)	χ^2 =94.046[a] Df = 1 p-value= .000
Male	37/172(21.5)	199/273(72.9)	χ^2 =111.845[a] Df = 1 p-value= .000
Commercial Baked foods (Cakes, Biscuits, Doughnuts, Pastries)			
Female	34/223(15.2)	117/187(62.6)	χ^2 =97.892[a] Df = 1 p-value= .000
Male	43/172(25.0)	193/273(70.7)	χ^2 =88.460[a] Df = 1 p-value= .000
Packaged Snack foods (chocolates, wafers, chips, crackers)			
Female	41/223(18.4)	121/187(64.7)	χ^2 =91.307[a] Df = 1 p-value= .000
Male	38/172(22.1)	209/273(76.6)	χ^2 =126.737[a] Df = 1 p-value= .000
Packaged Breakfast cereals			
Female	59/223(26.5)	121/187(64.7)	χ^2 =60.417[a] Df = 1 p-value= .000
Male	53/172(30.8)	208/273(76.2)	χ^2 =89.589[a] Df = 1 p-value= .000
Coffee creamers			
Female	48/223(21.5)	128/187(68.4)	χ^2 =91.412[a] Df = 1 p-value= .000
Male	38/172(22.4)	208/273(76.2)	χ^2 =124.916[a] Df = 1 p-value= .000
Milk and Plain Yogurt			
Female	32/223(14.3)	114/187(61.0)	χ^2 =96.379[a] Df = 1 p-value= .000
Male	38/172(22.1)	200/273(73.3)	χ^2 =111.041[a]

			Df = 1 p-value= .000
Meat (white or red or fish)			
Female	44/223(19.7)	113/187(60.4)	χ^2 =71.291[a] Df = 1 p-value= .000
Male	33/172(19.2)	199/273(72.9)	χ^2 =121.971[a] Df = 1 p-value= .000
Fruits and Vegetables			
Female	31/223(13.9)	107/187(57.2)	χ^2 =85.471[a] Df = 1 p-value= .000
Male	26/172(15.1)	184/273(67.4)	χ^2 =115.740[a] Df = 1 p-value= .000
Nuts			
Female	42/223(18.8)	113/187(60.4)	χ^2 =74.837[a] Df = 1 p-value= .000
Male	41/172(23.8)	201/273(73.6)	χ^2 =105.441[a] Df = 1 p-value= .000

Regarding the presence of artificial trans fats in commercially fried foods (french fries, fried chicken, and beef), a significant proportion (61.5%) of female respondents from non-medical faculty were unfamiliar as compared to females (15.2%) in the medical program. In the same manner, 199 of the 273 male responders from the non-medical group, which translates to a majority (72.9%) were unaware, in contrast to male medical participants (21.5%)

With respect to commercial baked goods, including (cakes, biscuits, doughnuts, and pastries), a considerably higher percentage of medical students, both female and male i.e. 62.6% and 70.7% responded “I don’t know” as compared to 15.2% females and 25% male participants of the medical program. Correspondingly, most female (64.7%) and male (76.6%) non-medical students reported that they were unaware of the presence of artificial trans fats in packaged snack products such as chocolates, wafers, chips and crackers. Also, 64.7% of female and 76.2% of male students from non-medical programs have no idea about the presence of artificial trans fats in packaged breakfast cereals. Similarly, a substantially similar proportion (68.4%) of female as well as (76.2%) male non-medical students were unable to identify that artificial trans fats are present in coffee creamers. Therefore, a statistically significant difference (≤ 0.05) relating to awareness about food items containing

artificial trans fats was found between medical and non-medical students, including both female and male participants.

Concerning participants' awareness about the food items that 'don't contain artificial trans fats' such as dairy products (meat, milk and plain yogurt) nuts, fruits and vegetables, a substantial proportion of female and male participants from non-medical faculty were unable to identify as compared to medical female and male students. 61% of female and 73.3% of male non-medical participants responded that dairy products (milk and plain yogurt) don't contain artificial trans fats as compared to female (14.3%) and male students (22.1%) from medical faculty. Almost a similar proportion of female and male non-medical students were unaware that fruits and vegetables didn't contain artificial trans fats. Likewise, non-medical participants (60.4% female and 73.6 % male) had significantly greater percentages of 'don't know' responses about artificial trans fats in Nuts than female (18.8%) and male (23.8%) participants of the medical program.

4.4. Practices related to Artificial Trans fats

4.4.1. The distribution of respondents by consumption of different types of oils or fats used in home for different cooking purposes

The frequency distribution of different food products consumed in the home for different types of oils or fats for different cooking purposes is summarized in table 4.11

Table 4.11. Distribution of respondents by consumption of different types of oils or fats for different cooking purposes (breakfast, meals, frying and baking) at home (n=855)

Types of oils or fats used in home for cooking purposes	Never	Sometimes	Frequently	Always
Breakfast				
Liquid Oil	88 (10.3)	151 (17.7)	344 (40.2)	272 (31.8)
Olive oil	464 (54.3)	274 (32.0)	85 (9.9)	32 (3.7)
Butter	306 (35.8)	355 (41.5)	156 (18.2)	38 (4.4)
Vanaspati Ghee	328 (38.4)	298 (34.9)	198 (23.2)	31 (3.6)
Margarines	555 (64.9)	229 (26.8)	68 (8.0)	3 (.4)
Meals (lunch and dinner)				
Liquid Oil	45 (5.3)	121 (14.2)	373 (43.6)	316 (37.0)
Olive oil	441 (51.6)	291 (34.0)	89 (10.4)	34 (4.0)
Butter	359 (42.0)	369 (43.2)	115 (13.5)	12 (1.4)
Vanaspati Ghee	299 (35.0)	283 (33.1)	245 (28.7)	28 (3.3)
Margarines	573 (67.0)	228 (26.7)	42 (4.9)	12 (1.4)
Frying				
Liquid Oil	70 (8.2)	94 (11.0)	341 (39.9)	350 (40.9)
Olive oil	622 (72.7)	172 (20.1)	27 (3.2)	34 (4.0)
Butter	520 (60.8)	260 (30.4)	62 (7.3)	13 (1.5)
Vanaspati Ghee	397 (46.4)	243 (28.4)	190 (22.2)	25 (2.9)
Margarines	681 (79.6)	127 (14.9)	39 (4.6)	8 (0.9)
Baking				
Liquid Oil	197 (23.0)	174 (20.4)	324 (37.9)	160 (18.7)

Olive oil	577 (67.5)	205 (24.0)	50 (5.8)	23 (2.7)
Butter	316 (37.0)	308 (36.0)	154 (18.0)	77 (9.0)
Vanaspati Ghee	471 (55.1)	215 (25.1)	149 (17.4)	20 (2.3)
Margarines	613 (71.7)	189 (22.1)	45 (5.3)	8 (.9)

The two most frequently consumed edible oils or fats based on participants' responses were liquid oils and vanaspati ghee for breakfast, meals and frying purposes. The frequency distribution of oils and fats used at home is illustrated in table 4.11.

Liquid oil was the most frequently consumed oil at home, which was used for all cooking purposes and always or often preferred for breakfast (72%), cooking meals including lunch and dinner (80.6%), and frying food (80.8%) at high temperatures. The reasons for the frequent use of liquid oils in Pakistan are traditional cooking practices. Most regional cuisines are prepared in large quantities of oil, especially various meat dishes and deep-fried food items. Secondly, liquid oils are easily available and also cost-effective because rapeseeds for canola oil and sunflower seeds are produced locally to meet the edible oil demands.

Vanaspati ghee was the second most regular consumed oil and is always or frequently preferred in meals (32%), and breakfast (26.8%) as this cooking product is a cheap substitute for expensive edible oils and butter and can stay fresh for up to three months at room temperature, therefore, making it a preferable choice for domestic use. Moreover, vanaspati ghee is favored for its aroma and taste when used as a cooking medium and is frequently used for sauteing and making paratha in breakfast. The third most used edible oil or fat at home is butter, and it is mostly preferred for baking purposes (27%). Butter is mostly made at home from milk as it is a conventional practice; therefore, butter is readily available at home. It adds to taste, so it is used in various food items as people in Pakistan are very taste conscious.

Olive oil is not a regular or commonly used choice for cooking purposes at home as compared to other liquid oils and is consumed for breakfast (13.6%) and meal preparation (14.4%). The main reason for less consumption of olive oil is that Pakistan is not self-sufficient in olive

cultivation and mainly relies on imports to meet the domestic demands; therefore, olive oil is expensive and not frequently used in homes. However, 34% of participants sometimes used olive oil for lunch or dinner purposes which indicates that participants were aware of the health outcomes of edible oils or fats. Therefore, olive oil is occasionally used in homes to cook meals.

