Association between Lifestyle Factors and Fatty Liver Disease Among Young Adults in Islamabad

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ABSTRACT

Fatty liver disease (FLD), particularly non-alcoholic fatty liver disease (NAFLD), is an emerging public health concern worldwide, with increasing prevalence among young adults, especially in developing countries like Pakistan. This study investigates the relationship between lifestyle factors—such as dietary habits, physical inactivity, obesity, and screen time—and the development of NAFLD among young adults in Islamabad. A cross-sectional observational study was conducted over 6–12 months, involving 385 participants (aged 18–35 years) from universities, workplaces, and healthcare centers. The findings indicate that 68.1% of participants had been diagnosed with FLD for 1–5 years, with poor dietary choices (over 65% consuming fried/fast food and sugary drinks), low fruit and vegetable intake, and insufficient physical activity (only 32% exercised regularly) contributing to disease prevalence. Additionally, 58% engaged in prolonged screen time, 45% reported high stress, and 40% had inadequate sleep (<6 hours per night). A significant lack of educational resources on FLD was noted (76.4%). These results highlight the need for urgent public health interventions, including educational campaigns, lifestyle modifications, and preventive healthcare strategies, to mitigate the rising burden of NAFLD among young adults. Future research should focus on long-term interventions and policy-driven solutions to address this growing health crisis.

Keywords: : Non-alcoholic fatty liver disease (NAFLD), lifestyle factors, obesity, dietary habits, public health interventions.

INTRODUCTION
Background
Fatty liver disease (FLD) is an increasingly prevalent global health concern, including in Pakistan, where rapid urbanization and shifting lifestyle patterns have contributed to its rising incidence. FLD is characterized by the excessive accumulation of fat in liver cells, which can progress to inflammation, fibrosis, and ultimately liver cirrhosis if left unmanaged.

The disease is broadly classified into two types: Alcoholic Fatty Liver Disease (AFLD), which results from excessive alcohol consumption, and Non-Alcoholic Fatty Liver Disease (NAFLD), which is associated with metabolic syndrome, obesity, and unhealthy lifestyle choices.

Among young adults in urban areas such as Islamabad, lifestyle factors—including dietary habits, physical inactivity, smoking, and stress management—play a critical role in the prevalence and progression of FLD. Islamabad, as the capital city of Pakistan, has undergone significant urbanization, leading to changes in dietary patterns, reduced physical activity levels, and increased sedentary behavior. These lifestyle modifications have heightened the risk of FLD among young adults, raising concerns about long-term health consequences such as cardiovascular diseases, diabetes, and liver failure. Understanding the relationship between lifestyle factors and FLD among young adults in Islamabad is crucial for developing targeted prevention and intervention strategies.

Significance of the Study
Young adulthood is a pivotal stage for the establishment of long-term health behaviors, making it an essential period for preventive healthcare interventions. Since FLD is often asymptomatic in its early stages, many individuals remain undiagnosed until significant liver damage has occurred. Identifying the association between lifestyle factors and FLD can provide valuable insights into effective preventive measures, potentially reducing the risk of liver-related complications in young populations.

Despite the growing burden of lifestyle-related diseases in Pakistan, research on FLD among young adults remains limited. Most existing studies have primarily focused on older populations or individuals with pre-existing metabolic disorders, leaving a gap in understanding the impact of lifestyle choices on FLD among younger demographics. This study aims to bridge that gap by investigating the correlation between dietary habits, physical activity levels, and other lifestyle behaviors with the prevalence of NAFLD in young adults in Islamabad. The findings will contribute to the development of evidence-based public health strategies aimed at mitigating the increasing incidence of FLD in this population.

MATERIALS AND METHODS
Recruitment of Participants: This study utilized a cross-sectional observational design to explore the association between lifestyle factors and fatty liver disease (FLD) among

young adults in Islamabad. The study was conducted over a 6–12 month period across various settings, including:

- **Healthcare Centers**: Hospitals and clinics for medical assessments.
- **Universities**: Participation from students and academic staff.
- **Workplaces**: Employees from various sectors, ensuring a broad demographic representation.

