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FAST-FOOD CONSUMPTION AND ITS ASSOCIATION WITH LIVER ENZYMES AND LIPID PROFILE IN YOUNG ADULTS OF FAISALABAD, PAKISTAN 2026

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Abstract
Background: *There was a significant rise in fast food intake among youth in recent years, especially for those living in cities. Fast food is often high in saturated fats, trans fats, and refined carbohydrates, which can lead to metabolic issues such as dyslipidemia and liver dysfunction. Although the increasing trend, there is a lack of local data on the impact of the consumption of fast food on lipid profile and liver enzyme levels in young populations. Hence, it is critical to make early evaluation of these parameters which is critical for timely prevention and management.*

Aim: *To evaluate the level of liver enzymes and lipid profile in young people with consumption of fast food and to reveal the associated dietary and lifestyle risk factors that lead to metabolic disorders*

Methods: *The study was descriptive and analytical with a cross-sectional design carried out in the city of Faisalabad, Pakistan. The number of participants were (e.g. 150) who were aged between 18-35 years and were obtained through purposive sampling methods. A structured questionnaire was used to gather data on demographic information, dietary habits, and lifestyle factors. Blood samples were taken under sterile conditions and biochemical tests including liver function tests (ALT, ALP, bilirubin), lipid profile (total cholesterol, triglycerides) was performed with standard methods. Descriptive statistics, one-way ANOVA, independent-samples t-test, Pearson correlation and chi-square analysis were conducted in SPSS with significance set at $p < 0.05$.*

Results: *Triglycerides (42.0%) were the most abnormal marker, followed by ALT (28.7%) and cholesterol (27.3%). There was a significant difference between overall abnormal/risk classification and fast-food consumption frequency: the frequency of consuming fast food was significantly associated with the overall abnormal/risk classification ($\chi^2 = 16.794$, df = 3, $p = 0.0008$), the percentage of subjects in the rare to daily fast-food consumption group being 37.8% and 90.0%, respectively. Higher intake of a dietary pattern high in fat was significantly related to higher ALP ($t = -3.161$, $p = 0.002$) and bilirubin ($t = -6.981$, $p = 0.0013$) levels and fried-food frequency was significantly related to higher bilirubin ($F = 3.073$, $p = 0.0297$) levels. Good correlation was seen with*

total cholesterol and triglycerides (r = 0.600, p < 0.0001) and moderate correlation was found between ALT and bilirubin (r = 0.415, p < 0.0001).
Conclusion: *The study finds a statistically significant relationship between a high intake of fast food and high levels of liver enzymes and abnormal lipid profile among young people. These results underscore the need to screen early, to be conscious of diet, and to make lifestyle changes to prevent the occurrence of liver-related disorders and metabolic complications. Promote healthy eating practices and reduce fast food consumption among youth to be the focus of public health strategies.*

1. INTRODUCTION

Fast food becomes a serious health threat on the global scale. In particular in our young population. Fast-food is a major determinant in food choice. It is attributed to the accelerated urbanization, high school pressure and technological development. Other factors are the pressure of the job, and the change in lifestyle pattern. Too much saturated fatty acids (SFA), trans fat, refined carbohydrates and added sugars found in fast food. Eating too much of these elements brings about dietary changes, however. This is associated with early biochemical alternation and changes in metabolism (Khatatbeh, 2021; Jalili et al., 2022).

In the liver, important processes regulated are: lipid biosynthesis, lipid oxidation and lipid transport. In excess, dietary fat accumulates in the hepatocytes to cause hepatic steatosis and thus elevation of alanine aminotransferase (ALT) and aspartate aminotransferase (AST), which are sensitive markers of early liver injury (Taniguchi, 2024; Bilondi, 2024). Liver enzymes are high and metabolic dysfunction-associated steatotic liver disease (MASLD) (formerly known as non-alcoholic fatty liver disease (NAFLD)) (He, 2025; Hamano, 2024; Geladari, 2025) have been found to be associated with eating fast food frequently.

