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A CLINICAL STUDY TO EVALUATE THE EFFECTIVENESS OF PALASA KSHARA BHAVITHA PIPPALI CHURNA IN NON ALCOHOLIC FATTY LIVER DISEASE

Ayurveda

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ABSTRACT

The Non-Alcoholic Fatty Liver Disease (NAFLD) has emerged as the leading type of chronic liver disease worldwide. Non-Alcoholic Fatty Liver Disease is defined as there is evidence of hepatic steatosis, either by imaging or histology and there are no causes of secondary hepatic accumulations such as significant alcohol consumption, use of steato-genic medication or hereditary disorders. In India, NAFLD is emerging as an important cause of liver disease. Epidemiological studies suggest the prevalence of NAFLD to be around 9 – 32 % in general Indian population, with a higher incidence amongst overweight or obese and diabetic / pre-diabetic patients. Ayurveda also vividly described Liver Diseases in the context of Yakrit Roga in different classical texts. Palasa Kshara Bhavitha Pippali Churna is mentioned in Chakradattam in Pliha Yakrit Adhikaram. Indications are Gulma Plihapaham, Yakrit Vriddhi Prasamanam, Agni Deepanam and Rasayanam. The present study aims to evaluate the general potential of oral administration of Palasa Kshara Bhavitha Pippali Churna for the clinical outcome of NAFLD. Assessment on USG, LFT, RFT, Lipid profile and BMI was done on the 1st and 22nd day of the study. The results were statistically analysed.

KEYWORDS

Non-alcoholic fatty liver disease, Palasa Kshara Bhavitha Pippali Churna, Yakrit Roga.

INTRODUCTION

Non-Alcoholic Fatty Liver Disease (NAFLD) has emerged as the leading type of chronic liver disease worldwide[1].The term NAFLD was coined by Ludwig in 1980 to describe the biopsy findings in patients with steato-hepatitis in the absence of significant alcohol consumption. Non-Alcoholic Fatty Liver Disease is defined as (a) there is evidence of hepatic steatosis, either by imaging or histology and (b) there are no causes of secondary hepatic accumulations such as significant alcohol consumption, use of steato-genic medication or hereditary disorders[2]. An increase in the number of cases of fatty liver among various age groups shows the gravity of this disease.

The overall prevalence of NAFLD in Western countries varies from 15 – 40 % and in Asian countries from 9 – 40 %[3-4]. In India too, NAFLD is emerging as an important cause of liver disease worldwide. Epidemiological studies suggest the prevalence of NAFLD to be around 9 – 32 % in general Indian population, with a higher incidence amongst overweight or obese and diabetic / pre-diabetic patients[5-6]. Fatty liver often associate with excessive alcohol consumption. Today, NAFLD is considered as the most common liver disease. It is strongly associated with obesity, insulin resistance and hypertension. Thus, NAFLD is considered as the hepatic manifestation of the metabolic syndrome. It is a spectrum that consists of simple steatosis (NASH), advanced fibrosis, cirrhosis and hepatocellular carcinoma[7].

Ayurveda also vividly described Liver Diseases in the context of Yakrit Roga in different classical texts. It can be interpreted as a Santharpanotha Vikara with Kapha Medho Dushti with its Sthanasamsraya in Yakrit, which is said to be the Rakthavaha Srothomoola and Pithasthana. The causative factor can be understood as Agni Mandhya leading to Ama which is reflected in Dhatwagni Mandhya and Bhootagni Mandhya.

According to Susrutha Acharya, Kshara is the superior among Shastras and Anushastras, with important qualities like Chedana, Bhedana and Lekhana. Palasa Kshara Bhavitha Pippali Churna mentioned in Chakradattam in Pliha Yakrit Adhikaram[8]. Indications are Gulmaplihapaham, Yakrit Vriddhi Prasamanam, Agni Deepanam and Rasayanam. The present study aims to evaluate the general potential of oral administration of Palasa Kshara Bhavitha Pippali Churna for the clinical outcome of NAFLD.