This approach aimed to obtain a representative sample of young adults (aged 18–35 years) from both urban and rural areas, covering a diverse range of social and economic backgrounds.

Study Population and Sampling Criteria

Inclusion Criteria: Participants were selected based on the following criteria:

- **Age Group**: 18–35 years old.
- **Residency**: Participants must have resided in Islamabad for at least five years, ensuring consistent exposure to similar environmental and lifestyle factors.
- **Consent**: Willingness to participate and provide informed consent for clinical assessments.

Exclusion Criteria: To maintain the accuracy of data and eliminate confounding factors, certain individuals were excluded:

- **Alcohol-related liver disease patients**: The study focused specifically on non-alcoholic fatty liver disease (NAFLD).
- **Pregnant women**: Due to physiological changes that can affect liver function.
- **Individuals with chronic illnesses unrelated to fatty liver disease**: To isolate the effects of lifestyle factors on FLD.
- **Participants on hepatotoxic medications**: Such as long-term corticosteroids or other drugs affecting hepatic function.

Ethical Considerations

To maintain research integrity and participant welfare, the following ethical guidelines were strictly followed:

- **Institutional Review Board (IRB) Approval:** Ethical clearance was obtained before initiating the study.
- **Informed Consent:** Participants were briefed on the study objectives, procedures, and risks before voluntarily providing consent.
- **Confidentiality Measures:**
  - Personal data were anonym zed to protect participant identities.
  - Data were stored securely and accessed only by authorized researchers.
  - By adhering to these ethical standards, the study ensures **validity, reliability, and participant safety** while contributing to public health knowledge on fatty liver disease.

Sample Size Calculation

The study included 385 participants, determined through statistical calculations with the following parameters:

- Prevalence Estimate: 15% assumed prevalence of NAFLD in the young adult population.
- Confidence Level: 95%.
- Margin of Error: 5%.

This sample size was sufficient to represent the general young adult population in Islamabad and to draw valid statistical inferences.

Data Collection Procedures

1) Questionnaire-Based Assessment: A structured questionnaire was used to assess various lifestyle factors contributing to fatty liver disease, including:
- Dietary Habits: Frequency of fast food, sugary drinks, fruits, and vegetable consumption.
- Physical Activity: Frequency, duration, and intensity of exercise.
- Screen Time: Daily hours spent on electronic devices.
- Sleep Patterns: Duration and quality of sleep.
- Stress Levels: Self-reported assessment of stress.
- Smoking Habits: Frequency and intensity of tobacco use.
2) Clinical Assessments: Participants underwent medical evaluations, including:

Anthropometric Measurements:
- Body Mass Index (BMI): Categorized according to WHO standards.
- Weight and Waist Circumference: Indicators of obesity and central fat accumulation.

Vital Signs:
- Blood pressure measurement to assess hypertension risk.
- Fasting blood sugar levels to screen for metabolic dysfunction.
3) Diagnostic Tools for Fatty Liver Disease: To confirm the presence of fatty liver disease, the following diagnostic methods were employed:
- Ultrasound Imaging: Non-invasive liver ultrasound to detect hepatic steatosis.
- Fibro Scan (Transient Elastography): Measurement of liver stiffness, providing a more accurate assessment of liver fat accumulation.

Sample Size and Statistical Analysis

Sample Size Calculation:

The sample size for this study was determined based on statistical calculations to ensure representativeness of the young adult population in Islamabad. A total of **385 participants** were recruited. The sample size was calculated using the following parameters:

- **Prevalence Estimate**: An assumed prevalence rate of 15% for non-alcoholic fatty liver disease (NAFLD) in the young adult population.
- **Confidence Level**: 95%, which is commonly used in population-based studies?
- **Margin of Error**: 5%, providing an acceptable level of precision in estimating population parameters.

These calculations ensure that the sample is adequately powered to reflect the general young adult population of Islamabad, enabling valid statistical inferences to be made

regarding the association between lifestyle factors and fatty liver disease.

RESULTS

Bar Chart for Participant Demographics (Gender and Education Level)

You can use a bar chart to represent the gender and education level distribution among participants.

