



A Cross-Sectional Study on the Relationship Between Timing of Food Intake and Non-Alcoholic Fatty Liver Disease

Radhika Hari¹, Marikutty², P V Giri³

1. PG Scholar, Department of Kayachikitsa, Vaidyaratnam Ayurveda College
2. Associate Professor, Department of Kayachikitsa, Vaidyaratnam Ayurveda College
3. Professor & HOD, Department of Kayachikitsa, Vaidyaratnam Ayurveda College

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Corresponding author-

Radhika Hari, PG Scholar,
Department of Kayachikitsa
Vaidyaratnam Ayurveda College,
Thaikkattussery, Thrissur, Kerala

Email: nightingalebhrs@gmail.com

ABSTRACT:

Background & Objective: Nowadays, Non-alcoholic fatty liver disease (NAFLD) is becoming the most common liver disease worldwide. In a recent study from the United States (US), the increase in liver mortality was associated with an increased prevalence of non-alcoholic fatty liver disease. It is considered as a *Santarpanajanya Vadhi* as per *Ayurvedic* literature. Dietary factors are one of the primary causes for the manifestation of NAFLD. Food timing also matters in the course of disease development. *Ayurvedic* literature strictly laid down on certain principles and one among them is the *Aaharavidhi Vidhanam*. It clearly explains the need for taking the food in right time and in the right amount. This study aims to establish the relationship between the timing of food and NAFLD. **Methodology:** A cross-sectional study was conducted among the 30 participants visiting the *Kayachikitsa* OPD of Vaidyaratnam Ayurveda College, Ollur diagnosed with NAFLD and enquired about their timing of food.

Results & Discussion: Among the 30 participants, 76.7% had irregular food habits in which 68.8% belong to female and 85.7% to male. The odds of irregular food habits in females are more than those in males who are diagnosed with NAFLD, but the p value 0.399 indicates there is no significant gender wise priority while analysing the relation between time of food and NAFLD.

Conclusion: This study establishes a positive relationship of time of food intake and NAFLD ie, those who are taking food at an irregular time is tend to develop NAFLD

Keywords: Non-alcoholic fatty liver disease, *Santarpanajanya Vyadhi*, *Aaharavidhi Vidhanam*

INTRODUCTION

Metabolism is a complex process by which energy is produced in our body from the foods and drinks that we consume. The liver is an important organ that takes part in the process of fat metabolism, protein metabolism, and carbohydrate metabolism. In addition, it removes the toxic

substances from the body.

Non-Alcoholic Fatty Liver Disease (NAFLD) is considered as the liver component of the metabolic syndrome and can be defined as the group of conditions where there is an accumulation of excess fat in the liver of



those people who drink little or no alcohol.¹ It is the most common cause of chronic liver disease, especially in Western countries. It stuck around one-third of adults, i.e. about 1 billion individuals worldwide². The prevalence of NAFLD is much higher in patients with obesity and diabetes, about 70% to 90% in statistics. People with simple steatosis are included under NAFLD and are not at higher risk of death but its progression to Non-Alcoholic Steatohepatitis (NASH) are at higher risk of death, mainly due to cardiovascular, malignancy and liver-related causes. By 2030, NAFLD is expected to be the main reason for liver transplantation worldwide.

The etiology of NAFLD can be classified as primary as well as secondary causes and are described in the Table 1. Among them, obesity and type 2 diabetes mellitus are the major risk factors. Food timing is yet another important aspect resulting in adverse metabolic outcomes³ The observational and experimental studies carried out by Beccuti *et al.* concluded the association between meal timing, weight gain, hyperglycemia and diabetes mellitus with benefits deriving from an early intake of food in the day in a wide range of individuals⁴. Also skipping the morning and midday meals is found to increase the odds of sonographic steatosis by 20% and 73%, respectively⁵. Calorically heavier dinners are also associated with 40% less weight loss, 50% lower reduction in waist circumference, 42% lower reduction on HOMA-IR, and 15% increase in triglyceride levels⁵. Taking more frequent meals, particularly snacking outside of conventional meal times, also shows an increased association with NAFLD and obesity.