The fast-food diet also has an impact on the metabolism of lipids. A high saturated fat diet causes an increase in the production of very-low-density lipoprotein (VLDL) in the liver, which leads to increased triglycerides and low-density lipoprotein (LDL) cholesterol and decreased high-density lipoprotein (HDL) (Byrd, 2022). Abnormalities in lipid profile typically accompany liver changes since the liver is the site of both lipoproteins synthesis and clearance. This relationship has been confirmed in young adults of Pakistan (Ahmad, 2023) which further emphasizes the need to examine both parameters together.

These metabolic disturbances are also more common in young adults these days, even in those who are not overweight or suffering from a known illness. As soon as dietary independence is achieved in early adulthood, unhealthy eating patterns increase and the weight, lipid profile and liver enzyme levels are likely to start to change (Hamano, 2024; Khatatbeh, 2021).

The majority of evidence available, however, is from sources outside of Pakistan and local studies have been largely limited to obese people or those who already have metabolic issues (Khan, 2025). The increased intake of fast foods has been observed in LMICs, due to several reasons including its affordability, accessibility, taste, and aggressive marketing (Li et al., 2020; Rafid et al., 2025; Wu et al., 2021).

Exceeding three times a week, more than two thirds of university students in neighboring Bangladesh reported eating fast food, which is a high risk for obesity (Banik et al., 2020). The consumption of ultra-processed foods has also been reported across the region, and has been further rising since the COVID-19 pandemic (Singh et al., 2021). Faisalabad, one of the key industrial/commercial cities of Punjab, exhibits these regional dietary patterns.

Significance of the study. Even if there are no clinical signs of liver or cardiovascular disease, recognizing the modifiable dietary risk factors early provides a chance for early prevention. This study will evaluate the association of fast-food consumption, liver enzyme activity, lipid profile in apparently healthy young adults to provide

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evidence for dietary counseling, screening and public health interventions in Pakistan.

Research gap. Although the use of fast food has risen, little is known about liver enzymes and lipid profile status of healthy young people who consume fast food in Faisalabad (Ahmad, 2023; Khan, 2025). The majority of studies done in Pakistan have been conducted on obese and/or metabolically unhealthy adults, thus, information regarding the early biochemical effects of FF consumption in healthy adolescent is lacking and limited information is available about the early biochemical effects of fast-food consumption in healthy youth.

Research question. Is there a measurable relationship between the consumption of fast foods and liver enzyme and lipid profile abnormality in young healthy adults in Faisalabad and which dietary/lifestyle factor are most responsible for this association?

Aim. This study set out to assess liver enzyme levels and lipid profile among young individuals consuming fast food in Faisalabad and to identify the dietary and lifestyle risk factors that contribute to the metabolic disturbances observed.

Objectives:

- To identify possible risk factors among individuals consuming fast food.
- To assess the relationship between dietary fatty acid intake, serum lipid profile, and liver enzyme levels.
- To evaluate the risk of NAFLD among participants consuming fast food.
- To assess the association between fast-food consumption and cardiovascular risk among young adults.

Hypothesis. The null hypothesis (H_0) stated that there is no significant relationship between the level of liver enzymes and the level of lipids; while the alternative hypothesis (H_1) assumed that there is a significant relationship. As would be expected, the fast-food consumers had higher serum levels of liver enzymes, as well as abnormalities in the lipid profile when compared to those who had fast food less than once per week, suggesting that there may be a synergistic interaction between saturated fat and fast food consumption on early hepatic and lipid homeostasis.

2. Materials and Methods

2.1 Study Design and Setting

Cross-sectional analytical design was used to obtain both the exposure (fast-food consumption) and the outcome (biochemical status) in the same observation period, thus enabling the dietary habits and biochemical parameters to be assessed within a specific study period. The study was done at Allied Hospital 2 and MTH, Faisalabad, Pakistan, which had laboratory facilities, patients with a wide socioeconomic background and was easily accessible.

