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Review Article

Curcuma and Emblica herbs in Metabolic Disorders

Role of Common Herbs- *Curcuma Longa* and *Emblica Officinalis* in Metabolic Disorders: A Narrative Review

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Abstract: In the present era, Metabolic disorder is a challenge to the medical community because of its increasing prevalence and unsatisfactory management. There is no permanent remedy, and the patient has to continue the medicine for a longer life. According to Ayurveda, all metabolic diseases are caused due to *Jathragnimandya*(improper digestion & metabolism). Hence the correction of Agni is the principle to treat it. Various herbs act as *agnivardhak* (increase digestive fire or *Rasayan* (Rejuvenator). *Haridra (Curcuma longa) and Amalaki (Emblica Officinalis)* are the herbal drugs recommended in Ayurveda literature. Ayurveda practitioners are using these medicines for various metabolic disorders. Hence this review was carried out to discover their utility in metabolic disorders. The aim and objective of this review are to study the role of common herbs available worldwide, which are *Haridra* (*Curcuma longa*) and *Amalaki* (*Emblicaofficinalis*), in metabolic disorders. The related data were collected from classical texts of Ayurveda, google scholar, and PubMed. A total of 10 articles were considered for review. Out of these, four were animal studies, and six were analytical studies in which the assessment parameters were fasting. From this review, few studies have been conducted on only Haridra as compared to Amalaki on the post-meal blood sugar levels, glycolatedhaemoglobin (HbA1c) levels, oral glucose tolerance test, and complete blood count metabolic disorders. The maximum studies are on *Nisha-Amalaki(*a combination of *Haridra&Amalaki*alongwith *bhavna*[trituration process] of *Amalakiswarasa*[Juice form of *Emblicaofficinalis*]to *Haridra*[*Curcuma longa*]*)* which is found to be effective in Diabetes mellitus and dyslipidemia, which can be considered as the cavity of previous reviews. Therefore, there is a need to conduct studies on *Nisha-amalaki* to explore its effect on other common metabolic disorders like PCOD, Hypothyroidism.

Keywords: Metabolic disorders, *Haridra, Amalaki*, *Nisha-amalaki*, Diabetes Mellitus, PCOS