Overall, margarines were the least preferred option for all types of cooking purposes at home, and only (9%) and (3%) of participants always used it for baking and preparing breakfast, respectively. As there is limited awareness among consumers regarding differences between butter and margarines, and both are considered as butter, margarines and butter are used interchangeably in Pakistan.

4.4.2. The distribution of respondents by consumption patterns of commercial food items

The frequency distribution of different food products consumed in or taken from cafeterias and restaurants by university students over the course of a week is summarized in table 4.12

Table 4.12. Frequency distribution of consumption pattern of food items at or taken from cafeterias and restaurants in a week (weekend inclusive) by participants (n = 855)

Food items	Never	< 1 Time/week *n* (%)	Once a week *n* (%)	2 – 4 times/week *n* (%)	≥ 5 times/week *n* (%)
Fried Potatoes (French fries)	174 (20.4)	71 (8.3)	254 (29.7)	70 (8.2)	286 (33.5)
Commercial Fried food (fried chicken, Burgers, Pizzas, Beef)	130 (15.2)	43 (5.0)	327 (38.2)	120 (14.0)	235 (27.5)
Commercial Baked Food (Doughnuts, Biscuits, Buns, Pastries and Cakes)	140 (16.4)	35 (4.1)	308 (36.0)	189 (22.1)	183 (21.4)
Street Fried Snacks (Samosa/Pakoras, poori, kachori)	154 (18.0)	32 (3.7)	360 (42.1)	113 (13.2)	196 (22.9)

Paratha (sold outside)	61 (7.1)	26 (3.0)	315 (36.8)	320 (37.4)	133 (15.6)
Packaged Breakfast Cereals	90 (10.5)	36 (4.2)	317 (37.1)	247 (28.9)	165 (19.3)
Packaged Snacks	84 (9.8)	47 (5.5)	399 (46.7)	149 (17.4)	176 (20.6)
Candies/Chocolates/Wafers	87 (10.2)	37 (4.3)	399 (46.7)	158 (18.5)	174 (20.4)
Packaged Ice Cream	63 (7.4)	25 (2.9)	380 (44.4)	207 (24.2)	180 (21.1)
Packaged sweetened frozen Yogurt	91 (10.6)	76 (8.9)	291 (34.0)	257 (30.1)	140 (16.4)
Plain Yogurt	38 (4.4)	19 (2.2)	247 (28.9)	486 (56.8)	65 (7.6)

Almost all of the respondents consume one or more of the food items taken from cafeterias or restaurants at least once a week. Fried potatoes were most popular among the various types of food products taken from cafeterias or restaurants, with 33.5% of respondents eating French fries five or more times per week, followed by fried food products (27.5%) which included (pizzas, burgers, fried chicken and beef), street fried snacks (22.9%) and commercial bakery food products (21.4%) including doughnuts, biscuits, buns, pastries and cakes. French fries were consumed at a trendy level among participants (both male and female) as compared to other food groups i.e. five times or higher in a week. One of the reasons that French fries are so popular is that they are affordable, inexpensive and so easy to get by; therefore, individuals become addicted to them.

The most popular breakfast meal in Pakistan is paratha, which was eaten by the majority of participants (37.4%) two to four times each week from cafeterias or outside their homes. Traditional paratha is prepared with refined flour with an evolved texture that requires a deft hand to make. It has no filling, although, in some restaurants, paratha is stuffed with minced meat, lentils spice, and potatoes.

Plain yogurt was favored by 56% of participants as a better option than frozen sweetened yogurt, and it was consumed two to four times a week. Other foods such as packaged snacks, candies/ chocolates/wafers were mostly consumed once a week i.e. (46.7%). Likewise, 44.45% of the respondents were taking packaged ice cream weekly. Furthermore, packaged breakfast cereals were consumed by 37.1% of the participants once per week. Similarly, 34% of the respondents mentioned that they ate packaged frozen yogurt at least once a week.

The overall data analysis reveals that different food groups have diverse consumption trends. Some of the foods were taken on a regular basis, while others were consumed only once or twice a week. This demonstrates that some participants were concerned about their health, whereas others consumed these food products on a frequent basis regardless of the health consequences.

4.5. Knowledge about SSBs among study participants

4.5.1. The frequency distribution of participants' health perceptions and knolwledge related to the consumption of Sugar-Sweetened Beverages

The distribution of the respondents' views on the impact of drinking sugar-sweetened beverages on their health is illustrated in Tables 4.13, Figures 4.2, and 4.3.

Table 4.13. Frequency distribution of participants' health perceptions regarding sugar-sweetened beverage consumption (n=855)

Health perceptions about SSBs	Totally Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Totally Agree
Habitual consumption of sugary beverages is harmful to health	209 (24.4)	227 (26.5)	102 (11.9)	174 (20.4)	143 (16.7)
Habitual consumption of sugary beverages can acause tooth decay	86 (10.1)	83 (9.7)	141 (16.5)	258 (30.2)	287 (33.6)
Habitual consumption of sugary beverages can cause obesity	98 (11.5)	57 (6.7)	93 (10.9)	282 (33.0)	325 (38.0)

Habitual consumption of sugary beverages can cause cancer & heart disease	141 (16.5)	98 (11.5)	178 (20.8)	248 (29.0)	190 (22.2)
Habitual consumption of sugary beverages can cause fatty liver disease	128 (15.0)	121 (14.2)	177 (20.7)	232 (27.1)	197 (23.0)
Habitual consumption of sugary beverages can cause diabetes	113 (13.2)	97 (11.3)	105 (12.3)	238 (27.8)	302 (35.3)
Carbonated beverages (Coca-cola/Pepsi) can be addictive	139 (16.3)	104 (12.2)	131 (15.3)	333 (38.9%)	148 (17.3)
Sweetened drinks, in general, can be addictive	68 (8.0)	80 (9.4)	377 (44.1)	214 (25.0)	116 (13.6)

The table indicates the health perceptions of participants related to the habitual consumption of SSBs. 24.4% of respondents strongly disagreed that consuming sugary drinks is harmful to health. However, concerning the health risks, e.g. obesity, diabetes, and tooth decay associated with consumption of sugary beverages, a substantial proportion of respondents were 'strongly agreed' i.e. 38%, 35.3% and 33.6%, respectively. 29% of the total respondents somewhat agreed that cancer and heart disease are caused by excessive consumption of sugary drinks, while 20.8% had neutral responses. Likewise, 27.1% somewhat believed that intake of SSBs can cause fatty liver disease, 20.7% had a neutral opinion, while 15% disagreed. Carbonated beverages were addictive by 38.9% of participants who somewhat agreed with the statement, while 16.3% strongly disagreed. A large fraction of students (44.1%) had neutral opinions (neither agree nor disagree), while one-fourth of the respondents somewhat agreed that SSBs were generally addictive.

Overall, these findings suggest that most students somewhat or strongly agreed that SSB consumption was associated with a variety of health outcomes.

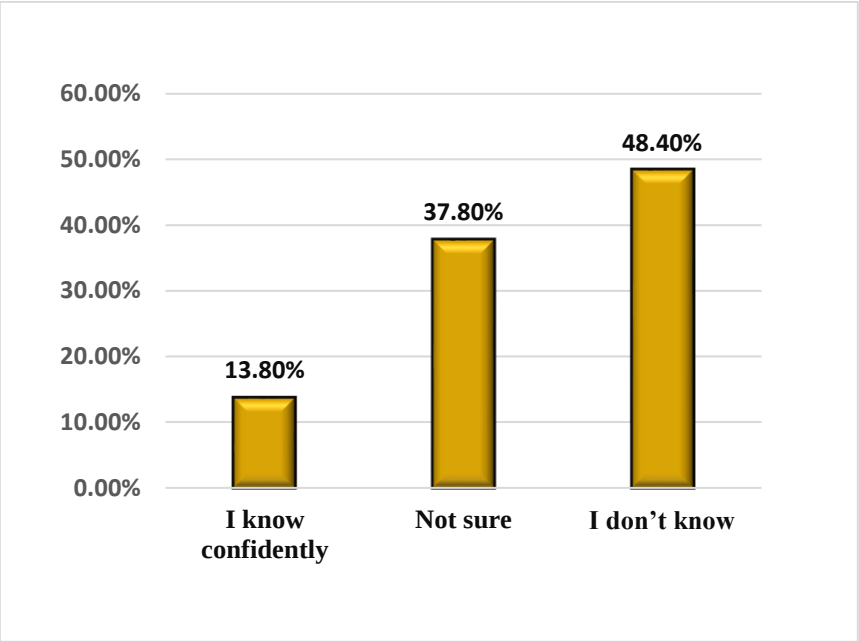

Figure 4.2. Participants' responses about the amount of sugar in a can (250 ml) of sugary beverages (cola or Fanta) (n=855)

Figure 4.2 illustrates the frequency distribution of participants' responses to the statement 'How much sugar, you can confidently say, in a can of (250ml) of sugary beverage has". Approximately 48.40% of the participants had no idea, 37.80% of respondents were not sure, while only 13.80% were confident about their correct response. These findings indicate that more than half of the population have no idea about the amount of sugar in a can of sugary beverage, so they are unaware of the quantity of sugar, which may be due to the reason that People lack sufficient knowledge and are unable to make healthy decisions as they are ignorant of considerable excessive sugar or calories intake.