Activity	January	February	March	April
Data Collection	✓	✓	✓	✓
Data Analysis	✖	✖	✖	✓
Report Writing	✖	✖	✖	✓

2.2 Study Population and Sample Size

The study population included young males and females aged 18–35 years in Faisalabad who consumed fast food regularly. Feasibility and availability in the study time frame resulted in a total number of 150 participants. Adult participants were between the ages of 18 and 35 who consumed fast food at least once a week and were willing to complete an informed consent form and have their blood drawn. Only those with full data were included in the analysis and those who were not matched and had any liver disease, diabetes, pregnancy or alcohol consumption were

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excluded to minimise the impact of other dietary factors on the biochemical outcomes.

2.3 Sampling, Data Collection, and Ethical Considerations

The participants were selected using purposive sampling technique because they consumed fast food. Structured face to face interview and Google Forms online questionnaire data was gathered and questions pertaining to demographic profile, dietary pattern and lifestyle behaviour were included. Three sections of the instrument developed by the researcher were: Section A (Demographic information: age and gender), Section B (Dietary intake and lifestyle: frequency of consuming fast food, fried food, type of fast food consumed, type of diet, fruits and vegetables intake, sleep time, activity level, smoking status, energy drink consumption), and Section C (Medical history and clinical information: prior diagnosis of liver disease or dyslipidemia, family history of liver disease, disease symptoms, willingness to provide blood sample). All ethical guidelines were followed, the purpose and procedure of the study was explained to all participants. Written informed consent was obtained and confidentiality was maintained by using unique identification codes instead of personal identifiers. This study was conducted in three months (January - April 2026), which involves recruitment, data collection and statistical analysis in the order

2.4 Blood Sampling and Biochemical Analysis

Blood was collected by venipuncture into gel separator tubes, let to clot 15-20 minutes at room temperature and then centrifuged at 3000 rpm for 10 minutes to collect serum. Serum was either analysed straight off or stored at −20°C for later analysis. Biochemical analysis was carried out on the Selectra Pro M automated chemistry analyzer (ELITech Clinical Systems, VitalScientific, Netherlands) which is a spectrophotometric benchtop system that can process up to 180 photometric tests per hour. Two levels of quality control material were performed before patient samples and the analyzer was calibrated at the beginning of each session with calibrated materials provided by the manufacturer. All tests were repeated twice and the average of the two readings used for the results. ALT, ALP, bilirubin, total cholesterol and triglycerides were measured by using reagents (Elicit Diagnostics, Martin Dow Pharmaceuticals, Pakistan and Merck KGaA, Germany) and interpreted according to standard reference ranges: ALT up to 40 U/L, ALP up to 300 U/L, bilirubin up to 1.0 mg/dL, total cholesterol < 200 mg/dL, and triglycerides < 150 mg/dL.

Fig:2.4.1 ELITech Selectra Pro M


Fig:2.4.2 ELITech Reagent Rotor

2.5 Statistical Analysis

Data were collected in MS. Excel and analysed in SPSS. Descriptive statistics including frequency, percentage, mean, standard deviation, median and range were used to describe the sample. One-way ANOVA, independent-samples t-tests, Pearson correlation and chi-square tests were used to analyze associations between biochemical outcomes and dietary/lifestyle exposures as appropriate. Throughout the p values were taken

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as statistical significant if < 0.05. The general process of securing ethical clearance to statistical analysis is detailed in the Figure 1.