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1. INTRODUCTION

A metabolic disorder affects the body's ability to digest macronutrients, including carbohydrates, proteins, and lipids. It occurs if the body's normal metabolic function is disrupted by aberrant chemical interactions[1]. The most common metabolic disorders include Diabetes Mellitus, Hypertension, Hypothyroidism, etc. Indian cities, like other major urban regions around the globe, have a greater prevalence of type 2 diabetes than village areas[2]. There has been a surge in the percentage of incidences of diabetes and associated disorders in India due to people leading increasingly sedentary lifestyles and eating meals rich in fats and carbohydrates[3]. The prevalence of high blood pressure is the marker utilized in the worldwide Non-communicable diseases (NCD) strategy, and it assesses the series of adults regardless of the treatment status. On the other hand, blood pressure has a log-linear relationship with cardiovascular illness and chronic renal disease that persists long underneath the borderline for elevated blood pressure, and therapy reduces risk proportionally regardless of baseline blood pressure[4,5]. Depending on the criterion employed, the prevalence of subclinical hypothyroidism within the population ranges from 0–3 per cent to 3–7 per cent in the United States and from 0–2 per cent to 5–3 per cent in Europe[6-10]. The prevalence of undetected hypothyroidism in extreme and subtle instances was predicted to be roughly 5 per cent in a meta-analysis of data from 9 European nations. Most metabolic disorders, such as high blood pressure, imbalanced blood sugar metabolism, insulin resistance, general and abdominal obesity, hyperuricemia, dyslipidemia, and hyperglycemia, have increased significantly over the past few decades. These conditions are risk factors for several serious illnesses, including coronary heart disease, obesity, type 2 Diabetes Mellitus, stroke and Polycystic Ovarian diseases[11-14]. Body mass index (BMI) and blood pressure are anthropometric and physiological measurements that must indicate not only innate genetic and physiological dependencies but also, essentially, metabolic putdowns resulting from the interaction between people and their surroundings as mediated by stress, nutrition, activity, and a variety of other variables that might also change between the genders[15,16]. As per the Ayurvedic aspect, metabolic disorders can be correlated with the dysfunction of *Agni*. So the basic treatment principle for metabolic diseases is the correction of *Agni* i.e. correction of metabolism. Many herbal preparations are described to correct the Agni and act as *Rasayan*(Rejuvenation). *Rasayan* acts at the level of proper nutrition, correction of metabolism, and patency of microchannels to provide nutrients at the cellular level. Along with this, as per classical texts, Rasayan acts as anti-ageing, helps in boosting immunity and fights against diseases (*Vyadhikshamatva*). *Haridra (Curcuma longa)* possesses *Katu* and *Tiktaguna*, which acts *as Agni Vardhak* for the correction of metabolism and *Amalaki (EmblicaOfficinalis)* is a herbal drug recommended as *Rasayan* (*Vaidya Yoga Ratnavali*, 2000). According to Ayurveda, the disequilibrium of *tridosha* (bio-humours) is the primary reason for illness. Both drugs are *Tridosaghna*(equilibrates the biohumors). These herbs are commonly used in the management of metabolic disorders. Metabolic disorders are progressive and rapidly spreading among the population all over the world. Therefore, there is a need to explore the herbal remedy for it. As *Haridra*(*Curcuma longa*) and *Amalaki*(*Emblicaofficinalis*) are commonly used in metabolic disorders, this review was conducted to explore scientific studies related to metabolic disorders. The diagrammatic representation of the effects of *Curcuma longa* and *Emblicaofficinalis* is included. (Figure 1)