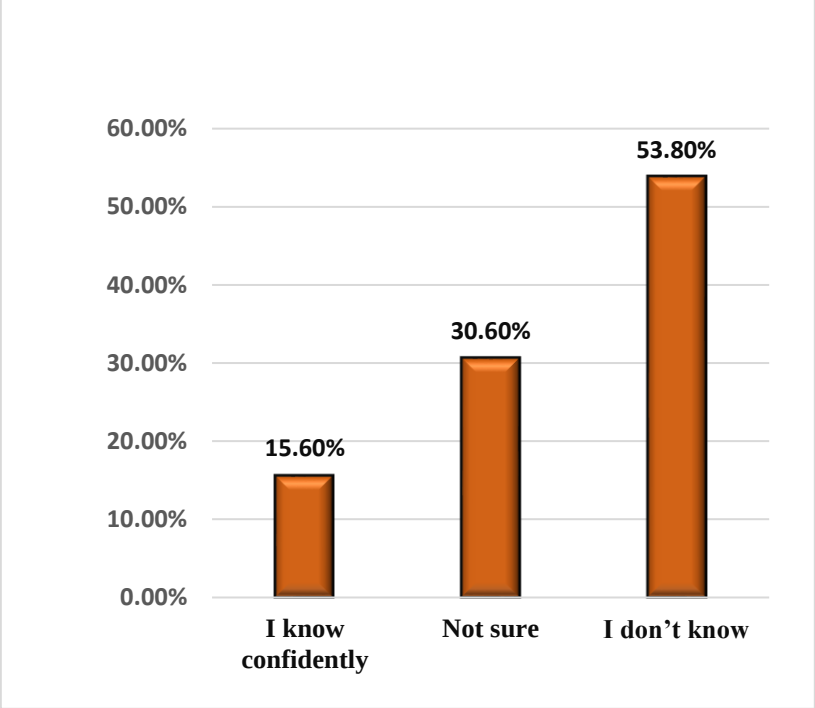

Figure 4.3. Participants' responses about added grams of sugar in beverages that can be consumed a day without health concerns? (n=855)

Figure 4.3 illustrates the frequency distribution of participants' responses to the statement 'How much added grams of sugar, you can confidently say, you can consume in a day without health concerns?". Approximately more than half, 53.80% of the participants had no idea, while 30.60% of respondents were not sure while only 15.60% were confident about their correct response. These findings indicate that more than half of the population are unaware of the health concerns relating to added grams of sugar which may be due to the reason that the majority of respondents underestimate the importance and ignore health issues that need to be addressed.

4.5.2. The distribution of respondents by their health perceptions related to SSBs by the study program

Table 4.14 depicts the health perceptions of study participants regarding the consumption of SSBs.

Table 4.14. Distribution of participants' knowledge about health perceptions towards Sugar-Sweetened Beverages by study program (n=855, medical/allied health sciences= 395. non-medical= 460)

Knowledge of Sugar Sweetened Beverages (variables = 8 ; Range = -13 – 15)			
Variables	**Medical**	**Non-Medical**	
	Mean	**Mean**	**P-value**
Habitual consumption of sugary beverages is harmful to health	0.15	-0.53	.000
Habitual consumption of sugary beverages can cause tooth decay	0.97	0.42	.000
Habitual consumption of sugary beverages can cause obesity	1.07	0.56	.000
Habitual consumption of sugary beverages can cause cancer & heart disease	0.78	-0.13	.000
Habitual consumption of sugary beverages can cause fatty liver disease	0.81	-0.15	.000
Habitual consumption of sugary beverages can cause diabetes	0.98	0.28	.000
Carbonated beverages (Coca-cola/Pepsi) can be addictive	0.33	0.25	0.232
Sweetened drinks, in general, can be addictive	0.36	0.19	0.008
Cumulative Mean Score	**5.46**	**0.89**	**.000**

Mean scores regarding the perceptions of participants were calculated, and the results of both T-tests, with “equal variances not assumed and Mann-Whitney U test, give the same p-value (≤ 0.05) In comparison to non-medical respondents, medical students had higher mean scores on the health concerns associated with SSBs. While considering the beliefs about harmful health effects of beverages such as obesity, cancer, heart disease, fatty liver disease, and tooth decay, medical responders were more likely to indicate the perceptions of risks associated with habitual consumption of SSBs.

As a result, except for one opinion about the addictive properties of carbonated drinks, there was a statistically significant difference (≤ 0.05) between medical and non-medical students' beliefs about health concerns associated with habitual SSB consumption. Carbonated beverages (Coca-cola/Pepsi) were thought to be addictive by medical and non-medical individuals.

While analyzing how SSBs knowledge influenced perceptions, it was revealed that the more aware a respondent was, the more inclined the individual was to report risk perceptions. Although the specific reasons for this difference of knowledge influencing the perceptions between two groups were not investigated, this could likely provide insight into whether or not a particular discipline, such as a medical program, influenced students' knowledge of the subject matter.

Considering the gender differences towards health perception, no statistically significant difference was found. Therefore, gender had no impact on health perceptions towards the consumption of SSBs.

4.5.3. The distribution of respondents by their knowledge about SSBs by study program

Table 4.15 indicates the participant’s knowledge about the amount of added sugar and health concerns regarding SSBs consumption.

Table 4.15. The distribution of respondents' knowledge about sugar-sweetened beverages by study program. (n=855, medical/allied health sciences= 395. non-medical= 460)

Participant's Knowledge about Sugary Beverages	Medical/ Allied health Sciences\ Program (n=395)	Non-Medical Program (n= 460)	Total (n= 855)	Chi-Square test Df & P- value
The amount of sugar, a can (250 ml) of sugary beverages (such as cola or Fanta etc.) has				
Yes I know that confidently	75 (19.0)	43 (9.3)	118 (13.8)	χ^2 =40.390[a] Df = 2 p-value= .000
I think I know that, but I am not sure	173 (43.8)	150 (32.6)	323 (37.8)	
I do not know that	147 (37.2)	267 (58.0)	414 (48.4)	
Added grams of sugar in beverages can be consumed in a day without health concern				
Yes I know that confidently	81 (20.5)	52 (11.3)	133 (15.6)	χ^2 =28.830[a] Df = 2 p-value= .000
I think I know that, but I am not sure	139 (35.2)	123 (26.7)	262 (30.6)	
I do not know that	175 (44.3)	285 (62.0)	460 (53.8)	

Overall, the majority of respondents had inadequate knowledge, i.e. (48.4%), and they were unaware of the amount of sugar in a can of soda or Fanta.

However, concerning specific discipline being studied by students, the knowledge about the amount of sugar was significant (p-value = ≤ 0.05) among medical students, as 19.0% of them were more confident about the sugar amount in a can (250ml) of Cola or Fanta

compared to the non-medical students (9.3%). Similarly, the percentage of non-medical participants who were unaware of the amount of sugar was significantly higher (58%) than medical participants (37.2%). However, the uncertainty level regarding the amount of sugar was significantly higher among medical participants (43.8%) compared to non-medical respondents (32.6%).

Moreover, most participants (53.8%) were unaware of the health concerns linked with the habitual consumption of sugary drinks. Among which the proportion of non-medical students was high (62%). Only 15.6% of total participants were confident regarding the health concerns of consumption of sugary beverages. The proportion of medical students was high (20.5%) among confident participants compared to non-medical participants (11.3%). The result of Chi-square analysis also shows a statistically significant difference (p-value = $\leq$ 0.05) between the two categories, as medical students were more confident about their knowledge regarding SSBs than non-medical participants. The specific reason for this has not been explained. Although medical students were more confident in their knowledge than non-medical individuals yet, this reasoning is not persuasive enough to describe the significance of the results, and further research will confirm these findings.

With respect to gender, a statistically significant difference was not found. Therefore, gender had no significant influence on the knowledge about the amount of sugar in a can of soda and health concerns about the quantity of added sugar consumption.

4.6. Attitudes toward SSBs consumption among study participants

Trends of respondents' consumption levels of Sugary beverages in their past, present, and future were also analyzed by asking questions about their consumption behaviors towards sweetened drinks and added sugary drinks. The results are depicted in table 4.16.