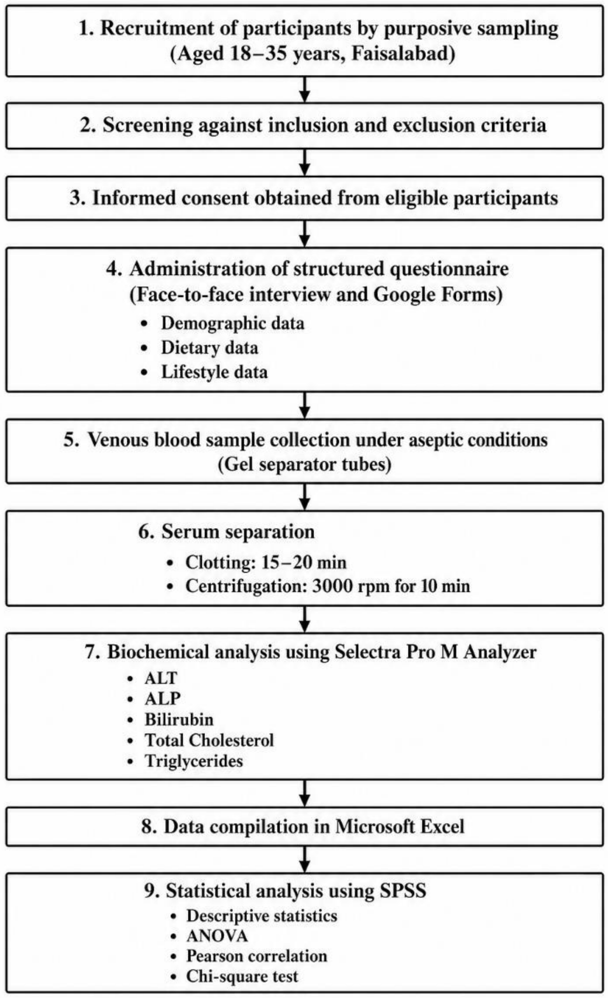

Figure 1. Sequential overview of the study methodology, from selecting participants to statistical analysis.

3. Results

Complete biochemical and questionnaire data were obtained from 150 participants. Females comprised the majority of the sample (78.7%), and the largest age subgroup was 18–25 years (48.7%), consistent with the study's focus on younger adults. Table 1 summarizes the demographic, dietary, and lifestyle profile of the sample.

Table 1. Demographic, dietary, and lifestyle characteristics of study participants (N = 150).

Variable	Category	n	%
Age group	18–25 years	73	48.7
Age group	26–30 years	40	26.7
Age group	31–35 years	37	24.7
Gender	Female	118	78.7

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Variable	Category	n	%
Gender	Male	32	21.3
Fast-food frequency	Rarely	45	30.0
Fast-food frequency	1–2 times/week	65	43.3
Fast-food frequency	3–4 times/week	30	20.0
Fast-food frequency	Daily	10	6.7
Diet type	Balanced	67	44.7
Diet type	High in fat	70	46.7
Diet type	Low in fat	13	8.7
Physical activity	Yes	42	28.0
Physical activity	No	108	72.0
Family history of liver disease	Yes	17	11.3
Family history of liver disease	No	133	88.7

The majority ate fast food 1-2 times a week (43.3%) and almost half reported eating foods high in saturated fat (46.7%). A high proportion of people were physically inactive (72.0%) and 11.3% had a family history of liver disease, which suggests a genetic susceptibility in addition to the dietary exposure investigated. The consumption of fried foods was broadly parallel to that of fast foods, with 40.0% of the respondents frying their foods once or twice a week and another 16.0% thrice or four times. More than one third of the sample (33.3%) reported the regular use of energy drinks, adding another hepatotoxic and stimulant stress to a high fat diet pattern, and over half reported at least one symptom potentially related to hepatobiliary disturbance (61.0%, fatigue, abdominal discomfort and/or jaundice-like changes). By contrast, smoking was rarely seen in these individuals (3.3%), and the biochemical signal seen here is therefore unlikely to be markedly confounded by smoking

Table 2 shows descriptive statistics for the five biochemical markers. Mean ALT was 37.12 ± 17.12 U/L and mean ALP was 258.83 ± 116.30 U/L, while mean total cholesterol and triglycerides were 185.49 ± 85.35 mg/dL and 186.98 ± 89.55 mg/dL, respectively. The high variability in the values observed for ALP, cholesterol and triglycerides, with maximal levels exceeding by far the upper reference limits, suggests that a sub-population of the participants had a significantly higher biochemical burden than the sample-average values.