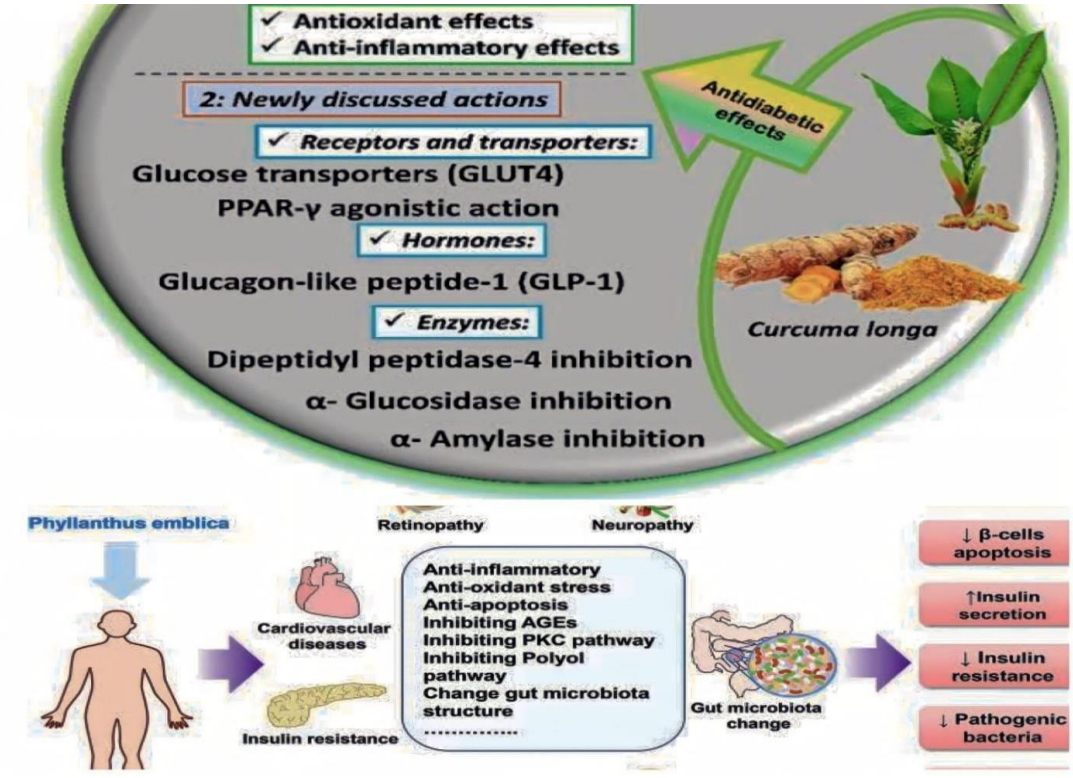

Fig 1: Diagrammatic representation of main bioactive compounds and effects on metabolic diseases in the study

2. MATERIALS AND METHODS

2.1 Search Strategy

The related data were collected from classical texts of Ayurveda, google scholar, and PubMed. Only original articles (multilingual, randomized controlled studies) were included. Case reports, case series and review articles were excluded from the study. The mentioned keywords were used in the search: 1) *Nisha-AmalakiChurna*; 2) *Nisha*or *Haridra* or *Curcuma longa*; 3) *Amalaki*or *Amla*or *AmalakiChurna*or *AmalakiRasayan*or *Emblicaofficinalis*; 4) Humans; 5) Animals or mice; 6) 1 and 2 and 3 and 4; 7) 6 not 5.

2.2. Study Including Standard

We read, discussed, and only included articles that matched the mentioned standards: 1) The treatment lasted not less than eight weeks; 2) The only herbs *Curcuma longa* or *Emblicaofficinalis* or in a combination of both. Other herbs combined with it are not included; 3) the presence of metabolic disorders such as pre-diabetes, Dyslipidemia, Type-2 Diabetes Mellitus, overweight or obesity, metabolic syndrome, Polycystic ovarian disease, hypothyroidism; 4) studies on Humans and animals 5) studies included at least one of the following parameters: fasting serum insulin, Fasting blood glucose, post-meal blood glucose HbA1c, Thyroid profile and lipid profile;

2.3. Data Collection and Quality Assessment

The mentioned data was collected from research studies by Dr Aman Chhabra and guided by Dr Vaishali Kuchewar. The following were the contents: 1) research attributes, such as the first author, year of publication, design of the study, dosage, intervention period, and form; 2) preliminary and endpoint values or net changes in Plasma glucose, Glycated haemoglobin, Malondialdehyde (MDA), Thiobarbituric acid reactive substances (TBARS), Glutathione (GSH), Body Mass Index, Waist-hip ratio, phases of the ovarian cycle, lipid profile and blood pressure. According to the Cochrane Handbook, we split up trials that used various dosages, intervention lengths, or oral medicines into independent studies that were contrasted with the expected standard group[18,19]. Only data about turmeric extract, curcuminoids, *Amalaki*, *Emblica officinalis*, or a combination of the two, as in *the Nisha-Amalaki Churna* group and the control group, were retrieved from trials that had several trial groups compared to a standard group. We only used the first-stage data from trials with crossover, which occurred before the individuals underwent a washout period[20]. The flowchart for database selection and studies selection is included. (Figure 2).