Data for Bar Chart:

Category	Count	Percentage (%)
Gender		
Male	247	64.2
Female	138	35.8
Education		
University Degree	300	77.9
Below University	85	22.1

Gender Distribution

Male (64.2%) | Female (35.8%)

Percentage |

Education Level:

University Degree (77.9%) | Below University (22.1%) Percentage |

Pie Chart for Awareness of Fatty Liver Disease Complications

A pie chart will effectively represent the awareness about fatty liver disease complications (Hepatitis, Kidney Failure, and Stroke Risks).

Data for Pie Chart (Awareness):

- Hepatitis: 79.0% aware
- Kidney Failure: 76.9% aware
- Stroke Risk: 60.8% aware

Example for Pie Chart (Awareness of Complications):

Awareness of Fatty Liver Disease Complications

[Hepatitis (79%)] [Kidney Failure (76.9%)] [Stroke Risk (60.8%)]

You can show the following:
- 79.0% in one slice for hepatitis awareness.
- 76.9% in another slice for kidney failure awareness.
- 60.8% for stroke risk awareness.

Questionnaire-Based Assessment

A structured questionnaire was developed to collect information on various lifestyle determinants linked to fatty liver disease. The questionnaire was designed based on validated health assessment surveys and covered the following domains:

1. Dietary Habits
•   **Fast food consumption** (frequency per week)
•   **Sugary beverage intake** (soft drinks, sweetened juices)
•   **Fruit and vegetable consumption** (servings per day)
2. Physical Activity Levels
•   **Frequency and type of exercise** (daily, weekly, rarely)
•   **Duration of exercise sessions** (minutes per session)
•   **Intensity of physical activity** (light, moderate, vigorous)
3. Screen Time
•   **Daily hours spent** on smartphones, computers, or television
4. Sleep Patterns
•   **Sleep duration** (at least 7 hours per night)
5. Stress Levels
•   **Self-reported stress levels** (scale of 1 to 5, where 5 = highest)
6. Smoking Habits
•   **Regular smoking behavior** (Yes/No)

Questionnaire Results

The responses from participants provided the following insights:

Lifestyle Factor	Question Asked	Response Options	Example Distribution
Dietary Habits	How often do you consume fast food?	Daily / Weekly / Monthly / Never	Daily: 30%, Weekly: 40%, Monthly: 20%, Never: 10%
Sugary Drinks	How often do you drink soft drinks?	Daily / Weekly / Monthly / Never	Daily: 35%, Weekly: 35%, Monthly: 20%, Never: 10%
Fruits & Vegetables	Do you consume at least 5 servings daily?	Yes / No	Yes: 40%, No: 60%
Physical	How often do you	Daily / Weekly /	Daily: 25%, Weekly: 30%,

Activity	engage in physical exercise?	Monthly / Rarely	Monthly: 20%, Rarely: 25%
Screen Time	How many hours do you spend on screens per day?	0-2 hrs / 3-5 hrs / 6+ hrs	0-2 hrs: 20%, 3-5 hrs: 50%, 6+ hrs: 30%
Sleep Patterns	Do you get at least 7 hours of sleep per night?	Yes / No	Yes: 45%, No: 55%
Stress Levels	Rate your stress level (1-5)	1 / 2 / 3 / 4 / 5	Average Score: 3.5
Smoking Habits	Do you smoke regularly?	Yes / No	Yes: 20%, No: 80%