Table 4.16. Distribution of participants' attitudes towards Sugar-Sweetened Consumption by study program (n= 855)

Participant's attitudes about Sugary Beverages consumption	Medical/ Allied health Sciences\ Program (n=395)	Non-Medical Program (n= 460)	Total (n= 855)	Chi-Square test Df & P- value
Comparison of current Sugar Sweetened Beverages consumption level (number of cups a day) with consumption level 5 years ago;				
Similar to the current consumption level	174 (44.1)	178 (38.7)	352 (41.2)	χ^2 =3.252[a] Df = 2 p-value= .197
Higher to the current consumption level	109 (27.6)	150 (32.6)	259 (30.3)	
Lower than the current consumption level	112 (28.4)	132 (28.7)	244 (28.5)	
Comparison of current intake of sugar in each tea/coffee cup with consumption level 5 years ago;				
Similar to the current consumption level	180 (45.6)	208 (45.2)	388 (45.4)	χ^2 =0.413[a] Df = 2 p-value= .814
Higher to the current consumption level	108 (27.3)	134 (29.1)	242 (28.3)	
Lower than the current consumption level	107 (27.1)	118 (25.7)	225 (26.3)	
Comparison of current Sugar Sweetened Beverages consumption with expected consumption level "five years" from now;				
Similar to the current consumption level	155 (39.2)	227 (49.3)	382 (44.7)	χ^2 =20.905[a] Df = 2 p-value= **.000**
Higher to the current consumption level	44 (11.1)	75 (16.3)	119 (13.9)	
Lower than the current consumption level	196 (49.6)	158 (34.3)	354 (41.4)	

With respect to current consumption level of SSBs, a large number of respondents i.e. (41.2%) had the same consumption patterns in comparison to 5 years ago, while 30.3% had higher consumption levels. A total of 28.5% had tried to lower their intake of SSBs compared to their past practices. Regarding study disciplines, no statistically significant difference was found between medical and non-medical students regarding trends in the current SSBs consumption levels compared to the consumption level 5 years ago.

In terms of comparing the current sugar intake in each tea/coffee cup to the consumption levels 5 years ago, the majority (45.4%) of the respondents had similar attitudes. 28.3% had a higher level of consumption, while 26.3% had attempted to reduce their intake of sweetened tea/coffee compared to previous practices. Concerning the study program, there was no statistically significant difference in current sugar intake levels compared to consumption levels five years ago between medical and non-medical students.

When examining how knowledge influenced medical students' practices in the past, it is revealed that although medical students were more aware of the health risks and other factors associated with increased SSB consumption, their practices were not influenced by knowledge. Most of them had not changed their consumption behaviors or adopted safe SSBs practices. Therefore, the more aware a responder doesn't have to be, the more likely the individual consumes SSBs according to the recommended levels.

Regarding the comparison of current Sugar-Sweetened Beverage intake to the anticipated consumption levels "five years" from now, a large proportion, i.e. (49.6%) of the medical students, favored reducing their consumption levels compared to their current intake. In contrast, 208 of the 460 respondents from the non-medical group, which translates to the majority (49.3%), reported that their attitudes would not change in the future. Contrary to non-medical participants who tended to follow similar patterns, a high proportion of medical students favored reducing their sugary beverage intake levels in the coming years.

4.7. Practices related to Sugar-Sweetened Beverages among study participants

4.7.1. The frequency distribution of daily SSBs consumption among participants

Table 4.17 shows the daily consumption patterns of different types of Sugar-Sweetened Beverages among university students.

Table 4.17. Frequency of consumption of Sweetened Beverages among study participants (n = 855)

BEVERAGE Note : I cup=250 ml	Never	Less than 1 time/day (non-daily)	1 – 2 times/day (%)	≥ 3 times/day (%)
Regular Coca-Cola, Pepsi-Cola	170 (19.9)	284 (33.2)	364 (42.6)	37 (4.3)
Diet or light or zero Coca-Cola, Pepsi-Cola	579 (67.7)	185 (21.6)	82 (9.6)	9 (1.1)
Fanta/sprite & other similar sugar sweetened carbonated products	307 (35.9)	322 (37.7)	201 (23.5)	25 (2.9)
Diet/Zero Sprite	568 (66.4)	184 (21.5)	92 (10.8)	11 (1.3)
Packaged Fruit Juices, Nectar with added sugars or similar manufactured products	276 (32.3)	326 (38.1)	233 (27.3)	20 (2.3)
Sports Drinks (Nestle Milo sports drink milk chocolate & Energy Drinks (Sting, Red Bull)	393 (46.0)	268 (31.3)	173 (20.2)	21 (2.5)
Ice Tea/Fused Tea	503 (58.8)	201 (23.5)	123 (14.4)	28 (3.3)

Flavored Milk / Milk Shakes	397 (46.4)	235 (27.5)	185 (21.6)	38 (4.4)

Among non-consumers, the majority of the participants had never taken light soft drinks, including diet cola and diet sprite i.e. 67.7% and 66.4%, respectively. While the most frequent daily consumed cold SSB was regular soda, and approximately 42.6% of the respondents mentioned that they consumed regular cola 1-2 times a day. Likewise, the other frequently consumed beverage was packaged fruit juices, with almost 27.3% of the participants consuming up to two times a day, followed by Fanta/Sprite 23.5%, and flavored milkshakes 21.6% and Sports/Energy drinks 20.2% consumers. The least daily intake of cold SSBs included diet cola, diet sprite, and ice tea/fused tea, which were consumed by 1.1%, 1.3%, and 3.3% of the respondents, respectively.

The non-daily or less than one per day consumption of SSBs reveals that the prevalence of intake of packaged fruit juices was highest (38.1%) among the students, followed by Fanta/Sprite 37.7% and regular cola 33.2%, respectively. Moreover, the frequency of non-daily consumption of other sweetened beverages, including Sports or Energy drinks, flavored milk or Milkshakes and Ice tea or fused tea was highest among nondaily consumers, i.e., 31.3%, 27.5%, and 23.5%, respectively. The lowest non-daily consumed beverages were diet sprite (21.5%) and diet cola (21.6%). The results of Chi-square showed that gender was not significantly associated with consumption of any of the listed sugar-sweetened beverages; however, the frequency of consumption of sugary beverages is slightly higher among male participants.

4.7.2. The frequency distribution of daily consumption of tea with added sugar among participants

Table 4.18 depicts the daily consumption patterns of sweetened Tea cups among study participants.

Table 4.18. Daily consumption patterns of sweetened tea cups among study participants (n=855)

Cubes/Cup	Tea Cups/ day			Total	Chi-Square Test & Df P- Value
	Less than 1 cup/day	1-2 cups/day	3 or more cups/day		
Do not add sugar	20 (23.8)	34 (40.5)	30 (35.7)	84 (100.0)	χ^2 = 281.028[a] df = 6 P-value =.000
1-2 cubes/Cup	132 (20.3)	326 (50.2)	191 (29.4)	649 (100.0)	
3-4 cubes/Cup	16 (19.3)	17 (20.5)	**50 (60.2)**	83 (100.0)	
Total	168 (20.6)	377 (46.2)	271 (33.2)	816 (100.0)	

39 respondents i.e., 4.5% of the total population, were non-consumers of tea. 168 (20.6%) of respondents were non-regular consumers as they were consuming less than 1 cup per day. In contrast, the majority of respondents (79.4%) were regular consumers of tea. Among which 377 (46.2%) were consuming 1-2 cups/day while 271 (33.2%) were taking 3 or more cups of tea in a day.

With respect to consumption frequency of tea with added sugar, more than 4/5th of the participants were drinking tea with added sugar. Approximately 50.2% of the participants were adding 1-2 cubes of sugar per cup and were consuming 1-2 cups of tea a day.

While majority 60.2%, of the respondents were consuming 3-4 cubes of sugar in a teacup, and they were taking 3 or more cups of sweetened tea daily. Therefore, participants who were drinking more tea each day were adding more sugar cubes to each cup.

With respect to gender, the results of Chi-square showed that gender was not significantly associated with the consumption of sweetened tea among male and female participants.

4.7.3. The frequency distribution of daily consumption of coffee with added sugar among participants

Table 4.19 depicts the daily consumption patterns of sweetened coffee cups among study participants.

