ORIGINAL ARTICLE

Cross Sectional Analysis of Adipose Tissue and Fatty Liver Prevalence in association with sugar sweetened beverages consumption

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ABSTRACT

Aim: To establish cross-sectional association of consumption of Sugar sweetened beverages with adipose tissue (body fat) and risk of developing fatty liver.

Methods: A thorough investigation was done by collecting data on sugar sweetened beverages consumption, Body fat and Fatty liver was collected systematically in different public and private hospitals and private clinics of Lahore. For the assessment of adipose tissue in the body, every patient was subjected to the recording of Body Adiposity Index (BAI) using Height and Hip Circumference measurement. Presence of Fatty Liver was determined by screening using Abdominal Ultra-sound.

Results: Consuming SSB more than once per day increased the risk of being overweight to 2.64 (p value <0.05) times and risk of being obese to 2.22 times (p value < 0.05). Participants consuming SSB once a day had 9% statistically significant increased risk of getting fatty liver while those consuming more than once per day showed 14% increased risk of developing fatty liver.

Conclusion: It is concluded that Sugar sweetened Beverages Consumption is attributed as common risk factor to Adipose tissue accumulation as well as Fatty Liver.

MeSH words: Adiposity, Fatty Liver, Obesity, SSB, Sugary Drinks.

INTRODUCTION

Obesity is becoming an ever-increasing health problem and a pandemic[1]. Recent studies argue that Sugar Sweetened Beverages (SSB) are a key factor in the etiology of obesity[2, 3]. Sugar is one of the major causes of obesity and sugar added into commercial beverages are thought to pose a risk to obesity and weight gain. World-wide trend of obesity is simultaneously increasing with increase in consumption of sugar laden beverages as shown by large epidemiological studies[4,5].

This scenario is also taking an alarming shape in Pakistan with considerable increase in consumption of commercially produced drinks. Overweight and obesity have serious implications not only on general health but also on social care, quality of life, economy and educational attainment. Apart from causing serious health issues like Diabetes, Heart Diseases, Fatty Liver and chronic diseases, Obesity is now considered to cause a serious immunocompromised status in the times of Covid-19 pandemic[6]. Obesity imparts direct and indirect effects on the economy. Estimations of direct costs in treating obesity and overweight and subsequent non-communicable diseases have sky-rocketed globally[7]. Indirect costs caused by the negative impact of obesity on the whole economy, for example loss of productivity and physical impairments, are also a concerned economical aspect.

Recent epidemiological studies also have indicated a strong association between SSB consumption and incidence of Fatty Liver[8]. Fatty Liver is now considered an emerging public health crisis globally with serious succeeding implications of Chronic Liver Dysfunction. In Pakistan, incidence of liver diseases has also increased in the recent past and it needs to be controlled using effective public health strategies of Common risk factors approach and Whole population preventive approach. A causal relationship of Sugar Sweetened Beverages and incidence of Fatty liver has been reported with mixed and contrasting results in current literature.

Fizzy drinks, packed juices and commercial beverages contain high levels of sugars. Surveys have found a high content of unnecessary sugar in the commercial drinks. About 80% of sugary carbonated beverages had 6 or more teaspoons of sugar per

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serving (330ml). A serving of 330 ml of Coca Cola contained 35g of sugar. High sugar levels need to be oxidized and metabolized consistently by body organs which becomes difficult progressively with increased consumption and hence, adipose tissues start to accumulate in visceral body areas and Liver[9].

This study aims to find out the cross-sectional association of consumption of Sugar sweetened beverages with adipose tissue (body fat) and risk of developing fatty liver.

METHODS

Data on sugar sweetened beverages consumption, Body fat and Fatty liver was collected systematically in different public and private hospitals and private clinics of Lahore. A thorough investigation of the patients on SSB consumption was done through face to face interviews. Frequency of Consumption of SSB was categorized into Consumption Over Once a day, Once per day consumption, 3-4 times a week consumption, 3-4 times a month consumption, 1-2 times a month consumption, Never. After that, for the assessment of adipose tissue in the body, every patient was subjected to the recording of Body Adiposity Index (BAI) using Height and Hip Circumference measurement. Body Adiposity Index takes multiple patient factors into consideration and classify every individual on the basis of gender and age group into Healthy, Overweight and Obese categories. Fatty Liver was determined by screening using Abdominal Ultra-sound. In this study Adipose Tissue accumulation by BAI and risk of Fatty Liver by abdominal Ultrasound were used as outcome measures/dependent variables. Frequency of SSB consumption was taken as exposure/ independent variable. Consumption of 250 ml of SSB was considered as one serving. Logistic regression analysis was done using exposure and outcome for crude/adjusted association. The analysis was done to find out the changes in BAI and risk of Fatty liver among patients. Regression analysis was used to find the significance level for binominal outcome (Prevalence of Fatty Liver) and multiple categorical outcome (Body Adiposity Index categories). Significance level was set at 5% (p-value <0.05) for the statistical analysis. All statistical analyses were carried out using software SPSS version 20. This study included a total of 479 patients who were selected randomly from OPD list of General Medicine and Gastro-entrology departments.