NAFLD is the cause behind for liver related morbidity and mortality and is also responsible for the increased susceptibility of Atherosclerosis, Cardiovascular Disease and Type 2 DM. The occurrence of NAFLD increases with increasing Insulin Resistance and Metabolic Syndrome. NAFLD encompasses a spectrum liver pathology with different clinical prognosis. The simple accumulation of triglyceride within the hepatocytes (hepatic steatosis) is on the most clinically benign extreme of the spectrum[9]. There is no scientific data regarding the Ayurvedic management of NAFLD. Hence this study is to analyze the effectiveness of Palasa Kshara Bhavitha Pippali Churna in the management of NAFLD.

AYURVEDIC PERSPECTIVE OF DISEASE

Ayurvedic classic like Caraka Samhitha, Susrutha Samhitha, Astanga Hrudaya, Madhava Nidhana and Bhavaprakasha had described the Hepato–biliary diseases either in Kamala or in Udararoga context. In Madhava Nidhana Parisista Prakarana, Yakrit Roga is described as a separate entity and Acarya Bhavamishra was the first to introduce the term 'Yakrit Vikara' with its classification in his treatise Bhavaprakasha. There is no direct reference available in the Ayurvedic classics correlating to Non- Alcoholic Fatty Liver Disease[10].

Nidana[11]

Nidana plays an important role in the development of diseases and its treatment. The Nidanas can be analyzed as:-

a) Aharaja

Excessive intake of Guru, Snigdha, Pichila, Sita and Madhurarasa Ahara which produces Brimhana and Lepana to Sareera and lead to Kapha and Medodushti. Dadhi, Navadhanya, Navamadya, Ksheera produces Kledanam and Abhishyanditwam. Abhishyandi Guna of Ahara produces Rasavahasrotho Rodham. This leads to Jathara Agnimandya. Virudhahara Sevana also causes Ulklesana of Dosha and further lead to Dhatudushti.

b) Vihara

Divaswapnam, Avyayamam, Sughasanam, Sughasayya etc for long time will lead to increased state of Kapha, consecutively Meda also increases (Asraya - Asrayi Bhava).

Poorvaroopa

The initial stage is usually asymptomatic, so detected only later, or when routine screening is done.

Rupa

Yakrit Roga is said to be of two types
1. Mlanayakrit
2. Yakrit Vrdddhi

1. Mlanayakrit

The word 'Mlana' denotes decresed function or improper function or shrinkage. In Mlanayakrit there occurs Pitta Alpatha, Avila Mutratha, Pandu, Angasadha, Alasya, Tikthamukhatha, Avasadha, Agnimandhya.

2. Yakrit Vriddhi

Yakrit Vriddhi or enlargement of liver is said to cause the symptoms like Dakshinasyaruja,Jadhyatha, Tikthaasyatha, Lohithamutratha, Jwara, Hinabala, Badhapurisha, Pithaakshi, Nidranasho, Daha, Totha, Bhedha, Sotha, Trisna.

Types of Yakrit Vriddhi:-
1. Vata:- Udavarta, DakshinasyaRuja.

2. Pitta:- Jwara , Pipasa, Daha, Moha, Raktodara.

3. Kaphaja:- Aruchi, Angasadha.

4. Rakthaja:- Klama, Bhrama, Vidaha, Vaivranya, Gatragaurava, Moha, Rakthodara.

Samprapti

Due to the Nidana sevana, Kapha Dosha Prakopa occurred in the body. This leads to Jadara Agnimandya and Ama formation. Ama is the Pradhama Dosha Dushthi of Rasadushti[35]. The formed Rasa Dhatu is in Sama condition. This Sama Rasadhatu entered into Yakrut and Rakthadhatu is formed by the help of Ranjaka Pitta. So the formed Rakthadhatu was Sama Rakthadhatu and Rakta Dhatwagnimandya also happened. Yakrut is the Kalamamsa Visesha and Vasa Sudhamamsasya Sneha.

Due to the presence of Sama Raktadhatu, the site which undergoes vitiation was Yakrut. Thus Mamsadhatu Dushti occurred. So the resultant Vasa formed from this Dushta Mamsa was Dushta Vasa. As Samprapthi happens in Yakrut which is the Rakthavaha Srothomula, due to the Asraya– Asrayibhava of Raktha and Pitta, Pitta is also found to be vitiated (Chaya).