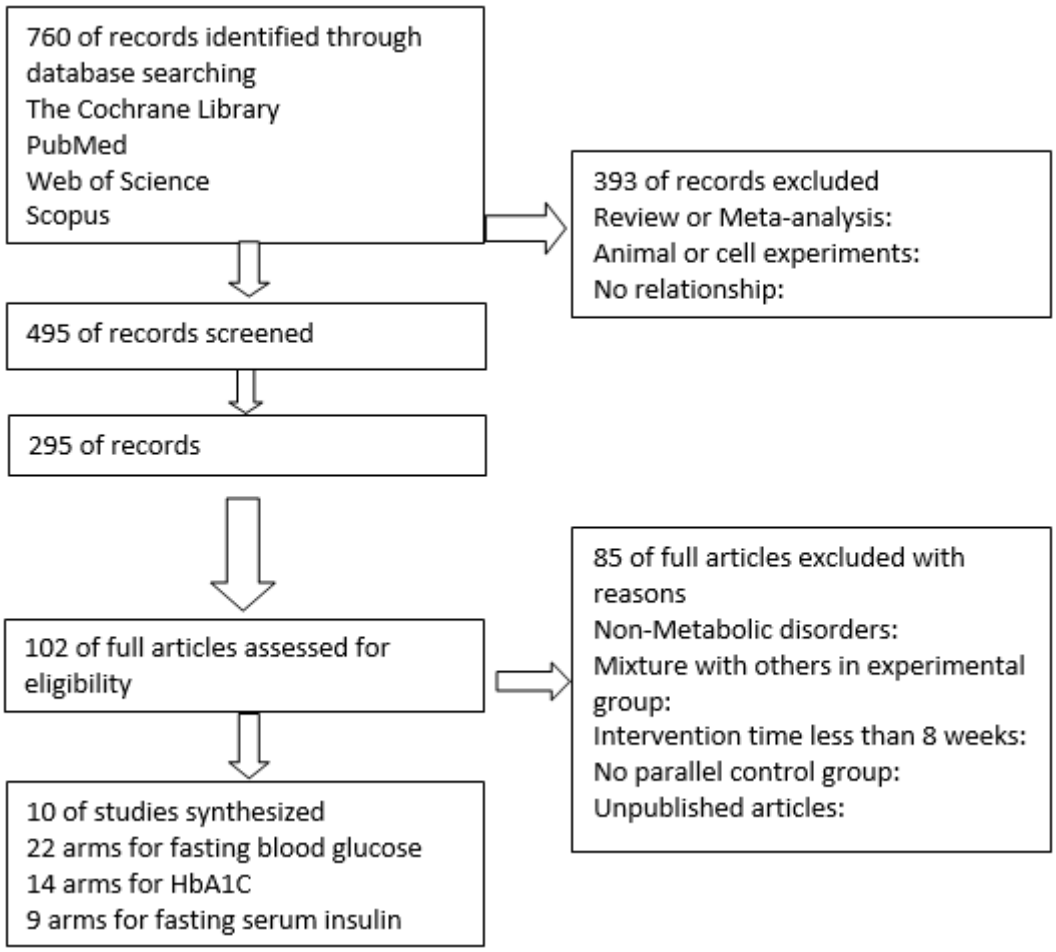

Fig 2: Database search and studies selections. We searched widely Web of Science, PubMed (including EMBASE and MEDLINE), Scopus, and the Cochrane Library for RCTs that focused on roles of *Haridra*, *Amalaki* and *Nisha-AmalakiChurna* on FBG, haemoglobin A1c(HbA1c), fasting serum insulin and lipid profile among patients with metabolic disease. By reading titles, abstracts and thorough studies, we selected ten studies finally to be included in the review article.

3. RESULTS

Ten articles were considered for review using search of Research Gate and PubMed. Out of these, four were animal studies, and six were analytical studies (Table no. 1)