Table 2. Descriptive statistics of liver enzymes and lipid profile parameters (N = 150).

Parameter	Mean	SD	Median	Minimum	Maximum
ALT (U/L)	37.12	17.12	35.50	18.00	140.00
ALP (U/L)	258.83	116.30	218.50	17.00	740.00
Bilirubin (mg/dL)	1.09	0.74	0.80	0.50	6.10
Cholesterol (mg/dL)	185.49	85.35	180.00	92.00	960.00

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Parameter	Mean	SD	Median	Minimum	Maximum
Triglycerides (mg/dL)	186.98	89.55	160.00	60.00	590.00

Each marker was compared with its standard reference interval (Table 3; Figure 2), triglycerides were the most common out of the normal range, with 42.0% of the participants exceeding the upper limit of the normal range significantly more than the percentage that exceeded the upper limit of the normal range for ALT (28.7%) and for cholesterol (27.3%). Of the 118 participants who had complete status labelling, ALP and bilirubin status was high in 28.8% and 26.3% respectively.

Table 3. Distribution of biochemical marker status against standard reference ranges.

Marker	Normal n (%)	High n (%)	Valid N
ALT	107 (71.3%)	43 (28.7%)	150
ALP[1]	84 (71.2%)	34 (28.8%)	118
Bilirubin[1]	87 (73.7%)	31 (26.3%)	118
Cholesterol	109 (72.7%)	41 (27.3%)	150
Triglycerides	87 (58.0%)	63 (42.0%)	150

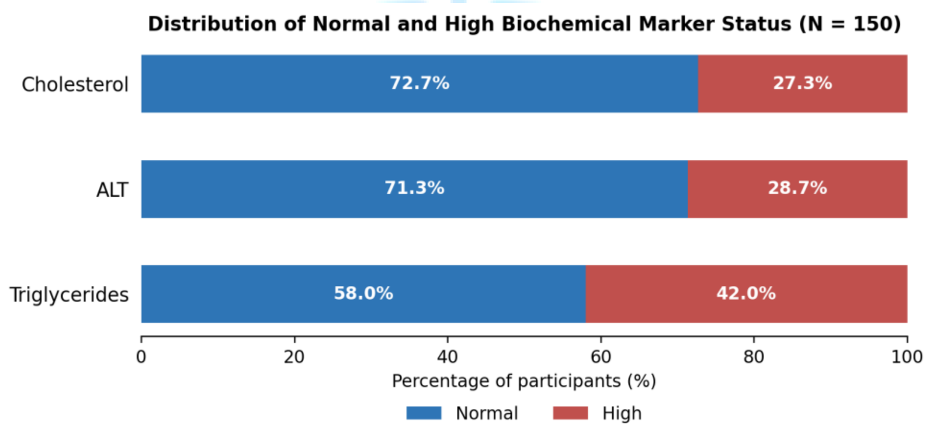

Figure 2. Proportion of participants with normal versus high status for ALT, cholesterol, and triglycerides. ([1]ALP and bilirubin status reflect 118 participants with complete status labelling.)

The relationship between frequency of fast food eaten and abnormal/risk classification was found to be statistically significant, strong, and positive (χ^2 = 16.794, df = 3, p = 0.0008; Table 4). Overall, the percentage at risk and the percentage of abnormal participants increased in a dose-response manner, from 37.8% of those who consumed fast food rarely to 70.8% of those who consumed fast food 1–2 times per week, 66.7% of 3–4 times per week, and 90.0% of those who consumed fast food daily (Table 1), suggesting a dose–response relationship and therefore supporting the alternative hypothesis when examining the overall risk category, even if not all individual biochemical markers demonstrated this pattern.