Dosha : Samana and Apana Vayu, Pachaka Pitta, Ranjaka Pitta, Kledaka Kapha

Dooshya : Rasa, Raktha, Mamsa, Medo and Vasa

Agni : Jadaragni, Rasadhatwagni, Rakthadhatwagni

Srothas : Rasavaha, Rakthavaha, Medovaha , Annavaha and Pureshavaha

Sanchara : Siras

Srotodushti : Sanga

Udbhava : Amashaya

Vyakta : Udara

Adhishtana : Yakrut

Vyadhi : Chirakari

Roga Marga : Abhyantara

Dosha Gathi : Thiryak Gathi.

Upadrava
When left untreated it progress to Kamala which later leads to Khareebhoota Yakrut and Yakruthodara.

Chikitsa[12]

Fatty infiltration can be considered as a Santharpanotha Vyadhi, Apatharpana Chikitsa should be adopted. It may be attained by Nidana parivarjana and Samprapti Vighatana. The treatment should aim at the correction of Agni and Lekhana of the accumulated fatty substance.

1. Nidana Parivarjanam: Avoidance of Kaphadushtikara and Medodushtikara Ahara Vihara is helpful in reducing its incidence as well as treatment.

2. Shodhana: Mridu Virechana is ideal as Asrayasthana of the disease which is Rakthavahasrotomoola. It brings about Dhatus Thirathva and Agni Deepthi.

3. Deepana and Pachana: Helps to pacify Ama and obtain Agni Deepthi which in turn corrects the Dhatwagnis.

4. Samsamana: Kapha medohara and Yakrit Prasadana drugs are the proper choice of Samana drugs. Use of Katu Tthiktha Rasa that becomes Katu Vipaka may be useful as these have Sneha - Meda Soshana property. Use of Lekhaneeya drugs helps in the removal of unwanted storage of fatty material. Medohara Chikitsa can also be adopted.

5. Rasayana: Rasayana corrects the structural deformity of the Dhatus there by normalizing the functions and prevents the instinct for secondary diseases. Free radical mediated oxidative processes play a good role in improper fat metabolism. As Rasayana drugs possess antioxidant nature these can prevent the biological effect of free radicals.

Pathya - Apathya

Pathya[13]

Ahara – Laghudeepana, Kapha-Medohara, Raktaprasadana, Puranasali, Yava, Mudga, Dadimarasa
Vihara – Vyayama

Apathya

Ahara – Guru, Abhishyandi, Snigdha, Kaphameda Vardhaka, Dadhi, Ghrita, Taila, Navadhanaya, Masha, Pishtanna.

Vihara – Divaswapna, Vegadharana

MATERIALS AND METHOD

Study Design

Interventional Study Pre and Post - test without control group.

Study Period

18 months

Diagnostic Criteria

Subjects to be included in the study based on USG findings, according to the standard criteria accepted by the American Gastroenterology Association i.e., an increase in hepatic echogenicity as a reference, the presence of enhancement and lack of differentiation in the periportal intensity and the vascular wall due to great hyper-echogenicity in the parenchyma[45]

Inclusion Criteria

1. Subjects diagnosed with NAFLD according to the USG report.
2. Subjects between the age of 30 and 65 years.
3. Subjects of either gender, irrespective of socioeconomic status.
4. Subjects willing to sign the informed consent form.

Exclusion Criteria

1. Subjects with history of alcohol intake more than 20 gm ethanol / week.

2. Subjects with history of jaundice, hepatitis or HBsAg positive.

3. Subjects with history of following drug intake – steroids, synthetic estrogens, heparin and calcium channel blockers, amiodarone, valproic acid, antiviral agents.

4. Diagnosed case of renal, respiratory, cardiovascular (including IHD), neurologic, immunologic or hematological diseases and infectious diseases.