Table 4.19. Daily consumption patterns of sweetened coffee cups among study participants (n=8550

Cubes/Cup	Coffee Cups/day			Total	Chi-Square Test & Df P- Value
	Less than 1 cup/day	1-2 cups/day	3 or more cups/day		
Do not add sugar	34 (46.5)	30 (41.1)	9 (12.3)	73 (100)	χ^2 = 479.199[a] df = 6 P-value =.000
1-2 cubes/Cup	344 (59.6)	204 (35.4)	29 (5.0)	577 (100)	
3-4 cubes/Cup	49 (55.7)	34 (38.6)	5 (5.7)	88 (100)	
Total	427 (57.9)	268 (36.3)	43 (5.8)	738 (100)	

The participants were divided into three categories i.e., non-consumers, non-daily and daily consumers, according to coffee consumption. 117 respondents of the total population were non-consumers of coffee. A majority of respondents 427 (57.9%) were non-daily consumers of coffee, while 42.1% were regular consumers. Among regular consumers, 268 (36.3%) of the respondents took 1-2 cups of coffee in a day, while only 43 (5.8%) of the consumers drank 3 or more cups of coffee daily.

Out of 577 participants consuming 1-2 cubes of sugar per cup, 344 (59.6%) were consuming less than 1 cup of coffee per day, while 204 (35.4%) were consuming 1-2 cups of coffee.

Only 29 (5 %) were consuming 3 or more cups of coffee with 1-2 cubes of added sugar per cup. 49 (55.7%) respondents were adding 3-4 cubes of sugar per cup, and they consumed less than 1 cup of coffee per day. The table shows that most of the participants who were taking coffee with added sugar were non-daily consumers.

With respect to gender, the results of Chi-square showed that gender was not significantly associated with the consumption of sweetened coffee among male and female participants.

4.8. The distribution of respondents by use of tobacco products

Tables 4.20, 4.21 and 4.22 depict the distribution of participants who had smoked/vaped/used different tobacco products in the previous thirty days, daily and occasionally, respectively.

Table 4.20: Distribution of respondents who smoked/vapid/use of different tobacco products at least once in last 30 days by gender (n= 855, males= 445, females= 410)

Smoked/ Vaped/Used tobacco products at least once in last 30 days	**Female (n=410)**	**Male (n=445)**	**Overall (n=855)**	**Chi-Square Test & Df P- Value**
Cigarette	**8** (2.0)	202 (45.4)	210 (24.6%)	χ^2 =217.346[a] df = 1 P-value =.000
E- Cigarette	4 (1.0)	122 (27.4)	126 (14.7)	χ^2 =118.724[a] df =1 P-value =.000
Water pipe	57 (13.9)	155 (34.8)	212 (24.8)	χ^2 =50.126[a] df = 1 P-value =.000
Other Tobacco products (Paan, Chalia, Supari, Naswar, Gutka)	11 (2.7)	35 (7.9)	46 (5.4)	χ^2 =11.310[a] df = 1 P-value =.001

The above table depicts that among various tobacco products used at least once in the last 30 days, the proportion of usage of cigarettes and water pipe was found to be similar (25%) while the second most consumed tobacco product was e-cigarettes (14.7%). This is possible because e-cigarettes are most often considered less harmful than conventional cigarettes by the majority of the users as well as to non-users and are advertised as either a safer substitute for other tobacco products. As a result, it is of great concern to young adults because most new users try it primarily on an experiment basis; therefore, it also has the potential to turn non-smokers to e-cigarette users and can possibly lead to addiction of nicotine among the young population.

Only 5.4% of the population used other smokeless tobacco products such as supari, naswar, ghutka & pan. Among these products, naswar, supari, and paan were the most popular smokeless tobacco products used by 1.2%, 0.6%, and 0.5% of the participants, respectively. These findings indicate that cigarettes and water pipes were the most commonly used tobacco products by both genders in the last 30 days. This could be because these are the most commonly available and reasonably inexpensive tobacco products, making them accessible and affordable to students. Also, young adults are influenced and encouraged by smoker peers who are currently consuming these products. Furthermore, in general, male students were more likely than female students to have used any form of tobacco product in the previous thirty days.

Table 4.21. Distribution of respondents who daily smoked/vaped/use of different tobacco products by gender (n= 855, males= 445, females= 410)

Currently daily Smoked/ Vaped/Used following tobacco products	Female (n=410)	Male (n=445)	Overall (Daily users) (n=855)
Cigarette	3 (0.7)	132 (29.7)	135 (15.8)
E- Cigarette	0 (0.0)	21 (4.7)	21 (2.5)
Water pipe	3 (0.7)	17 (3.8)	20 (2.3)
Other Tobacco products (Paan, Chalia, Supari, Naswar, Gutka)	0 (0.0)	7 (1.6)	7 (0.8)

Table 4.21 describes the frequency distribution of current smoking status and use of other tobacco products in participants. Among regular smokers, the majority of the participants (15.8%) were cigarette smokers, while the proportion of respondents using e-cigarettes and water pipes on a daily basis was found to be similar (2.5%). Only 0.8% of respondents were daily users of other tobacco products (Paan, Chalia, Supari, Naswar, Gutka). Naswar and paan were the two most popular smokeless tobacco products used by 0.7% and 0.4% of the participants, respectively. With respect to gender, the prevalence of use of all types of tobacco products such as cigarettes, e-cigarettes, water pipes, and smokeless tobacco was found to be higher among males compared to female participants on a daily basis. This could be due to the reason that male students are inspired more by their peers and prefer to be friends with smokers rather than be excluded from the circle of friends solely because they do not smoke cigarettes. Furthermore, many individuals associate smoking with the fact that it improves a person's image alleviates boredom and also aids in the relief of stress. However, the lower smoking proportions among females than male students could be due to societal stigma because it is often morally objectionable or unacceptable for the female to smoke.

Concerning whether or not there was a transition in the respondent's smoking status as a result of the pandemic, only 4.6 % mentioned a shift in their smoking status.

Table 4.22. Distribution of respondents who occasionally smoked/vapid/use of different tobacco products by gender (n= 855, males= 445, females= 410)

Occasionally Smoked/ Vaped/Used following tobacco products	**Female (n=410)**	**Male (n=445)**	**Overall (Non-daily users) (n=855)**
Cigarette	3 (0.7)	54 (12.1)	57 (6.7)
E- Cigarette	1 (0.2)	31 (7.0)	32 (3.7)
Water pipe	40 (9.8)	100 (22.5)	100 (16.4)
Other Tobacco Products (Paan, Chalia, Supari, Naswar, Gutka)	3 (0.7)	8 (1.8)	11 (1.3)

Considering occasional smokers, a significant proportion (16.4%) of participants were consuming water pipes, while (6.7%) were cigarette smokers. Non-daily users of e-cigarettes were 3.7% while only 1.3% were occasional consumers of other tobacco products, including paan, chalia, gutka, etc. Overall, the proportion of male students who occasionally used all types of tobacco products was higher than the proportion of female students. However, among all the tobacco products, water pipe was mostly used by both males (22.5%) and females (9.8%). This could be due to the general perception that waterpipe smoking is a less hazardous, less addictive, fashionable, and more socially adept substitute for cigarette smoking, especially for females. Therefore, the most common reasons for occasional use of water pipes could be enjoyment, relaxation, and culture among young adults.

5. DISCUSSION

This chapter provides a detailed description of the discussion regarding the knowledge related to trans fats, consumption patterns of different types of edible cooking oils, and food items among study participants. This chapter also discusses the knowledge, attitudes, and consumption patterns of different types of SSBs among university students.

5.1. Knowledge related to Trans fats among study participants

The current study is to assess the awareness regarding trans-fat and to know about the consumption habits of trans-fat-enriched foods among university students in Pakistan. The findings of our study indicate that majority of our respondents were unaware of the term "trans-fat". Among these, a substantial proportion of students (both male and female) were from the non-medical study program. Our study results contrast with research conducted in India, where a majority (62%) of the participants had heard about the term "trans fat" before.[129] In our study findings, 39% of females and 32% of males knew that artificial trans fats are produced by heating liquid oils, a process called hydrogenation, in contrast to 65% of females and 56% of males in another study.[130]

Regarding participants' knowledge about characteristics of trans-fat, such as enhancing taste and texture, food shelf-life, and cost-effectiveness, a significant proportion of female and male participants from medical faculty had better awareness than non-medical female and male students. This may indicate that a particular discipline, such as a Medical or Allied Health Sciences program, influenced students' knowledge of this subject.

In order to determine the participants' awareness of health risks (type 2 diabetes, fatty liver disease, and cardiovascular disease) associated with trans fats consumption, students were asked to identify the correct statements about trans fats. More than half (65%) of all the study participants (including male and female) were unable to ascertain the right answers, which suggests that most of them were unfamiliar with the health outcomes relating to artificial trans fats. According to the findings of another study, 59% of the total participants did not correctly identify that cardiovascular diseases are associated with trans fats.[130]

Concerning the knowledge about the presence of trans fats in numerous food items, a considerable proportion of respondents were unaware of the presence of trans fats in commercially fried foods, bakery products, packaged snacks, and breakfast cereals. In contrast, another study revealed that the majority (96%) of participants were aware that processed foods contained trans fats.[131] Therefore, our study findings suggest a knowledge gap regarding participants' awareness about various food items containing trans fats, although they were consuming these foods regularly.