As per *Ayurvedic* point of view, we can conclude that *Apathya Aharas* and *Viharas* are mainly responsible for the manifestation of metabolic disorders and hence in NAFLD too. In other words, *Atisantarpana* leading to *Agnimandya* is the prime cause and hence can be considered as a *Santarpanajanya Vyadhi*. There will be impaired formation of *Saara* portion of the digested food i.e. *Rasa* and results in the formation of *Ama* and leads to the impaired formation of other *Dhatu*s especially that of *Rasa*, *Mamsa* and *Medo Dhatu* in case of NAFLD.

Ayurvedic literatures clearly explain the rules to be kept in mind while taking the food. It is explained in *Ashtanga Hridayam* as “*Jeerne Hitam Mitam Cha Adyyath*”⁶ and in *Charaka Samhita*, it is mentioned as one among the *Dasavidha Aahara Vidhi Vidhanam* as *Jeerne Asneeyath*⁷. It means that one should take the food only after the digestion of the previous meal. Also the amount of food taken should be according to one's *Agnibala* too, i.e.

*Matravath Asneeyath*⁸. If not so, the immature digestive product, i.e. the *Rasa Dhatu* of the previous meal will get mixed up with the food taken later and will result in the vitiation of all the three *Doshas*, namely *Vata*, *Pitta* and *Kapha*. It will hamper the process of digestion too by causing *Agnimandya*. Also *Acharya Vagbhata* in *Ashtanga Hridayam* mentions about *Adhyasanam* and *Vishamasanam*⁹. *Adhyasanam* is taking the food again and again before the previous meal get digested. On the other hand, *Vishamasanam* means untimely administration of food either in excess or in low quantity. These conditions will result either in death or in serious diseases. Hence, irregularities in the diet will result in the vitiation of *Agni* and impairs the formation of *Dhatu*s and will lead to manifestation of various diseases¹⁰. NAFLD can be considered as one among them.

AIM: To find out the role of timing of food in the development of NAFLD

OBJECTIVE: To establish the relationship between the timing of food and NAFLD.

MATERIALS & METHODS

Study design: Cross-sectional Study

Study setting: Vaidyaratnam Ayurveda College OPD, Thaikkattussery, Ollur, Thrissur, Kerala.

Study population: 30 participants visiting the OPD of *Kayachikitsa* Department, Vaidyaratnam Ayurveda College, Thaikkattussery, Ollur, Thrissur, Kerala diagnosed with NAFLD in the age group 25-60 years

Study tool: Questionnaire enquiring about the time of administration of food.

Plan of analysis: Frequency distributions of the variables were obtained.

Ethical clearance number: IEC-14/28/07/2020/ECC

RESULTS

Among 30 participants, 9 belong to the age group 25-35 years, 4 in the age group 36-45 years, 9 in the age group 46-55 years and 8 in the age group 56-65 years. So, the maximum number of participants were in the age groups 25-35 years and 46-55 years. Among them 53% were females and rest were males. Only 23% were taking food at regular time interval while rest were taking it irregularly. (Table 2)

From this, we can interpret that the odds of irregular food habits in females are more than those in males who are diagnosed with NAFLD. While doing statistical analysis

using Fisher's Exact Test, p value is 0.399 indicates there is no significant gender wise priority while analysing the relation between time of food and NAFLD.

DISCUSSION

Out of the 30 participants, 16 represents females and 14 males. (Table 3) Though the prevalence is more for males in literatures, here in this study, female participants were more and may be due to small sample size or their high proportion in the study setting. 76.7% had irregular food timings suggesting a positive relationship with NAFLD. But the gender wise analysis did not show any significance as $p=0.399$ and hence we can interpret that both males and females had equal probability of getting the disease if following an irregular food timing. The quantity of food consuming varies from person to person and is determined by the ability of the *Jataragni* to digest the food properly. So, if we are taking food at regular time period, it aids in proper digestion and absorption of the nutrients. On the other hand, taking the meal after prolonged fasting, results in the consumption of more food and will not be properly digested. Also, taking the food when we are not hungry adversely affect the digestive fire. Both these conditions will results in the impaired formation of *Dhatu*s and may end in the manifestation of metabolic errors like NAFLD.