5. Pregnant, breast feeding women.

6. Uncontrolled Diabetes Mellitus and Hypertension.

7. All types of malignancies.

Investigations

1. LFT

2. RFT

3. Lipid profile

4. USG – Abdomen

5. Fasting Blood Sugar (FBS)

Plan and Intervention of Study

Patients diagnosed as per diagnostic criteria and satisfying the inclusion criteria was selected in a single group from the study setting and written consent was taken after explaining the study. 1.5 gm Palasa Kshara Bhavitha Pippali Churna was given twice daily after food with 3 ml Madhu as Anupana, for a period of 21 days. Assessment was conducted on day 1st and 22nd day of the study.

Outcome Variable

1. Changes in the following values of LFT, RFT, Lipid profile, BMI was tabulated and statistically analyzed.
2. Changes in the echogenicity of fatty liver using USG Grading as per American Gastroenterology Association was statistically analysed.

OBSERVATION AND RESULTS

The data related to USG change, LFT, RFT, Lipid profile and BMI before (BT) and after treatment (AT) were collected from 30 participants and out of these 4 participants were dropouts and were statistically analyzed using Paired t Test.

1.Data related to USG Analysis

90% of participants had slight diffuse in the echogencity of liver before treatment and after treatment was reduced to 85.5%, 10% participants had moderate diffuse in the echogencity of liver before treatment and after treatment was 11.5%.

2. Data related to BMI Analysis

61.5% of participants shows 5% of decrease in BMI after treatment, 19.2% shows 10% of decrease in BMI, 19.2% of participants shows no change in BMI after the treatment.

3. Data related to Liver function test Analysis

Only Bilirubin, ALT, AST and ALP shows significant changes after the treatment.

1. Data related to Bilirubin Analysis

76.7% of participants had bilirubin at normal range before the treatment and after the treatment was reduced to 65.4%, 23.3% had low range of bilirubin before the treatment and after the treatment was reduced to 15.4%.

2. Data related to ALT Analysis

83.3% of participants had Normal ALT before treatment and after treatment was 88.5%, 16.7% had low ALT before treatment and after treatment was 3.8%.

3. Data related to AST Analysis

80.0% of participants had normal AST before treatment and after treatment it was 88.5%, 20.0% of participants had high AST before treatment and after treatment it was 11.5%.

4. Data related to ALP Analysis

56.7% of participants had high range of ALP before the treatment and after the treatment was 38.5%, 40.0% had normal ALP before the treatment and after the treatment was 50.0%.

4. Data related to Renal function test Analysis

1. Data related to Creatinine Analysis

63.3% of participants had normal level of creatinine before the treatment and was reduced to 42% after the treatment, 20.0% had high level of creatinine before the treatment and after the treatment it was 23%, 16.7% had normal creatinine before the treatment and was increased by 35% after the treatment.

2.Data related to Urea Analysis

80.0% of participants had normal level of urea before the treatment and 69% after the treatment, 20% had low level of urea before the treatment and increased by 31% after the treatment.

3. Data related to Uric acid Analysis

86.6% of participants had normal level of uric acid before the treatment and was decreased by 88% after the treatment, 6.7% had low level of uric acid and was increased by 12% after the treatment.

5. Data related to Lipid profile Analysis

1. Data related to Cholesterol Analysis

53.3% of participants had border level of total cholesterol before the treatment and after the treatment was 42.3%, 26.7% had desirable level of total cholesterol before the treatment and 53.8% was after the treatment, 20% had high level of total cholesterol before the treatment and reduced by 3.8% after the treatment.

2. Data related to Triglyceride Analysis

23.3% of participants had borderline high level of triglycerides before the treatment and after the treatment it was 11.5%, 63.3% had desirable level of triglycerides before the treatment and 84.6% was after the treatment, 13.4% had high level of triglycerides before the treatment and reduced by 3.8% after the treatment.

3. Data related to LDL

50% of participants had high level of LDL before the treatment and after the treatment was 46.2%, 33.3% borderline high level of LDL before the treatment and 30.8% was after the treatment, 16.7% had Desirable level of LDL before the treatment and 23.1% after the treatment.