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Table 4. Association between fast-food consumption frequency and overall abnormal/risk classification.

Fast-food frequency	Total N	Normal n (%)	Abnormal/risk n (%)
Rarely	45	28 (62.2%)	17 (37.8%)
1–2 times/week	65	19 (29.2%)	46 (70.8%)
3–4 times/week	30	10 (33.3%)	20 (66.7%)
Daily	10	1 (10.0%)	9 (90.0%)

When individual lifestyle and dietary exposures were tested against each of the biochemical markers individually, four were found to be statistically significant (Table 5). The physical inactivity was significantly associated with higher levels of ALT ($t = -3.161$, $p = 0.0020$) which indicated that the mean ALT concentration was high among those participants who were not physically active. The mean ALP and bilirubin levels were significantly higher in high-fat dietary pattern groups than in balanced or low-fat dietary pattern groups, as indicated by the dietary pattern groups for both ALP ($F = 6.981$, $p = 0.0013$) and bilirubin ($F = 4.250$, $p = 0.0161$). Fried food consumption frequency was significantly correlated with bilirubin ($F = 3.073$, $p = 0.0297$), suggesting an important contribution of the habits of frying food beyond the consumption of fast food.

Table 5. Statistically significant associations between dietary/lifestyle factors and individual biochemical markers.

Factor	Outcome	Test	Statistic	p-value
Physical activity	ALT	Independent t-test	t = -3.161	0.0020
Diet type	ALP	One-way ANOVA	F = 6.981	0.0013
Diet type	Bilirubin	One-way ANOVA	F = 4.250	0.0161
Fried-food frequency	Bilirubin	One-way ANOVA	F = 3.073	0.0297

There were several statistically significant correlations between biochemical variables, as shown in Table 6 and in Figure 3. There was a strong positive correlation between the important lipid markers, total cholesterol and triglycerides ($r = 0.600$, $p < 0.0001$). ALT had a moderate correlation with bilirubin ($r = 0.415$, $p < 0.0001$) and ALP had a moderate correlation with bilirubin ($r = 0.404$, $p < 0.0001$) suggesting a hepatobiliary process link between these markers. ALP was negatively correlated with triglycerides ($r = -0.227$, $p = 0.0052$), but the correlation was weak. A positive correlation between ageing and mean lipid levels was observed in the youngest age group, with small but statistically significant negative correlations having been found for cholesterol ($r = -0.211$, $p = 0.0094$) and triglycerides ($r = -0.200$, $p = 0.0142$).

Table 6. Statistically significant Pearson correlations among biochemical variables.

Variables	Pearson r	p-value
Cholesterol vs Triglycerides	0.600	< 0.0001
ALT vs Bilirubin	0.415	< 0.0001

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Variables	Pearson r	p-value
ALP vs Bilirubin	0.404	< 0.0001
ALP vs Triglycerides	-0.227	0.0052
Age vs Cholesterol	-0.211	0.0094
Age vs Triglycerides	-0.200	0.0142