CONCLUSION

Non-Alcoholic Fatty Liver Disease (NAFLD), the liver component of the metabolic syndrome, is a non-serious condition of accumulated fat in liver of those people who drinks little or no alcohol. Further progression may result in fibrosis and ultimately ends in cirrhosis or HCC in 1% of the people. Dietary factors are one among the primary causes of the said disease. Excessive consumption of carbohydrates, specially refined ones, fats, saturated fats in precise, and protein from meat, can cause NAFLD. In addition, higher intakes of soft drinks and meat are also associated with NAFLD in adults. More than that, time of food intake also plays a vital role in the development of the disease. *Ayurvedic Samhitas* clearly mentioned the need for taking the food at regular time interval in specific quantity in order to kindle the digestive fire and for the proper assimilation and absorption of the nutrients. This study establishes a positive relationship of time of food intake and NAFLD ie, those who are taking food at an irregular time is tend to develop NAFLD. Also males and females had equal probability of getting the disease if following an irregular food timing.

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ORCID

Radhika Hari , <https://orcid.org/0000-0002-0597-7676>

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Table 1 Causes of NAFLD

Primary Causes / Risk Factors	Secondary Causes
Dietary Causes	Disorders of lipid metabolism (usually gene related rare disorders)
Physical Inactivity	Nutritional Causes
Metabolic Syndrome	Medications
Obesity	Certain diseases (Wilson's disease)
T ₂ DM	Hepatitis C infection, Celiac disease)
Dyslipidaemia	Environmental toxicity
Hypertension	
Stress	
Vitamin D	

TABLE 2 DISTRIBUTION ACCORDING TO THE TIME OF FOOD INTAKE

Time of Food Intake	Frequency(Percent)
Regular	7 (23.3)
Irregular	23(76.7)
Total	30

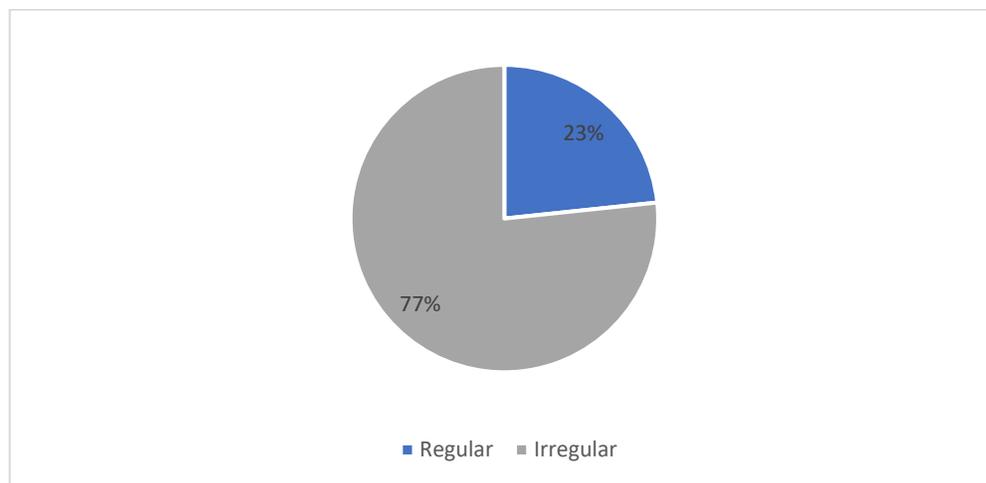


Fig 1 Distribution according to time of food intake

TABLE 3 DISTRIBUTION OF SEX ACCORDING TO THE TIME OF FOOD INTAKE

	Irregular (Percent)	Regular (Percent)	Total
Female	11 (68.8)	5 (31.3)	16
Male	12 (85.7)	2 (14.3)	14
Total	23 (76.7)	7 (23.3)	30