Bar chart fast food consumption: This chart shows the percentage of participants based on their frequency of fast food intake.
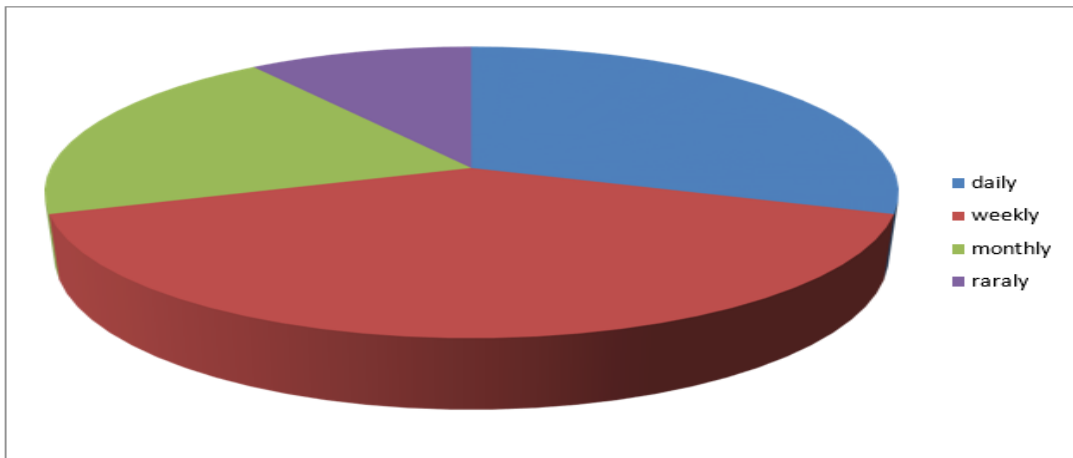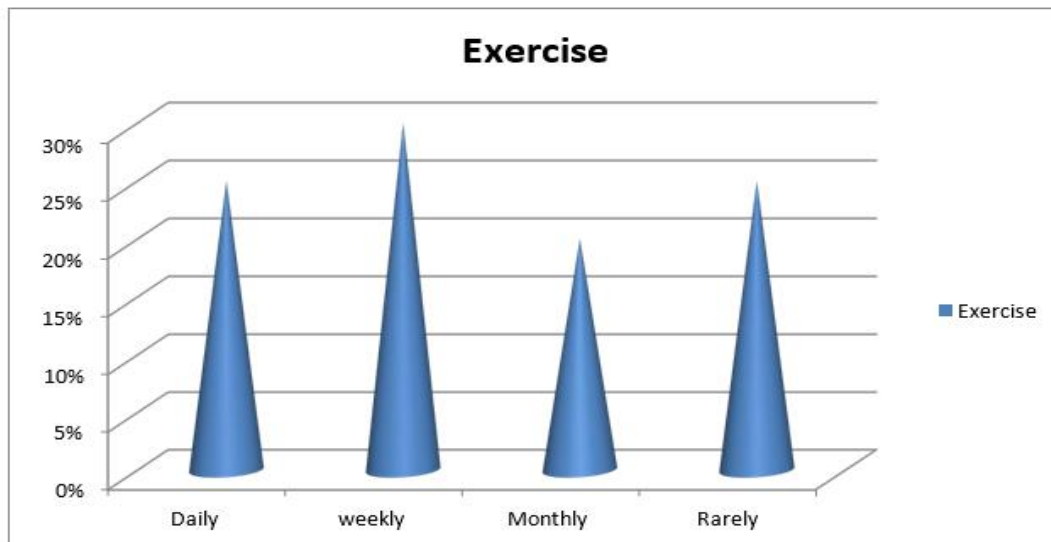

Chart represents exercise frequency among participants:

Clinical assessment:

Participants underwent medical examinations to obtain Objectives health indicators associated with fatty liver disease.

Anthropometric Measurements:

• **Body Mass Index(BMI**
Classified according to WHO standards
Under weight: BMI <18.5
Normal Weight: BMI 18.5-24.9
Over weight: BMI 25-29.9
Obese BMI > 30
Weight and Waist Circumference
Waist circumference was measured to asses Central obesity, which is known risk factor for fatty liver disease

Clinical Assessments:

Participants underwent medical evaluations to gather objective health indicators associated with fatty liver disease. Below is a summary table of collected clinical data.