Table 1: Characteristics of reviewed studies

Sr. No.	Author name and year of publication	Place	Sample size &interventional drug	Assessment parameters	Outcome
1.	Guruprasad Rao.Surekha Bhat et.al[21]; 2013	Melaka Manipal Medical College, Manipal University, Manipal, India	A total of 60 rats were taken into the study and divided into five groups of 12 rats in each group. "*Nisha-AmalakiChurna*"	i. Plasma glucose ii. Glycated haemoglobin iii. Malondialdehyde (MDA), iv. Thiobarbituric acid reactive substances (TBARS) v. Glutathione (GSH)	Treatment with *Nisha-amalaki* preparation achieved significant glycemic control in streptozotocin-diabetic rats comparable to glyburide and troglitazone. *In addition, nisha-amalaki* provided better erythrocyte antioxidant protection than glyburide and compared favourably with troglitazone.
2.	Manoj Gupta et.al[22]; 2016	SP Medical College Bikaner 334001, Rajasthan, India	100 Patients suffering from metabolic syndrome were randomly assigned to get either standard therapy along with or without Amalaki. Amalaki (Emblicaofficinalis).	At baseline and three months after initiating *Amalaki*, the patient's BMI, waist-hip ratio, fasting blood sugar, blood pressure, glycosylated haemoglobin, and lipid profile were assessed.	Resveratrol lowered rodents' blood sugar levels, insulin resistance, weight, and blood pressure. Quercetin decreased blood sugar and cholesterol levels in obese rats. In a clinical study of patients suffering from metabolic syndrome, the drug dropped blood pressure without changing lipid levels. In rats, drug-induced weight reduction reduced blood sugar levels and insulin resistance while improving humans' haemoglobin A1C and cholesterol levels. Thus, the study showed significant improvement in Fasting Blood Sugar and HbA1C after *Amalaki* therapy.
3.	M.B. Kavita et.al[23]; 2016	SDM College of Ayurveda and Hospital, Tanniruhalla, B. M. Road, Hassan, Karnataka State, India	A total of 116 patients had dyslipidemia. *AmalakiChurna*	The total Cholesterol level of patients was assessed in this study.	*Amalaki* is a potential nutritional additive for dyslipidemia. Its *Rasayana*(rejuvenating) activity causes lipid levels in the blood to remain stable. The *Vayasthapana* (antiaging) activity protects against the negative consequences of dyslipidemia, that is, increased oxidative stress.
4.	Jayshree S Dawane. VijayaPandit et.al[24]; 2017	BVU College of Ayurveda, Pune, Maharashtra, India	Forty-two rats with regular cycles were included, divided into seven groups of six animals. Herbal formulation "*Nisha-Amalaki*"	Throughout the study, the phases of the Estrous cycle were monitored on a daily basis. Every day, the body weight was recorded. On days 0, 28, and 56, blood samples were taken. Serum levels of blood glucose, insulin, cholesterol, triglycerides, and HDL were measured. In addition, the ovaries and uteri were evaluated and histological examinations were performed.	*Nisha-amalaki* effectively corrected all changes in PCOS, whereas KanchanarGuggulu only regularized the oestrous cycles.