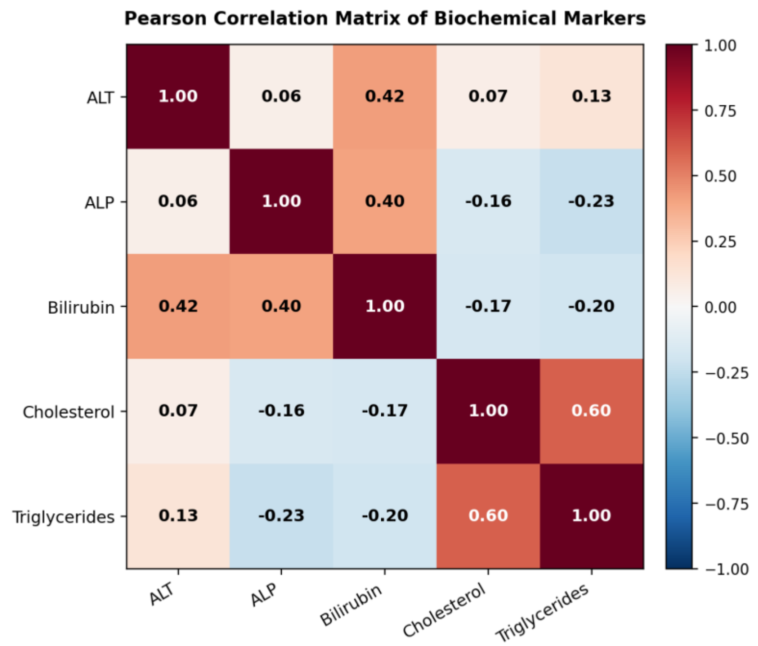

Figure 3. Pearson correlation matrix of liver enzyme and lipid profile parameters.

Beyond the individual markers, biochemical risk classification identified 12.0% of participants (n = 18) as showing a biochemical profile consistent with risk of NAFLD, and 17.3% (n = 26) as showing indicators of cardiovascular risk — findings that, while based on a modest absolute number of cases, are clinically notable given the young, otherwise healthy composition of the study sample.

4. Discussion

The aim of this study was to find out if there was any correlation between liver enzyme and lipid profile abnormalities in young healthy males of the city of Faisalabad who consume fast food on regular basis. The higher the rate of eating fast food, the higher the biochemical risk status was ($\chi^2 = 16.794$, p = 0.0008), with abnormal/risk status rising from 37.8% in the rare fast-food consumers to 90.0% in the daily fast-food consumers. This dose-dependent trend corroborates the findings of Partisa et al. (2025) which showed that frequency of eating fast food had a significant association with high cholesterol in Indonesian students (p = 0.008). These results confirm evidence of repeated fast-food consumption contributing to early metabolic risk (Khatatbeh, 2021; Rafid et al., 2025).

Low levels of physical activity also were a significant risk factor. Levels of ALT were significantly elevated in inactive participants (t = -3.161, p = 0.002); 72.0% of all participants indicated that they did not exercise regularly. Inconsistent results have been found by Haider et al., (2024) which showed that a high prevalence of physical inactivity was seen among medical students and a correlation with poor lipid profile. Less exercise leads to less clearance of lipid from

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the liver and more deposition of triglyceride in the liver, which increases liver damage (Haider, 2024). Liver biomarker had the strongest independent association with diet type. High fat diets showed a significant relationship with high ALP ($p = 0.0013$) and bilirubin ($p = 0.0161$) levels, which is consistent with the results obtained by Hodson et al. (2020) that saturated fat loaded diets correlate with increased hepatic fat content independent of caloric intake. The findings indicate that chronic consumption of high-fat diets can lead to a dysfunction of hepatobiliary before the onset of liver disease.

Bilirubin ($p = 0.0297$) was significant and negatively associated with fried food consumption. This is in line with Grootveld et al. (2020), who showed that lipid oxidised products produced during high-temperature frying can cause hepatic injury. Based on the present findings, the authors suggest that frying practices can be considered as potential independent source of liver stress in young adults, based on the biochemical evidence.

This was confirmed by the correlation analysis. Triglycerides had a significant positive correlation with total cholesterol ($r = 0.600$, $p < 0.0001$) as both are used for hepatic lipid metabolism, which is stimulated by the consumption of saturated fat (Byrd, 2022). ALT levels moderately correlate with bilirubin ($r = 0.415$) and ALP levels moderately correlate with bilirubin ($r = 0.404$), suggesting concurrent hepatocellular and biliary stress, which is similar to the findings of young Pakistani adults (Ahmad, 2023). It is likely that the weak negative correlations of age with lipid markers are due to higher consumption of fast food by younger participants.