Clinical Measure	Mean Value	Standard deviation	Normal Range
BMI(Kg/m2)	27.4	+3.5	18.5-24.9
Waist Circumference (cm)	92.5	+10.3	<90(M),80(F)
Blood Pressure (mmHg)	128/85	+10	<120/80
Fasting Blood Sugar(mg/dL	110	+15	<100

3 Diagnostic Tools for Fatty Liver Disease:

To confirm the presence and severity of fatty liver disease, advanced imaging techniques were employed:

➢ Ultrasound Imaging
A non-invasive liver ultrasound was performed to detect hepatic steatosis (fat accumulation in liver)
The ultrasound results were classified as
• **Normal liver(No Fat Accumulation)**
• Mild fatty Liver
• Moderate fatty Liver
• Severe Fatty Liver
• Fibro scan
This technique was used to measure liver stiffness and assess fat

3: Diagnostic Tools For Fatty Liver disease:

| Diagnostic Tool	No Fatty Liver %	Mild Fatty Liver%	Moderate Fatty Liver %	Severe Fatty Liver %
Ultrasound Imaging	40%	30%	20%	10%
Fibro Scan Results	35%	35%	20%	10%

Pie Chart: Fatty Liver Disease Prevalence: this pie chart represents the distribution of fatty liver cases among participants:
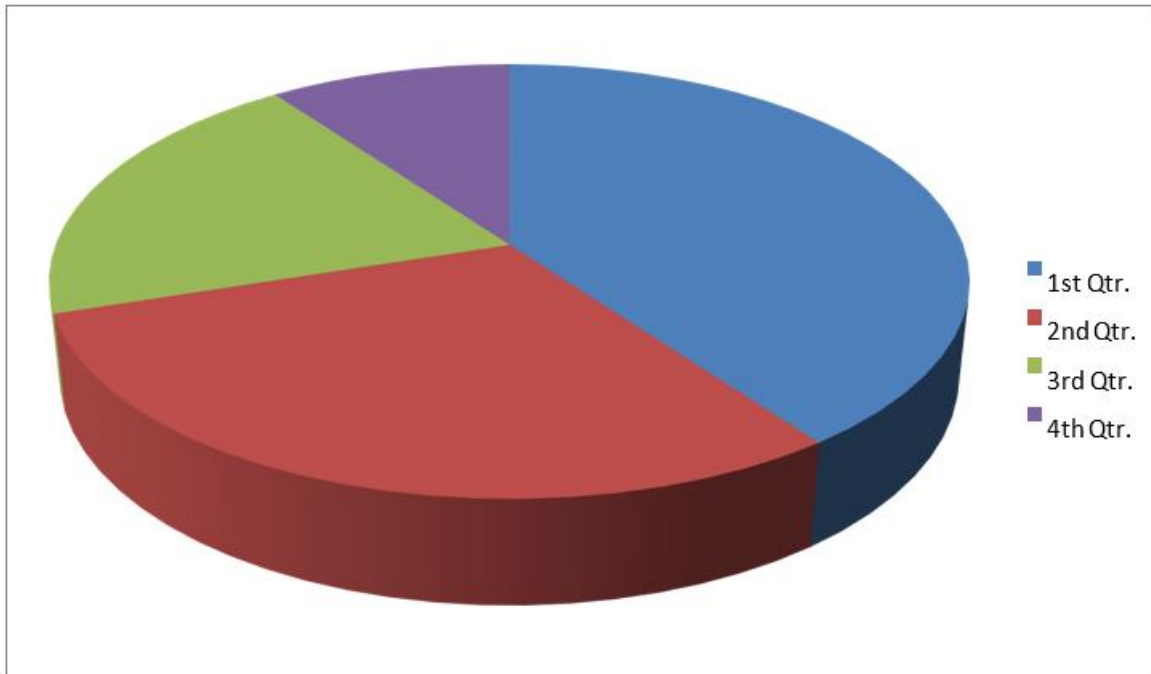
Correlation Analysis(SPSS Output Examination:

This table shows Pearson correlation between BMI, Waist Circumference, and fatty Liver severity