5.	Prashant B BedarkarNidhiRampara et.al[25]; 2017	IPGT and RA, Gujarat Ayurved University, Jamnagar, Gujarat.	24 mice were randomly divided into four groups, 6 in each *"Nisha-Amalaki"*	Fasting Blood sugar level [BSL, (initial reading)]. The test drug and standard control drug was administered to respective groups. After one hour of test drug administration, glucose solution (5g/kg) was administered by dissolving it in distilled water (p.o.) based on individual body weight. After that, blood sugar level was recorded after 30min, 60min, 90, and 120 minutes.	A single dose of *Nisha-amalaki* derived from 89mg of *Haridrachurna* and 121 mg of *AmalakiSwarasa triturated Amalakichurna*reduced the increased blood sugar in less than two and a half hours after its administration.
6.	Vikas Kumar et. Al[26]; 2017	Rajiv Gandhi Center for Biotechnology (RGCB), Trivandrum, India	24 rats were taken *AmalakiRasayan*	Parameters of ECG – "P wave, QRS interval, R-R interval (in seconds), QT interval". Mean blood pressure and—heart rates.	Regular consumption of *AmalakiRasayan* enhances left ventricular dimension, exercise tolerance capacity, and function in ageing rats. The rats in all groups had an average blood pressure of 116–120 mmHg. All of the rats' heart rates also were in normal ranges.
7.	SushantShengule, KalyaniKumbhare et.al[27]; 2018	Dr Prabhakar Kore Basic Science Research Centre, KLE Academy of Higher Education and Research (KLE University), Belagavi, Karnataka, India	Rats having Normal and diabetic conditions *Nisha-AmalakiChurna*	Pharmacodynamic parameters, which include blood sugar levels followed by an oral glucose tolerance test, high-density lipoproteins, total cholesterol and triglycerides, were assessed on day 15.	Curcuminoids and *Nisha-amalaki*affect the absorption and excretion of metformin and are possible because of lower excretion via the transporter system.
8.	Manish Kumar Singh et.al[28]; 2019	Indian Journal of Clinical Medicine	Mice suffering from Metabolic Disorders were divided into four groups *AmalakiChurna*	Fasting Blood Sugar, Oral Glucose Tolerance Test, the bicarbonate, haemoglobin, pH, lactate, Na^+, and Cl^- ion levels in the freshly collected whole blood.	*Amalaki*possessthe arsenic-induced free radicals scavenging and antidiabetic activity.
9.	Mahendra Prakash Kapoor et.al[29]; 2020	Taiyo Kagaku Co. Ltd., Nutrition Division, 1-3 Takaramachi, Yokkaichi, Mie, Japan.	Fifteen patients were recruited for this study. *AmalakiChurna*	The cardiac functioning, complete blood count, inflammatory and oxidative biomarkers, lipid profile and blood sugar levels, analysis of urine, and liver toxicity.	The presence of low molecular weight (1000 Da) hydrolyzable ellagitanninsgallic acid, ellagic acid, and their metabolites is principally responsible for the suppression of accumulation of platelets by oral administration of *Amalaki*. The study also demonstrated that four weeks of standardized *Amalaki* oral administration efficiently altered cholesterol levels by lowering low-density lipoprotein, total triglycerides, and total cholesterol while simultaneously increasing high-density lipoprotein. In contrast, the placebo had no significant effect on the study variables.
10.	Vandana Panda,	Department	Rats are suffering	The values of the Fasting	Conventional *Nisha-amalaki*

AmolDeshmukh et.al[30]; 2021	of Pharmacology & Toxicology, Prin. K. M. Kundnani College of Pharmacy	from Type-2 Diabetes Mellitus. *NishaChurna* and *AmalakiChurna*	blood glucose level and Oral Glucose Tolerance Test were used to calculate Insulin Resistance.	extract EmbliQur 1000 mg/kg was more effective than EmbliQur 500 mg/kg in alleviating insulin resistance.

3.1. Quality and publication bias

There was no quality or publication bias in any of the studies on *Haridra*, *Amalaki*, or on *Nisha-AmalakiChurna*, in the role of metabolic disorders.

4. DISCUSSION

Compared with *Amalaki and Haridra*, most studies are found on Amalaki. The studies conducted for *Amalaki* are as follows:

i. EFFECT ON METABOLIC SYNDROME

- Manoj Gupta et.al[22] had studied plant polyphenols, organic compounds found in *Amalaki* as empiric therapies for the metabolic syndrome's components, and specific polyphenols such as resveratrol, quercetin, and epigallocatechin-3-gallate were studied. Resveratrol lowered rodents' blood sugar levels, insulin resistance, weight, and blood pressure. Quercetin decreased blood sugar and cholesterol levels in obese rats. In a clinical study of patients suffering from metabolic syndrome, the drug dropped blood pressure without changing lipid levels. In rats, drug-induced weight reduction reduced blood sugar levels and insulin resistance while improving human haemoglobin A1C and cholesterol levels. Thus, the study showed significant improvement in Fasting Blood Sugar and HbA1C after *Amalaki* therapy.