DISCUSSION

The world wide spread of sedentary lifestyle and diet westernization, the prevalence of NAFLD has increased in many countries among children and elderly alike. NAFLD is a term for a host of histological findings stemming from hepatic steatosis and remains the most common Liver disease globally with increasing prevalence. NAFLD is associated with many metabolic co-morbidities including Obesity, Type II Diabetes, Dyslipidemia and Metabolic Syndrome. Its potential to develop into more severe liver conditions such as NASH, advanced Fibrosis, Cirrhosis and Hepatocellular carcinoma.

The precise etiology of NAFLD is unknown, but there is strong association with Obesity, Insulin resistance and Dyslipidemia. NAFLD can occur in all age groups although the highest prevalence is in those between 40-49 years. Pathophysiology of NAFLD had strong role of lipid accumulation, insulin resistance, adipokines, oxidative stress and mitochondrial dysfunction. Most of patients are asymptomatic. Severe condition leads to anorexia and feeling of heaviness in the right hypochondrium.

Laboratory investigations carried out are LFT, RFT and Lipid profile. Radiological investigations such as USG, computed tomography and liver biopsy can also be done. Treatment of NAFLD includes achieving good metabolic control, improving insulin sensitivity, intake of antioxidants and anti fibrotic agents as well.

In Madhava Nidana, Parisista Prakarana Yakrit Vriddhi is mentioned. Symptoms such as Dakshinasya Ruja, Jadhyatha and Tikthasyatha are mentioned in Yakrit Vriddhi are similar to clinical features of later stages of NAFLD. As per Ayurvedic classics, the treatment of Yakrit Vriddhi includes Deepana, Pachana, Samsamana and Rasayana.

This study is meant to evaluate the effectiveness of Palasa Kshara Bhavitha Pippali Churna in NAFLD. The study emphasizes the effectiveness by evaluating the changes in USG grading, LFT, RFT, Lipid profile and BMI.

Discussion of BMI

In this study, 56.7% of participants had over weight, 30% were obese while only 13.3% were under normal BMI before the treatment. After the treatment 62% of participants experienced a 5% reduction in BMI and 19% shows more than 10% decrease in BMI.

NAFLD has been increasingly recognized as the most common pathological conditions affecting in conjunction with the increase in Body Mass index. BMI is said to be an important risk factor for NAFLD (4.1 to 14 fold higher). Excessive intrahepatic triglyceride (IHTG) content in over weight persons is a robust marker of metabolic abnormalities like insulin resistance in liver, muscle and adipose tissue, alterations in FFA metabolism and increased VLDL – TG secretion rate.

In Palasa Kshara Bhavitha Pippali Churna, Tikta – Katu Rasa of Palasa Kshara and Deepana and Pachana properties of Pippali increases the Jatharagni and there by removes the formation of Kapha Dushti

Karaka Apakva Anna Rasa ie, "Kleda – Medo Upasoshanam". This shows that Palasa Kshara Bhavitha Pippali Churna had a significant role in maintaining the metabolic abnormalities and thereby reducing the BMI.

Discussion of Liver Function Test

In this study, Bilirubin, ALT, AST and ALP shows significant changes after the treatment. 92% of participants had reduction of bilirubin after the treatment, 77% had reduction of ALT, 85% of participants had reduction of AST after the treatment, 76.9% had reduction of ALP after the treatment.

NAFLD is the most common cause for mild to moderate elevated liver enzymes. The AST/ALT ratio > 1 is associated with advanced fibrosis in NAFLD. Serum alkaline phosphatase is usually two times the normal range .Although ALT elevation is the most common laboratory abnormality in NAFLD patients with isolated ALP elevation. NAFLD with isolated ALP elevation are more likely to have advanced fibrosis.
Deepana, Pachana and Lekhana properties of Palasa Kshara, does Sroto Shodhana by removing Kapha – Medho Dushti in the Yakrit and there by regulating the proper function of Ranjaka Pitta. This is clearly mentioned in Cakradatta Pliha Yakrit Adhikara. This shows that Palasa Kshara Bhavitha Pippali Churna has a significant role in maintaining the normal range of liver enzymes.