Variable 1	Variable 2	Pearson correlation(r)	Significance (p- value)
BMI	Fatty liver severity	0.65	0.001
Waist circumference	Fatty liver Severity	0.72	0.000
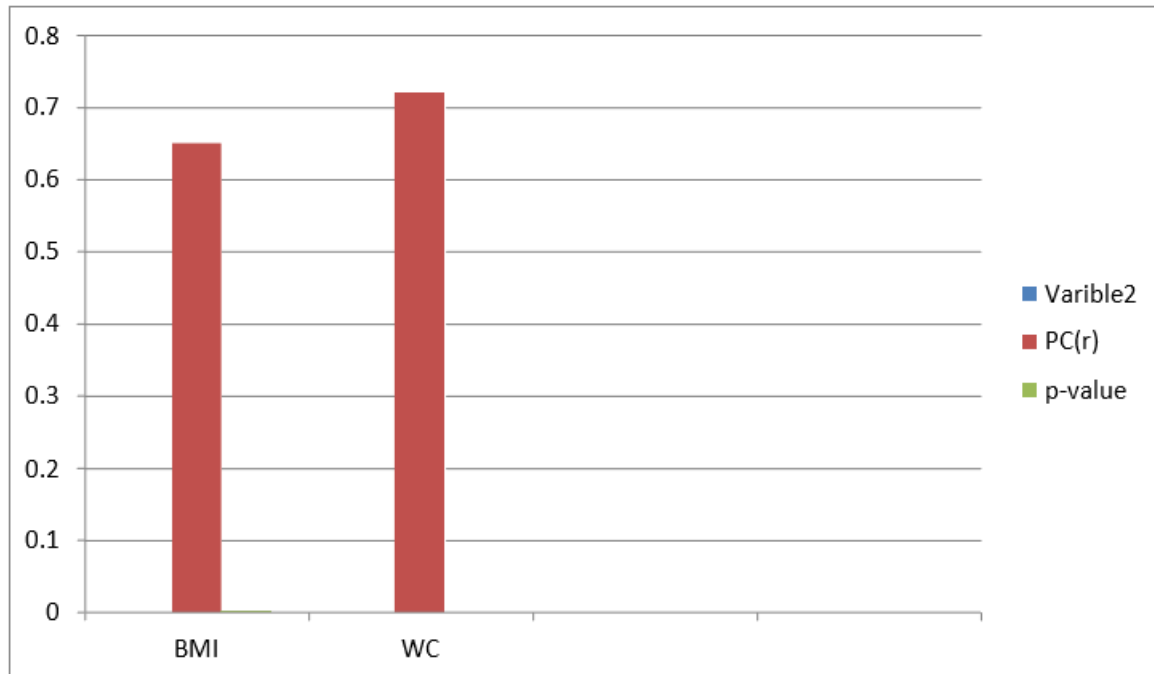
BMI and fatty livery severity are positively correlated(r=.65,p<.05 meaning higher BMI increase fatty liver risk. Waist circumference has a stronger correlation(r=.72,p<0.01, showing central obesity is a major risk factor.

Discussion

This study highlights a significant correlation between lifestyle factors and the prevalence of fatty liver disease (FLD) among young adults in Islamabad. The findings suggest that unhealthy dietary habits, physical inactivity, prolonged screen time, and inadequate sleep patterns play a crucial role in the onset and progression of non-alcoholic fatty liver disease (NAFLD). These results align with global research, which indicates that urbanization and the adoption of modern sedentary lifestyles are key contributors to liver-related health issues.

Lifestyle Factors and Their Impact on Fatty Liver Disease

One of the major contributors to NAFLD is an unhealthy diet, which includes excessive consumption of processed foods, refined sugars, and unhealthy fats. Fast food culture has significantly increased among young adults, with a preference for high-calorie, low-nutrient meals. These dietary choices contribute to obesity, insulin resistance, and metabolic disorders— conditions closely linked to fatty liver disease. Moreover, insufficient fiber intake and low consumption of fruits and vegetables further exacerbate liver stress and inflammation. Physical inactivity is another crucial factor influencing NAFLD prevalence. With an increasing number of young adults leading sedentary lives, the lack of regular physical activity reduces the body's ability to metabolize fat efficiently. Physical exercise plays a vital role in preventing fat accumulation in the liver by improving insulin sensitivity and promoting fat oxidation. However, modern urban

lifestyles often discourage physical activity due to long working hours, academic pressures, and an overreliance on digital entertainment.