5.2. Consumption patterns of different types of edible oils or fats for cooking purposes at home

According to our study results, on average, 32.1% of the participants always preferred to use cooking oils for various cooking purposes at home, such as breakfast, meals, frying, and baking. Our findings also indicate that most participants often preferred cooking with edible oils. Results of another survey conducted in Pakistan reported that 40% of the respondents were consuming cooking oil in their homes for cooking a variety of food products.[84] Furthermore, several studies have found that Pakistan is among the world's largest consumers of edible oil, consuming nearly 2.5 million tons domestically. Palm oil accounts for nearly 65% of domestic and industrial vegetable oil consumption in the country, compared to 35% for other oil types such as soybean, corn, and canola.[132]

In our study, vanaspati ghee was the second most preferred product for domestic cooking, and it was frequently used in meals (32%) and breakfast (26.8%) preparations. Another study conducted in Pakistan reported that 45% of the respondents consumed vanaspati ghee for cooking purposes.[84] Vanaspati ghee (made from partially hydrogenated vegetable oil) is a major source of artificial trans fats in Pakistan, and a study found 14.2 to 34.5% of artificial trans fats content in samples of vanaspati ghee.[84] However, apart from its high proportion of artificial trans fats, this cooking product is popular as a low-cost substitute for expensive edible oils as well as for its aroma and taste when it is used as a cooking medium.[86]

The findings of our study reveal that margarines were the least preferred option for all types of cooking at home. Only 9% of participants used it exclusively for baking, and 3% used it

for breakfast. In Pakistan, consumers are unaware of the difference between butter and margarine, and both are considered butter.[85] Because margarines and butter are used interchangeably, and it may suggest that our study results on margarine consumption for cooking purposes could be underestimated. Although margarine is made from hydrogenated vegetable fat, most individuals continue to believe butter and margarine are substitute products. Therefore, it is critical to raise awareness about the differences between margarine and butter to change consumer behavior.

5.3. Consumption patterns of different food items among study participants

Excessive commercial food consumption is one of the most significant issues in Pakistan, as it is readily available at restaurants and cafeterias. This trend of eating out could be potentially hazardous for health, as the food prepared there is particularly rich in trans fats.[133] Moreover, almost all snack foods, packaged baked goods, and frying fast foods contain artificial trans fats.[134]

Deep-fried foods are popular in Pakistan, and street restaurants and food vendors prefer cooking with repeated boiling at very high temperatures.[15] Our data findings indicate that 33.5% of the respondents were consuming fries from cafeterias five times or more a week. French fries were consumed at a trendy level among participants compared to other food groups. Another research conducted among medical students in Rawalpindi, Pakistan, reported 31% intake of French fries among study subjects.[133] Similarly, 31% intake of fries by consumers is mentioned in another study in Punjab.[135] Karim et al. found higher TFA levels (10-24%) in samples of fast food outlets in Karachi selling French fries.[15] Despite this, a large proportion of students in our survey eat French fries every week.

All fast foods, bakery items, biscuits, candies, chocolates, spreads, and snacks consumed in Pakistan contain artificial trans fats.[85] According to our descriptive statistics, fried street snacks and packaged snacks were consumed once a week by 42.1% and 46.7% of respondents, respectively, while others preferred to consume these food items two to four or more times a week. These findings indicate that a significant percentage of our participants were occasional consumers of snack foods; however, one-fifth of the respondents consumed

these food products regularly. According to our findings, nearly half of the participants consumed packaged breakfast cereals, packaged sweetened yogurt, ice cream, candies, chocolates, and wafers once a week, and a fifth of the total population consumed them five or more times per week. These findings suggest that educational interventions should be prioritized by increasing knowledge about trans fats and promoting lower intakes of trans-fat-rich foods among young adults.

Paratha is the most traditional breakfast food in Pakistan, with most of our study participants (37.4%) consuming it frequently (at least twice a week). Although artificial trans fats are primarily found in breakfast and snack items in Pakistani diets with high TFA levels, i.e., 11.01% (paratha) and 12.2% (cake) [14], a majority of our respondents often consumed these food items, indicating that consumption of foods rich in trans-fats is popular among youngsters. These findings suggest that a quantitative assessment of dietary trans fat intake in high-risk populations, as well as other local government regulations on trans fats, is required to truly evaluate the consumption volume of artificial trans fats in the young population.

5.4. Knowledge and attitudes related to SSBs among study participants

According to our research findings, the participants' knowledge about health concerns regarding habitual consumption of sugar-sweetened beverages reveals that in comparison to non-medical respondents, medical students had adequate knowledge of the health concerns related to SSBs. The overall mean score regarding health risks (obesity, cancer, heart disease, fatty liver disease, and tooth decay) also reveals that medical students have better knowledge levels in contrast to non-medical students. Our results are similar to another study conducted among students in Karachi, Pakistan, where a majority of medical students were aware of the health hazards related to the consumption of sugary drinks.[136]

In our study, only 13.8% of responders were confident about the amount of sugar in a regular can (250ml), while 37.8% were unsure about the exact amount of sugar in a can, whereas, in another study conducted among university students, a considerable proportion i.e., 53.1% participants were able to correctly identify the amount of sugar in a can of sugary beverage.[137]

Concerning students' knowledge about adding sugar in drinks, more than one-half (53.8%) of the total participants had no idea about the daily intake of added grams of sugar in beverages without health concerns. These findings indicate that a substantial proportion of university students were consuming sugary drinks without knowing the recommended level of sugar in beverages, and they were not familiar with the health hazards relating to the intake of added sugar in drinks.

In terms of attitudes on current consumption levels of cold and hot beverages with added sugar, the vast majority of participants in our study had similar levels of intake five years ago. Moreover, our study participants from the medical and non-medical programs had similar attitudes towards consuming sugary drinks. When analyzing how knowledge influenced medical students' practices in the past, it is revealed that although medical students were more aware of the health risks associated with increased SSB consumption, their practices were not influenced by knowledge. The majority of them had not changed their consumption behaviors. As a result, the more aware a responder doesn't have to be, the more likely the individual is to consume SSBs according to the recommended levels.

Considering the anticipated consumption levels of SSBs five years from now, depict that a larger proportion (49.6%) of medical students favored reducing their consumption levels compared to their current intake. The results of another study conducted among medical students in Lahore, Pakistan, indicated that 36.7% of the participants were confident enough to stop or lower their intake of sugary beverages.[26]

5.5. Consumption patterns of SSBs among study participants

This present study showed that regular soda was the most heavily consumed SSB type and 42% of our participants were taking regular soda 1-2 times a day. According to many research findings, regular soda is the most common type of SSB consumed, especially among university students. Research conducted in Bangladesh also reported the same results in which Coca-Cola was consumed by 49% of the respondents regularly.[138]

Other surveys conducted in different cities across Pakistan also reported the high consumption of carbonated drinks among university students. According to recent survey

findings among medical and non-medical students in Lahore, more than one-third of the respondents (73.3%) mentioned that they took carbonated drinks regularly.[139] Findings of a study among medical students in Karachi reported that 26.7% of the subjects consumed cola more than twice each day while 10.7% were taking 10.7% of regular soda more than 3 times in a day.[140] Another recent survey conducted among students in Gujrat, Pakistan, also indicated almost similar findings i.e. 44.5% of the study subjects used soda drinks 1-2 times/week.[142] This may suggest that considering the increasing trend of carbonated beverages among youth, there is a critical need to establish an understanding in the young generation of Pakistan.

In our study, the daily consumption of packaged fruit juice was second-highest among students. 29.6% of the students were taking fruit juices regularly. According to a study conducted among undergraduate students, regular consumption of fruit juices was 49.9% which was found to be the highest as compared to the findings of our study.[141] This could indicate that fruit juice consumption may be higher due to students' beliefs in the high nutritional content of juices and their perceptions of these beverages as health-promoting food items. As a result, it is critical to underline the high sugar content of packaged juices, which contributes to the epidemic of obesity.[143]

31.3% of the participants were non-regular consumers of Energy or sports drinks. Our results are similar to another study conducted among university students in Lahore, Pakistan, where 32% of the participants reported irregular consumption of energy drinks.[145] Yet the pattern of consumption is not much high among students according to our study, but energy drinks or sports drinks have been increasing its popularity, especially among young adults in Pakistan, and most of the students did not know about the ingredients as well as the side effects of these drinks.