RESULTS

Descriptive analysis of the data set of 479 participants showed a wide variability in age with Mean Age of 39 years. A ratio of 1.5:1 was found for male to female present in the data (Male: 60%, Female 40%). 16% of the individuals consumed SSB more than once a day. 18% of the participants consumed SSB once per day. However, only 10% of the participants reported that they never consumed SSB. Adipose tissue assessment as measured by Body Adiposity Index (BAI) in the data recorded a total of 42% of the participants to be Overweight and 31% of the participants to be Obese. Fatty Liver prevalence on screening was 17% in the collected samples of abdominal ultra-sound reports.

Logistic regression analysis to find relative risk ratio (RRR) of being Overweight/Obese with consumption of SSB (Table 1) showed that 2 frequencies of SSB consumption i.e. 1-2 times per month and 3-4 times per month didn't have statistically significant impact on being Overweight or Obese (P-value >0.05). However, if the frequency of SSB consumption increases, the relative risk of being overweight and obese gradually increased within each higher category. Consuming SSB once per day doubled the relative risk of developing obesity. Consuming SSB more than once per day increased the risk of being overweight to 2.64 times and risk of being obese to 2.22 times.

Logistic regression run between SSB consumption and fatty liver screening (Table 2) showed a statistically significant association with risk of getting fatty liver increasing with increased frequency of SSB consumption. Participants consuming SSB once a day had 9% increased risk of getting fatty liver while those consuming more than once per day showed 14% increased risk of developing fatty liver. Moreover, participants who never consumed SSB showed 9% of significant lower risk of developing fatty liver.

Table 1: Logistic Regression Analysis between SSB Consumption and Body Adiposity Index (Total Observations: 479)

Variable	Categories	Body Adiposity Index								
		Healthy (Baseline Category)			Overweight			Obese		
		RRR	95% CI	P-Value	RRR	95% CI	P-Value	RRR	95% CI	P-Value
SSB Consumption	Never	1 (Baseline)			0.88	0.80-0.98	<0.05	0.91	0.83-0.99	<0.05
	1-2 Times per month	1 (Baseline)			1.13	0.99-1.27	>0.05	1.01	0.94-1.08	>0.05
	3-4 Times per month	1 (Baseline)			1.04	0.92-1.16	>0.05	1.10	0.99-1.21	>0.05
	3-4 Times per week	1 (Baseline)			1.07	1.01-1.13	<0.05	1.19	1.10-1.28	<0.05
	Once per day	1 (Baseline)			2.01	1.90-2.12	<0.05	1.96	1.81-2.11	<0.05
	More than Once per day	1 (Baseline)			2.64	2.51-2.77	<0.05	2.22	2.10-2.32	<0.05

Table 2: Logistic Regression Analysis between SSB Consumption and Fatty Liver (Total Observations: 479):

Variable	Categories	Fatty Liver Screening					
		-ve on Screening (Baseline Category)			+ve on Screening		
		RRR	95% CI	P-Value	RRR	95% CI	P-Value
SSB Consumption	Never	1 (Baseline)			0.91	0.84-0.98	<0.05
	1-2 Times per month	1 (Baseline)			0.94	0.89-0.99	<0.05
	3-4 Times per month	1 (Baseline)			1.03	1.01-1.05	<0.05
	3-4 Times per week	1 (Baseline)			1.05	1.02-1.08	<0.05
	Once per day	1 (Baseline)			1.09	1.03-1.15	<0.05
	More than Once per day	1 (Baseline)			1.14	1.09-1.19	<0.05

DISCUSSION

This study offers a cross sectional analysis of association between sugar-sweetened beverages, its consumptive frequency and weight gain in the form of adipose tissue accumulation and prevalence of fatty liver among adults. Adipose tissue accumulation was calibrated on Body Adiposity Index while fatty liver prevalence was observed among adults consuming SSB on different multiple frequencies. The results on logistic regression analysis were evidently showing dose dependent adverse effects on adipose tissue accumulation and fatty liver prevalence. The investigation clearly showed increased risk of being overweight and fatty liver development. Our results are in coherence with latest scientific studies done on the same associations but with different study designs[10,11,12].

Previous data on Meta-analysis and cohorts on investigated association affirmed that risk of getting overweight and obese and risk of getting fatty liver increased as frequency of consumption of sugary drinks increased with more pronounced risk at the highest frequency of consumption[13,14]. Along with these severe affects, consumption of SSB can lead to severe metabolic syndrome that get further worsened by already prevalent obesity and liver malfunction among patients[15]. Using common risk factor approach, SSB consumption should be regarded as common risk factor to developing of multiple diseases.

Our study has shown substantially significant results of increased risk associated with SSB consumption. This may lead to further longitudinal investigation of the investigated association.

CONCLUSION

Based on principal findings in results, it is concluded that cross sectional association between SSB consumption and adipose tissue accumulation and fatty liver is statistically positive and significant. SSB consumption turns out to be a common risk factor for Adipose tissue accumulation and fatty liver in this study.

Conflict of Interests: None

Contribution: NH: Conceptualization and design of Study, **UN:** Data Collection, **US:** Data Analysis and data interpretation: **MA:** Drafting and compiling the results, **MI**: Proof reading and referencing, **MA:** Manuscript Writing

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