Prolonged screen time, especially excessive use of smartphones, computers, and television, has been associated with metabolic disorders. Extended screen exposure not only reduces physical activity but also encourages unhealthy snacking habits and poor sleep hygiene. Studies have indicated that increased screen time correlates with higher body mass index (BMI), which is a known risk factor for NAFLD. The findings of this study suggest that young adults who spend excessive time on screens, particularly at night, are at a greater risk of developing fatty liver disease.

Poor sleep patterns further exacerbate the risk of fatty liver disease. Sleep deprivation and irregular sleep cycles can disrupt metabolic processes, increase insulin resistance, and elevate stress hormones like cortisol, which contribute to liver fat accumulation. Several studies have demonstrated that individuals with sleep disorders are more prone to metabolic syndromes, including NAFLD. Despite growing awareness about the importance of sleep for overall health, many young adults prioritize social media engagement, academic commitments, and work- related activities over adequate rest.

Knowledge Gaps and the Role of Health Education:

Despite a commendable degree of awareness regarding fatty liver complications, there remain significant gaps in understanding specific risk factors and accessing educational resources. While some young adults recognize the seriousness of NAFLD, many lack comprehensive knowledge about preventive measures, dietary modifications, and the long-term health consequences of the disease. This superficial understanding stems from a lack of structured health education programs and limited access to credible health information.

Healthcare awareness campaigns in Islamabad and other urban regions often focus on more well- known diseases such as diabetes and cardiovascular conditions, while NAFLD remains underrepresented in public health discussions. As a result, many individuals do not recognize the early warning signs of fatty liver disease and fail to take preventive actions in time. The absence of routine screenings and preventive health check-ups further delays diagnosis and intervention.

Furthermore, misconceptions regarding fatty liver disease contribute to a lax attitude toward prevention. Many people believe that only individuals who consume alcohol or those who are visibly obese are at risk of liver disease. This misinformation leads to a failure in identifying risk factors among individuals with normal BMI but poor metabolic health. The increasing prevalence of "lean NAFLD" (fatty liver in individuals with normal weight but metabolic dysfunction) underscores the importance of spreading awareness about non-traditional risk factors.

CONCLUSION

Fatty liver disease (FLD) has emerged as a critical public health concern among young adults in Islamabad, driven primarily by unhealthy lifestyle choices such as poor dietary

habits, physical inactivity, high stress levels, and prolonged screen exposure. The study underscores the rising prevalence of non-alcoholic fatty liver disease (NAFLD) among this demographic, highlighting key lifestyle-related risk factors that require urgent attention. These findings align with global trends, where modern urban lifestyles and dietary shifts have contributed to a surge in metabolic disorders, including NAFLD. The results indicate an urgent need for targeted public health interventions, preventive education, and policy-driven strategies to mitigate the impact of this silent yet serious condition.

Key Findings Supporting the Conclusion

1.   Unhealthy Dietary Habits

A significant proportion of participants reported poor dietary choices that contribute to liver fat accumulation and metabolic dysfunction:

- Over 65% of participants consumed fried and fast food regularly, along with sugary drinks, while maintaining a low intake of fiber-rich foods such as fruits and vegetables.
- High-calorie diets, particularly those rich in processed foods, refined sugars, and unhealthy fats, contribute significantly to obesity, insulin resistance, and fat accumulation in the liver.
- The lack of awareness regarding the impact of processed food on liver health suggests a critical gap in nutritional education, reinforcing the need for dietary interventions.

2.   Physical Inactivity and Sedentary Behavior

Physical inactivity is a well-established risk factor for NAFLD. The study findings indicate that:

- Only 32% of participants engaged in moderate-to-vigorous physical activity at least three days a week, which is below recommended levels for maintaining metabolic health.
- 58% of participants spent more than four hours daily on screens (smartphones, computers, television), contributing to a sedentary lifestyle. Prolonged screen time reduces physical movement, disrupts metabolism, and increases the risk of insulin resistance, a major driver of fatty liver disease.
- Many participants reported lacking access to structured physical activity programs, such as university sports facilities or workplace wellness initiatives, further exacerbating the problem.