The highest percentage of students belongs to the Non-consumer category. Among these, most participants never consumed light soft drinks, including diet cola 67.7% and diet sprite 66.4%. In comparison, only 9.6% of the participants consumed diet cola one or two times daily. Similar results were found in another study conducted by Norliza et al., where 9.0% of the participants reported consuming a moderate quantity of diet soda or soda pop in a day.[141]

The present study's findings reported high consumption of fruit juices, energy, sports drinks, and flavored milk, which demands public health attention. It is possible that students believe such beverages are healthy, but these drinks include a considerable quantity of added sugar. This misunderstanding could be a critical concern as sales of fruit juice and energy drinks have surged globally.[144]

Many studies have examined the relationship between SSB intake and gender.[146,147] However, our study found no association between gender and SSB consumption.

For hot SSBs like sweetened tea and sweetened coffee drinks, a significant proportion of the population consumed 3-4 cubes of sugar in a teacup. They were taking 3 or more cups of sweetened tea while sweetened coffee was occasionally consumed. Our findings indicate that a significant proportion of participants were consuming additional grams of sugar in tea, which exceeded the WHO's recommended levels. This suggests that tea is a popular hot beverage and one of the major sources of added sugars among students. The extensive use of tea could be related to cultural food patterns, as it is regarded as a necessary component of breakfast.[148]. Other reasons for preference for excessive tea intake over coffee include increased alertness and performance while preparing for exams, relief from headaches, and the ability to satisfy cravings because it is a caffeinated beverage.[149]

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

This study examined the knowledge, attitude, and consumption patterns of university students towards trans fats and sugar-sweetened beverages.

Our results indicate that knowledge about trans fats is not adequate among students. Their consumption patterns of foods rich in trans fats are also not satisfactory because a substantial proportion of study participants are unaware of the characteristics and health risks associated with artificial trans fats. Thus, these findings indicate a significant gap between students' concerns about artificial trans fats and related health outcomes. This study also emphasizes the significance of trans-fat knowledge, awareness, and consumption behavior among the younger generation. Therefore, our findings contribute to the existing body of knowledge about artificial trans fats and the health risks associated with excessive consumption of trans-fat-rich foods among young adults.

In terms of participants' knowledge and perceptions of the health risks associated with excessive SSBs consumption, most participants have a mediocre level of knowledge. However, knowledge about SSBs has no significant impact on students' consumption habits. The majority of students maintained the same attitudes toward SSB consumption as were in the past. Moreover, our study concludes that the practices of participants are neither preventive nor health-promoting. This demonstrates that they were not adopting a healthy way of life. Thus, health education and primary prevention are recommended as the best methods for adopting a healthy lifestyle and preventing the complications related to SSB intake.

6.2. Limitations of the study

The findings of this study may be limited due to the self-reporting information by the participants, which is subject to recall bias mistakes because the outputs depend significantly on the participants' memory to recall the frequency of SSB and food items consumption. Also, they tend to under-or overestimate their intake. Another limitation of this research is

using a single FFQ for sugar-sweetened beverages and food items consumption; however, it may have been more precise to use food records.

Furthermore, this research focused on students from a specific region, so the generality of the research outcomes from the institutions in other areas of the country may also be restricted.

6.3. Recommendations

Our findings suggest that improving trans fat knowledge among university student groups could have a greater impact on their health. Additionally, future research should consider the quantitative assessment of intake of food items containing artificial trans fats and the effectiveness of trans fat awareness programs, particularly among groups with low knowledge of trans fat. It is essential to achieve policymakers' support for legislative requirements, as well as strong advocacy for their regulation. Currently, public awareness of regulations is low, and it is not a primary concern of policymakers. To accomplish this goal, mainstream media campaigns and high-level participation of legislators should be considered. Therefore, we highly suggest promoting policies that encourage the replacement of vanaspati ghee with healthy options, implementing regulatory practices in accordance with WHO recommendations, and also modifying food labeling laws so that customers have access to comprehensive information on healthy food choices.

Regarding sugar-sweetened beverages, in future studies, quantitative consumption patterns of SSBs and their associations at personal levels should be addressed to check and avoid the disease burden associated with them. Also, there should be monitoring of consumption behaviors among youth, including the risks associated with heavy consumption. Furthermore, future studies should determine the modifiable contextual factors of SSB consumption in order to find out more evidence of the efficacy of various policy interventions. In this way, we will be able to discourage the intake of sugary beverages, specifically higher intakes that are causing non-communicable diseases. This will help to improve the health-related outcomes across the country, particularly for the population at risk.

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8. APPENDICES

8.1. Ethical Approval

T.C. YEDİTEPE ÜNİVERSİTESİ

Sayı : 37068608-6100-15- 2013 **19/11/2020**
Konu: Klinik Araştırmalar
Etik Kurul Başvurusu hk.

İlgili Makama (Gul E.Rana Khan)

Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü Halk Sağlığı Program Başkanı Prof. Dr. Recep Erol Sezer'in sorumlu araştırmacı olduğu **"Knowledge, Attitude and Consumption Patterns of Trans Fats and Sugar Sweetened Beverages Among University Students İn Punjab, Pakistan"** isimli araştırma projesine ait Klinik Araştırmalar Etik Kurulu (KAEK) Başvuru Dosyası **(2010)** kayıtlı Numaralı KAEK Başvuru Dosyası, Yeditepe Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından **18.11.2020** tarihli toplantıda incelenmiştir.

Kurul tarafından yapılan inceleme sonucu, yukarıdaki isim belirtilen çalışmanın yapılmasının etik ve bilimsel açıdan uygun olduğuna karar verilmiştir. **(KAEK Karar No:1320)**

Prof. Dr. Turgay Çelik

Yeditepe Üniversitesi
Klinik Araştırmalar Etik Kurul Başkanı

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8.2. Informed Consent

Study Title: Knowledge, Attitude and Consumption Patterns of Trans Fats and Sugar Sweetened Beverages among University Students in Punjab, Pakistan

Electronic Consent

You are invited to participate in a research study. Your participation is voluntary. This consent form will provide you with information on the research project and what you will need to do.

The purpose of this study is to assess the Knowledge, Attitude and Consumption Patterns of Trans Fats and Sugar-Sweetened Beverages among University undergraduate students. Participation in this study typically takes 10-15 minutes and is strictly anonymous. The data being collected will include demographic information, nutrition knowledge, and practice questions. All responses are treated as confidential, and in no case will responses from individual participants be identified. Taking part in this research study is entirely up to you. Your participation will be highly appreciated.

Please select your choice below. Clicking on the "I Agree" button below indicates that you are 18 years of age or older, have read the above information, and voluntarily agree to participate in this research study.

- ◯ I Agree
- ◯ I disagree

8.3. Questionnaire

Knowledge, Attitude and Consumption Patterns of Trans Fats and Sugar Sweetened Beverages among University Students in Punjab, Pakistan

Research Questionnair

Socio demographic Information

1. **Year of birth ……..**
2. **City**
    a. Multan
    b. Lahore
3. **Gender :**
    a. Male
    b. Female

4. **Which programs (medicine, nursing etc) are you currently enrolled in?**
    a. Medical / Allied Health Sciences program
    b. Non-medical program

5. **University type?**
    a. Public
    b. Private

6. **Year of Program (Mark only one option)**
    a. 1st year
    b. 2nd year
    c. 3rd year
    d. 4th year
    e. 5th year

7. **The highest education level that your Father has attained? (Mark only one option)**
    a. No formal Education
    b. Primary school (Grade 1-5)
    c. Intermediate/ High school (Grade 6-12)
    d. College / University

8. **The highest education level that your Mother has attained? (Mark only one option)**
    a. No formal Education
    b. Primary school (Grade 1-5)
    c. Intermediate/ High school (Grade 6-12)
    d. College / University

9. What is your Total monthly family income ? (Mark only one option)
    a. Less than 30,000 PKR
    b. 30,000 to 80,000 PKR
    c. 80, 000 to 150,000 PKR
    d. 150,000 to 300,000 PKR
    e. 300,000 to 500,000 PKR
    f. Above 500,000 PKR

10. Number of members in your Family (Household) ----------

11. What is your height (meters) ? ----------
12. What is your current weight (kg) ? --------

12- How long in a day, on average, do you spend for exercising (walking, jogging, swimming etc) as your leisure time physical activity? (Mark only one option)

    a. No leisure time Physical activity
    b. Less than 30 minutes a day
    c. Equal or longer than 30 mins , but less than 1 hour
    d. Equal or longer than 60 mins but less than 100 mins
    e. Equal or longer than 100 mins

13- How often do you use food label nutrition information while purchasing a food/ drink item? (Mark only one option)

    a. Always/ Every time
    b. Almost every time / frequently
    c. Sometimes / Occasionally
    d. Almost never / Rarely
    e. Never