The study involved also finding clinically relevant risk indicators, 12.0% of which had biochemical risk of NAFLD and 17.3% had cardiovascular risk. The results are consistent with the systematic review by He (2025), which showed the association between fast-food consumption and NAFLD/MASLD, indicating that metabolic abnormalities occur before the onset of clinical disease. Likewise, Donat-Vargas et al. (2021) and Sari (2025) linked ultra-processed food consumption to dyslipidemia and low physical activity, which are also similar to the behaviour of this cohort.

As a whole, these results are in line with Geladari (2025) and allow to maintain a multifactorial approach in which frequent consumption of fast-food, high fat diet, fried-food, and physical inactivity are associated together to create an early metabolic risk. Some individual biochemical variables were not associated with fast-food consumption separately; however, the composite risk index revealed a clear dose-response relationship, indicating that a combination of risk assessment may be more effective in identifying early metabolic dysfunction in young adults.

4.1 Implications for Dietary Modification and Risk Reversal

The results imply that early biochemical disturbances caused by eating fast food can be corrected by changing the diet. Mediterranean-style diets were found to have a significant effect in reducing liver stiffness, cholesterol and central obesity in NAFLD patients (Musazadeh et al., 2022), and citrus flavonoids have been shown to have cholesterol-lowering and anti-inflammatory properties (Del Bo' et al., 2023). Likewise, probiotic meta-analyses by Akiyama et al. (2009) and thereafter showed a decrease in ALT, AST, and GGT after dietary interventions. A combination of these studies suggests that the diet-related abnormalities observed in the present studies are modifiable. Cooking methods are also highlighted as an important factor, based on the evidence. These studies are in agreement with the mechanism proposed by Grootveld et al. (2020), as repeated frying and hydrogenation was demonstrated to exacerbate lipid oxidation and formation of trans fats in food chain by Harlina et al. (2024). Therefore, the consumption of grilled, baked or boiled foods may be associated with lower liver and cardiovascular risk.In addition to lipid abnormalities, frequent fast food intake was correlated with elevated diastolic blood pressure, indicating cardiovascular effects can manifest prior to clinical symptoms, in young adults, according to Alsabie et al. (2019). Overall, Wu et al. (2021) noted that there is a need for population-level dietary counseling and

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environmental strategies to limit the availability of fast food. In universities, regular screening of liver enzymes and lipids together with counselling on healthier food and physical activity can be effective way to prevent young Pakistani adults.

4.2 Limitations

There are several limitations of this study. Due to its cross-sectional design, it was not possible to draw causal inferences because dietary exposure and biochemical outcome were simultaneously measured. The majority of the sample consisted of females (78.7%) which limited generalizability and only 10 participants consumed fast-food daily, resulting in a limited statistical power. Higher sample size, gender balanced samples, and prospective designs and direct measurement of dietary fatty acids should be used in further research to bolster the evidence.

5. Conclusion

A significant positive association was observed between frequency of fast-food consumption and the overall abnormal biochemical status where 37.8% of the rare consumers of fast food had abnormal biochemical status as compared to 90.0% of the frequent consumers ($\chi^2 = 16.794$, $p = 0.0008$). High fat foods were the most well-established modifiable factor, significantly increasing ALP and ALT, with the frequency of fried foods also having a significant association with bilirubin. Lipid abnormalities were also strongly correlated with one another, with a strong positive correlation between cholesterol and triglycerides ($r = 0.600$, $p < 0.0001$). The high prevalence of biochemical risk of NAFLD (12.0%) and of cardiovascular risk indicators (17.3%) highlights the fact that hepatic and lipid disturbance may be present well before middle age or clinical obesity. Biochemical screening should be a simple, low-cost part of public health interventions for young urban populations, along with dietary counselling to avoid eating fried food and high-fat foods and to increase physical activity.

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