Discussion of Lipid profile

Lipid profiling is necessary to understand the pathogenesis of NAFLD. Abnormalities in lipid and lipid protein metabolism accompanied by chronic inflammation are considered to be the central pathway for the development of NAFLD. NAFLD is associated with dyslipidemic profile characterized by large VLDL, small dense LDL and decreased HDL correlates with the intra-hepatic lipid content.

In this study, 20% of participants show high level of Total Cholesterol, 13.4% had reported high level of Triglycerides, 50% of participants show high level of LDL and 10% of participants had high level of HDL before the intake of trial drug. After the treatment 85% of participants had reduction of Total cholesterol, 85% had reduction of Triglycerides, 81% had reduction of HDL and 84% of participants had reduction of LDL. This shows that Palasa Kshara Bhavitha Pippali Churna had a significant role in the de novo lipogenesis and β-oxidation.

In Palasa Kshara Bhavitha Pippali Churna, Usna – Tikshna properties of Palasa Kshara and Katu Rasa of Pippali leads to Kleda – Medo Upashoshana and thereby reduce excess accumulation of Bahudrava Kleda in the Yakrit, there by breaking the Sampraptihi of Yakrit Vridhi. Discussion of Renal function Test NAFLD is an independent risk factor associated with the progression of Renal impairment. The association was stronger in patients with more advanced NAFLD as indicated by a higher fibrosis score in those with lower eGFR and those with proteinuria. Mounting evidence on liver – kidney interactions includes; altered rennin- angiotensin system activation, impaired antioxidant defense and damaged lipogenesis.

In this study, 80% of participants had reduction in creatinine after the treatment, 73% had decline in level of urea and 80% had reduction in uric acid. Ethanolic extract of Butea significantly reduces the serum creatinine and blood urea. This shows that Palasa Kshara Bhavitha Pippali Churna had a significant role in maintaining nuclear factor –KB and the C-Jun-N- terminal pathways.

Discussion on USG data

In this study, 90% of participants had slight diffuse echogencity of liver before treatment and after treatment it was reduced to 85.5%, 10% participants had moderate diffuse echogencity of liver before treatment and after treatment it was 11.5%. Deepana, Pachana, Vilayana and Lekhana properties of Palasa Kshara along with Usna Virya of Pippali Churna leading to reduction in the accumulation of fatty Infiltration in the hepatocytes. In Cakradatta Pliha Yakrit Adhikara clearly mentioned the Rasayana Property of Palasa Kshara Bhavitha Pippali Churna. Rasayana act as an excellent anti-oxidant and there by prevents the further staging of fibrotic changes in the hepatocytes. Probable mode of action of Palasa Kshara Bhavitha Pippali Churna.

It contains two ingredients – Palasa Kshara and Pippali Churna
1. Palasa Kshara – As per Ayurvedic classics, Palasa has the properties of Katu- Tikta-Kashaya Rasa, Laghu - Snigdha Guna, Usna Virya, Katu Vipaka and Vata Sleshmahara Karma. Palasa Kshara has properties like Agnideepna, Lekhana, Srotoshodhana and Yakrit Vriddhi prasamana. Palasa Kshara with its above mentioned Rasa Panchakas induces Agnideepthi thereby increasing Jatharagni and prevents the Ama formation. Lekhana property of Palasa Kshara prevents the fatty infiltration in the hepatocyctes.

As per modern pharmacology,

- The major chemical constituents of Palasa were Beac, sterols, polyphenols, flavonoids, ascorbic acid and saponins.
- It is well established that saponins are useful in obesity, phytosterols are beneficial in hyperlipidemia and flavonoids have potential antioxidant properties
- Beac along with liver anti-oxidative molecules normalizes the bio chemical markers like serum bilirubin, AST, ALT, ALP and Albumin. Beac also restores the markers of fibrosis to normal.
- Methanolic extract shows significant hepato - protective effect in reducing the liver injury induced by Ccl4.
- Ethanolic extract of Butea significantly reduces the serum creatinine and blood urea.