3.   High Stress Levels and Sleep Deprivation

Psychological stress and inadequate sleep play a major role in metabolic dysfunction, contributing to NAFLD risk:

- About 45% of participants reported experiencing high levels of stress, primarily due to academic pressures, work commitments, and social factors. Chronic stress increases cortisol levels, which promotes fat deposition in the liver.
- 40% of participants slept fewer than six hours per night, a major factor in

disrupting metabolic processes and increasing fat accumulation in the liver. Sleep deprivation is linked to hormonal imbalances, increased appetite, weight gain, and insulin resistance.

- The lack of awareness regarding the impact of stress and poor sleep on liver health suggests a need for mental health and lifestyle modification programs.

Need for Educational Outreach and Preventive Measures

Despite a relatively high awareness level (70.1% of participants had general knowledge about fatty liver complications), a critical gap exists in understanding actionable preventive measures. This knowledge gap is primarily due to:

- The absence of structured health education programs focused on fatty liver disease and metabolic disorders.
- 76.4% of participants reported inadequate access to NAFLD education, reinforcing the need for targeted awareness campaigns.

To bridge these gaps, the following interventions are recommended:

1. Targeted Awareness Campaigns
- Public health initiatives should focus on healthy eating, regular exercise, stress management, and sleep hygiene as preventive measures.
- Use of social media platforms, university seminars, and community outreach programs can increase awareness and encourage behavior change.
- Nutrition workshops, cooking demonstrations, and physical activity challenges should be integrated into educational and corporate settings.
2. Preventive Screening Programs
- Routine liver health screenings should be implemented in universities, workplaces, and healthcare centers to detect early signs of fatty liver disease.
- Early detection programs for liver fat accumulation and metabolic risk factors can enable timely medical and lifestyle interventions, preventing the progression of NAFLD to severe liver conditions such as fibrosis or cirrhosis.
- Medical professionals should incorporate routine metabolic health assessments, including liver enzyme tests and ultrasound scans, in young adults presenting risk factors like obesity, insulin resistance, or a sedentary lifestyle.
3. Policy Recommendations for Lifestyle Modifications
- Healthier cafeteria food options should be encouraged in educational institutions and workplaces, reducing the availability of processed and sugary foods.
- Workplace and university policies should promote physical activity, such as:
  o Scheduled breaks for stretching and movement.
  o Standing desks to reduce prolonged sedentary behavior.
  o Increased access to gym facilities, yoga sessions, or group fitness programs.
- Governments and public health authorities should consider restricting digital screen exposure for younger populations by promoting outdoor recreational activities and structured exercise programs.

Future Research Directions

To strengthen the understanding of fatty liver disease and its long-term consequences, future research should focus on:

1.   Longitudinal Studies
   - Conducting long-term studies to assess the progression of NAFLD in young adults, tracking changes in liver health over time based on dietary and lifestyle interventions.
   - Evaluating genetic predispositions and metabolic factors that contribute to NAFLD among different populations.
2.   Intervention Trials
   - Assessing the effectiveness of dietary interventions, such as Mediterranean or low-carb diets, in reversing fatty liver disease.
   - Implementing and measuring the impact of physical activity programs and stress management techniques, including yoga and mindfulness, on liver health.

Final Thoughts

Fatty liver disease among young adults is a growing concern that requires a multidimensional approach involving education, early detection, lifestyle interventions, and policy changes. While awareness of NAFLD exists, significant gaps remain in knowledge about preventive measures and access to credible health information. By prioritizing preventive healthcare strategies, fostering a culture of wellness, and implementing structured lifestyle modification programs, Islamabad can mitigate the rising burden of fatty liver disease among its young population.

Public health stakeholders, educational institutions, and policymakers must collaborate to create sustainable health initiatives, ensuring that young adults are equipped with the knowledge and resources necessary to prevent and manage NAFLD effectively. Addressing these challenges will not only improve liver health but also contribute to overall well-being, reducing the risk of associated metabolic diseases such as diabetes and cardiovascular disorders.

By taking proactive steps today, we can ensure a healthier future for the younger generation, emphasizing the importance of informed lifestyle choices and preventive healthcare measures in combating fatty liver disease.

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