TRANS FATS

1. **Have you heard a term called 'Trans Fats' an ingredient present in Dietary fats?**

    a. Yes
    b. No

2- Which of the following include artificial Trans fats / Trans fatty acids? (choose more than one option)

a. Partially hydrogenated vegetable oils
b. Other liquid vegetable oils
c. Olive oil
d. Butter
e. Margarines
f. Fat in meat and milk
g. Vanaspati ghee
h. Don't know

3- Which of the following food items can have artificial Trans fats? Please click one option in each row

FOOD ITEMS	YES	No	DON'T KNOW
Commercial Fried foods (French Fries, Fried chicken and Beef)			
Commercial Baked foods (Cakes, Biscuits, Doughnuts, Pastries)			
Packaged Snack foods (chocolates, wafers, chips, crackers)			
Packaged Breakfast cereals			
Milk and Plain Yogurt			
Meat (white or red or fish)			
Coffee creamers			
Fruits and Vegetables			
Nuts			

4- Which of the following is/are healthier choice for Dietary fats? (Please tick all appropriate options)

a. Butter
b. Vanaspati ghee
c. Margarines
d. Olive oil
e. Other liquid cooking oils (sunflower oil, canola, soybean oil)
f. Palm oil

g. Don't know

5- How often do you use the following types of Oils or Fats in your home for COOKING MEALS (lunch and dinner) ?
(Please tick one option in each row)

Types of fats and oils	Never	Sometimes	Frequently	Always
Liquid cooking oils (Sunflower oil, Soybean oil, Canola oil, palm oil)				
Olive oil				
Vanaspati ghee				
Butter				
Margarines				

6- How often do you use the following types of Oils or Fats in your home for BREAKFAST? (Please tick one option in each row)

Types of fats and oils	Never	Sometimes	Frequently	Always
Liquid cooking oils (Sunflower oil, Soybean oil, Canola oil, palm oil)				
Olive oil				
Vanaspati ghee				
Butter				
Margarines				

7- How often do you use the following types of Oils or Fats in your home for FRYING
?
(Please tick one option in each row)

Types of fats and oils	Never	Sometimes	Frequently	Always
Liquid cooking oils (Sunflower oil,				

Soybean oil, Canola oil, palm oil)				
Olive oil				
Vanaspati ghee				
Butter				
Margarines				

8- How often do you use the following types of Oils or Fats in your home for BAKING ?
(Please tick one option in each row)

Types of fats and oils	Never	Sometimes	Frequently	Always
Liquid cooking oils (Sunflower oil, Soybean oil, Canola oil, palm oil)				
Olive oil				
Vanaspati ghee				
Butter				
Margarines				

9- What do you think about following statements: (Please tick one option in each row)

	True	False	Don't know
Artificial Trans fats enhance taste and texture of food			
Artificial Trans fats enhance shelf life of food			
Edible oils or fats containing artificial artificial trans fats are cheaper			
Oils with artificial trans fats can be used many times in commercial fryers			
Edible oils or fats containing artificial trans fats are made by heating liquid vegetable oils, in a process called Hydrogenation.			
As fats containing trans fatty acids are plant (vegetable) based			

they can be protective against Cardiovascular diseases			
Edible oils or fats containing trans fats can increase the level of high density lipoprotein (HDL) cholesterol that is protective against Heart disease			
Edible oils or fats containing artificial trans fats can cause Type 2 diabetes and Fatty liver disease			

10- How often do you eat any of these Food items at or taken from Cafeterias and Restaurants in a week (weekend inclusive)? (Please tick one option in each row)

FOOD ITEMS	Never	Less than once a week	Once a Week	2-4 times/week	5 or more times/ week
Fried Potatoes (French fries)					
Commercial Fried food (fried chicken,Burgers, Pizzas,Beef)					
Street fried Snacks (Samosa/Pakoras, poori, kachori)					
Commercial Baked food (Doughnuts, Biscuits, Buns, Pastries and Cakes)					
Paratha (sold outside)					
Packaged Breakfast Cereals					
Packaged Snacks (chips, nimko)					
Candies / Chocolates and Wafers					
Packaged Ice cream					

Plain Yogurt					
Frozen /sweetened packaged Yogurt					

SUGAR SWEETENED BEVERAGES

1- On average, how many cups in a Day (1 cup=250 ml), do you take the fallowing manufactured drinks? (Please tick one option in each row)

BEVERAGE Note : I cup=250 ml	Never	Less than 1	1	2	3	4	5 or more
Regular Coca-Cola, Pepsi-Cola							
Diet or light or zero Coca-Cola, Pepsi-Cola							
Fanta/sprite & other similar sugar sweetened carbonated products							
Diet/Zero Sprite							
Packaged Fruit Juices, Nectar with added sugars or similar manufactured products							
Sports Drinks (Nestle Milo sports drink, Milo milk chocolate &							

Energy Drinks (Sting, Red Bull)							
Ice Tea/Fused Tea							
Flavored Milk / Milk Shakes and similar drinks							

2- On average, how many cups of Tea in a day do you take? (Please tick one option)

a. I never consume
b. I don't consume daily
c. 1
d. 2
e. 3
f. 4
g. 6
h. 7 or more

3- On average, how many cups of Coffee in a day do you take?

(Please tick one option)

a. I never consume
b. I don't consume daily
c. 1
d. 2
e. 3
f. 4
g. 6
h. 7 or more

4- On average, how many cups of other drinks (e.g Lemonade , Lassi , Sharbat etc) in a day do you take? (Please tick one option in each row)

a. I never consume
b. I don't consume daily
c. 1
d. 2
e. 3
f. 4

g. 6
h. 7 or more

5- On average, how many Cubes or number of Tea spoons of sugar you add in 1 cup of Tea, Coffee or other drinks? (Please tick one option in each row)

	I dont add sugar	**1**	**2**	**3**	**4**	**5 or more**
Tea						
Coffee						
Other drinks (e.g Lemonade , Lassi , Sharbat etc)						

6- What do you think about the following statements? (Please tick one option in each row)

	Totally disagree	**Somewhat disagree**	**Neither agree nor disagree or I don't know**	**Somewhat agree**	**Totally agree**
Consuming sugary beverages habitually is not harmful to health					
Carbonated sweetened drinks can cause tooth decay					
Sweetened drinks can cause obesity					
Sweetened drinks can cause					

serious diseases such as cancer and heart disease					
Sweetened drinks can cause fatty liver					
Sweetened drinks can cause Diabetes					
Coca-Cola or Pepsi-Cola can be addictive					
Sweetened drinks in general can be addictive					

7- Could you compare your current sugar sweetened beverage consumption level (number of cups a day) with your consumption level five years ago?

My current sugar sweetened consumption level is;

a- similar to the level 5 years ago
b- higher than the level 5 years ago
c- lower than the level 5 years ago

8- Could you compare the number of cubes or teaspoons of sugar you currently put into a cup of tea or coffee, with the level you put 5 years ago?

My current consumption level is;

a. similar to the level 5 years ago
b. higher than the level 5 years ago
c. lower than the level 5 years ago

9- How much sugar, can you say confidently, a can (250 ml) of sugary beverages (such as cola or Fanta etc.) has?

a. Yes I know that confidently
b. I think I know that, but I am not sure
c. I do not know that

10- How much added grams of sugar in beverages, can you say confidently, you can consume a day without health concern?

a. Yes I know that confidently
b. I think I know that, but I am not sure
c. I do not know that

11 – Regarding Sugar Sweetened Beverages use, what will be your likely consumption level "5 years" from now comparing with current consumption level?

a. Similar to the current consumption level
b. Higher than the current consumption level
c. Lower than the current consumption level

TOBACCO CONSUMPTION PATTERNS

(Occasional and Nonsmoker)

1- Have you Smoked/ Vaped/Used the following tobacco products at least ONCE IN LAST 30 DAYS?

	YES	NO
Cigarette		
E- Cigarette		
Waterpipe		
other Tobacco products		

2- If you have ever used any other Tobacco products in last 30 days, please specify ? NO, please skip this question

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3- Have you ever smoked or used at least 100 cigarettes or equal amount of tobacco from different tobacco products (e.g E-cigarette, Waterpipe, and any other tobacco products - traditional or not) in your ENTIRE LIFE?

a. Yes
b. No

4- Your Current tobacco product use status : (Please tick one option in each row)

	Yes, everyday	Yes, but not daily	No, cutrently i donot use
Cigarette			
E- Cigarette			
Waterpipe			
other Tobacco products			

5- If you use other Tobacco products, could you please specify? If NO, please skip this question

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6- Has any change happened in your smoking status during the pandemic?

a. Yes
b. No
c. I do not smoke

7- If YES, could you please specify? If NO, please skip this question

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