2. Pippali – As per Ayurvedic classics, Pippali has the properties of Katu Rasa, Laghu-Snigdha Guna, Usna Virya and Madhura Vipaka. It also has the property of Vatasleshmahara, Yakrit Vriddhi Prasamana, Deepna, Pachana and Rasayana. Deepana – Pachana property of Pippali helps to pacify Ama and corrects the Dhatuparinama. Katu Rasa and Deepna-Pachana of Pippali acts as Kledamedo Upashoshnam and disintegrates the obstruction of Raktha Vaha Srothas and thereby prevents the accumulation of Avabaddha Medas in the Yakrit.

As per modern pharmacology,

- Pippali improves the regeneration process by restricting fibrosis.
- Ethanol extract of Pippali inhibits liver fibrosis induced carbon tetrachloride.
- Piperine acts as a significant protection against hepatotoxicity by reducing lipid peroxidation.
- Pippali has the properties such as anti-inflammatory, anti-oxidative, hepatoprotective, hypocholesterolemic and immune modulatory activities.
- Piper longuminine helps in the regeneration of Hepatocytes.

Anupana – Madhu has the properties like Yogavahi, Agnideepana and Sleshma Shodhana. Yogavahi property of Madhu catalyses the action of Palasa Kshara Bhavitha Pippali Churna. Madhu also considered as Nithya Rasayana by Acarya Susrutha, thus by its Rasayana and anti – oxidative action it revitalize the hepatocytes.

Postulated mode of action

- Palasa Kshara Bhavitha Pippali Churna is highly anti- oxidative, anti- inflammatory and hepato - protective activity and its Rasayana property also helps in the regeneration of hepatocyctes.

Hence there is clinically significant effect in Palasa Kshara Bhavitha Pippali Churna in the management of Non – Alcoholic Fatty Liver Disease rejects the null hypothesis. Thus alternative hypothesis has been accepted.

Extra findings from the study

Though the aim of the study was to evaluate the effect of Palasa Kshara Bhavitha Pippali Churna in NAFLD. During the course of the study, got some benefits for other diseases. It is being mentioned below:-

- Pruritus ani and mucous discharge of one participant with first degree Haemorrhoid reduced considerably.
- Noticed reduction of blood sugar level in Type II Diabetic participants.
- One participant showed cystic lesion at right lobe of the liver measuring 3.8×2.2cm before the treatment and after the treatment reduced to 0.6×0.7cm.
- Two participants with irregular menustral cycles attained regularity.
- Participants with recurrent upper respiratory tract infections got significant relief.

CONCLUSION

The present study leads to the following conclusions:-

- The NAFLD is more common in the age group of 30-45 years. As per gender, it is more common in females than males and seen more in participants with sedentary and stress life style.
- Majority of participants (53.3%) followed mixed diet pattern and 80% of participants under gone day napping.
- NAFLD cannot be correlated to a single disease in Ayurveda. It covers a spectrum of conditions such as Ajirna, Yakrit Vriddhi and Sthoulya in initial stages later to Pandu, Kamala and Yakritodara.
- The risk factors of NAFLD includes Vidahi –Abhishyandi Ahara and Vihara which leads to Kapha and Medo Dushti causes Srotorodha.
- Palasa Kshara Bhavitha Pippali Churna is effective in reducing the fatty infiltration of hepatocyctes as evident by changes in USG.
- 62% of participants experienced as 5% reduction in BMI and 19% shows more than 10% of decrease in BMI after the intake of Palasa Kshara Bhavitha Pippali Churna.
- Palasa Kshara Bhavitha Pippali Churna is effective in improving liver functions as evident by the changes in Bilirubin, AST, ALP, ALT. 92% of participants had reduction in Bilirubin, 77% had reduction of ALT, 85% of participants had reduction of AST and 76.9% had reduction of ALP after the intake of trial drug.
- 80% of participants had reduction in creatinine, 73% had decline in the level of urea and 80% had reduction in uric acid. This shows that Palasa Kshara Bhavitha Pippali Churna is effective in maintaining the rennin- angiotensin system and improves the impaired antioxidant defense mechanism.
- 85% of participants had reduction of total cholesterol, 85% had reduction of triglycerides, 81% had reduction of HDL and 84% of participants had reduction of LDL after the intake of Palasa Kshara Bhavitha Pippali Churna. This shows that trial drug had a significant role in the de novo lipogenesis.
- The effect of Palasa Kshara Bhavitha Pippali Churna is highly significant in the management of Non–Alcoholic Fatty Liver Disease. Hence null hypothesis has been rejected and alternate hypothesis has been accepted.
- Palasa Kshara Bhavitha Pippali Churna has lesser number of ingredients which are easily available and cost effective.
- Palasa Kshara Bhavitha Pippali Churna has no side effects.

Limitations of the study

- Though the study deals with NAFLD most of the participants belonged up to the stage of grade Fatty liver only.
- Non-palatability of the trial drug led to reluctance of participants ingesting.
- Limited period of the study.
- Longer follow up was not done
- Comparative study was not done.
- Shelf life and storage of trial drug was challenging.

Suggestions for future research

- Future controlled studies can be conducted with large samples to get more reliable results.
- Study may be conducted as regards the three different stages of NAFLD.
- In vitro studies may be conducted to test the efficacy of the trial drug.
- Dietary habits should also be taken for consideration for future studies.

Table. 1

BMI	Before		After	
	Frequency	Percentage	Frequency	Percentage
Normal	4	13.3	5	19.2
Over Weight	17	56.7	13	50.0
Obese	9	30.0	8	30.8
Total	30	100.0	26	100.0

Table. 2

Bilirubin	Before		After	
	Frequency	Percentage	Frequency	Percentage
Low	7	23.3	4	15.4
Normal	23	76.7	17	65.4
High	-	-	5	19.2
Total	30	100.0	26	100.0

Table. 3

ALT	Before		After	
	Frequency	Percentage	Frequency	Percentage
Low	5	16.7	1	3.8
Normal	25	83.3	23	88.5
High	-	-	2	7.7
Total	30	100.0	26	100.0

Table. 4

USG	Before		After	
	Frequency	Percentage	Frequency	Percentage
Slight Diffuse	27	90	23	85.5
Moderate Diffuse	3	10	3	11.5
Total	30	100.0	26	100.0

Table. 5

Urea	Before		After	
	Frequency	%	Frequency	%
Low	6	20.0	8	31.0
Normal	24	80.0	18	69.0
High	-	-	-	-
Total	30	100.0	26	100.0

Table. 6

Uric acid	Before		After	
	Frequency	Percentage	Frequency	Percentage
Low	2	6.7	2	12.0
Normal	26	86.6	23	88.0
High	2	6.7	-	-
Total	30	100.0	26	100.0

Table. 7

Creatinine	Before		After	
	Frequency	Percentage	Frequency	Percentage
Low	5	16.7	9	35.0
Normal	19	63.3	11	42.0
High	6	20.0	6	23.0
Total	30	100.0	26	100.0

Table. 8

AST	Before		After	
	Frequency	Percentage	Frequency	Percentage
Low	-	-	-	-
Normal	24	80.0	23	88.5
High	6	20.0	3	11.5
Total	30	100.0	26	100.0

Table. 9

ALP	Before		After	
	Frequency	Percentage	Frequency	Percentage
Low	1	3.3	3	11.5
Normal	12	40.0	13	50.0
High	17	56.7	10	38.5
Total	30	100.0	26	100.0

Table. 10

Total cholesterol	Before		After	
	Frequency	Percentage	Frequency	Percentage
Desirable	8	26.7	14	53.8
Borderline High	16	53.3	11	42.3
High	6	20.0	1	3.8
Total	30	100.0	26	100.0

Table. 11

Triglyceride	Before		After	
	Frequency	Percentage	Frequency	Percentage
Desirable	19	63.3	22	84.6
Borderline High	7	23.3	3	11.5
High	4	13.4	1	3.8
Total	30	100.0	26	100.0

Table. 12

LDL	Before		After	
	Frequency	Percentage	Frequency	Percentage
Desirable	5	16.7	6	23.1
Borderline High	10	33.3	8	30.8
High	15	50.0	12	46.2
Total	30	100.0	26	100.0

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