- The effects of *Amalaki* (*Emblica officinalis Gaertn.*) on fructose-induced metabolic syndrome were investigated using a rat model. In rats fed a high-fructose diet, the increased levels of hepatocellular triglyceride and total cholesterol were considerably lowered. Because there is a need for more data on clinical trials, this research is crucial. Both total cholesterol and triglyceride levels were found to have robust significant variances in this investigation.

ii. ANTIOBESITY & HYPOLIPIDEMIC EFFECT

A study was conducted to see if *Emblica officinalis* has any anti-obesity impacts on mice with a 58 per cent kilo-calorie high-fat diet for 16 weeks. All male mice were assigned to one of the four groups: 1) control, 2) *Emblica officinalis* (10% w/w), 3) High-fat diet and 4) High-fat diet + *Emblica officinalis*. In mice provided with a high-fat diet, it had no impact on daily food consumption but drastically reduced body weight increase and adipose tissue weights. *According to mechanistic investigations, Emblica officinalis* normalized the expression of fatty mRNA nuclear transcription factor, Peroxisome proliferator-activated receptor gamma (PPAR). Flavonoids in *Emblica Officinalis* help to lower lipid levels in the blood. Some animal studies showed that lipid profiles had been improved. Flavonoid preparations from emblica fruits decreased cholesterol synthesis by reducing hepatic 3-hydroxy-3-methyl glutaryl-coenzyme A (HMG-CoA) reductase and improved lipid breakdown. Furthermore, in elderly rats, oral dosing of *Amalaki* dramatically reduced blood and hepatic mitochondrial thiobarbituric acid-reactive substance levels. The lipid profile improved markedly in this trial. The differences in means between high-density lipoprotein, low-density lipoprotein, and very low-density lipoprotein were all highly significant ($p<0.001$).M.B. Kavita et.al[23] studied that the *Amalaki* is a potential nutritional additive for dyslipidemia. Its *Rasayana*(rejuvenating) activity causes lipid levels in the blood to remain stable. The *Vayasthapana* (antiaging) activity protects against the negative consequences of dyslipidemia, that is, increased oxidative stress.

iii. ANTI-HYPERTENSIVE ACTIVITY

Emblica Officinalis has antioxidant qualities that may help deoxycorticosterone acetate/1 per cent NaCl high salt (DOCA/HS)-induced hypertension by improving redox-sensitive vascular, renal, and cardiac alterations. Deoxycorticosterone acetate-salt (20 mg/kg, S.C.) was given to rats twice a week for five weeks, and drinking water was replaced with a 1 per cent NaCl solution. For five weeks, these rats were given varying doses of *Emblicaofficinalis* (75, 150, and 300 mg/kg/day). Compared to deoxycorticosterone acetate control rats, it dramatically reduced renal and cardiac hypertrophy, heart rate, and arterial blood pressure in a dose-dependent manner. After *Amalaki* administration, the study group's systolic and diastolic blood pressure improved considerably. The variations in averages for Systolic and Diastolic blood pressure were statistically highly significant. Vikas Kumar et.al[26] studied that regular consumption of *AmalakiRasayan* enhances left ventricular dimension, exercise tolerance capacity, and function in ageing rats. The rats in all groups had an average blood pressure of 116–120 mmHg. All of the rats' heart rates also were in normal ranges. The studies conducted on both *Nisha* and *Amalaki* are as follows:

iv. ANTIOXIDANT PROPERTY

G GuruprasadRao, et.al[21]studied that Streptozotocin-induced diabetic control rats showed a significant decrease in Glutathione levels and the antioxidant enzymes using *Nisha-amalaki* therapy. Glutathione peroxidase and Superoxide dismutase activities in erythrocytes indicated an overall decrease in erythrocytes' ability to deal with reactive oxygen species produced in the state of diabetes mellitus. The positive correlation between glycated haemoglobin levels and lipid peroxidation in untreated diabetic control rats confirmed the association between persistent hyperglycemia and enhanced oxidative stress in diabetes. Because troglitazone is an antidiabetic drug with proven antioxidant effects, researchers employed it to compare the antioxidant benefits of *Nisha-amalaki* in diabetic rats. With diabetic rats, the *Nisha-amalaki* therapy resulted in significant decreases in both fasting plasma glucose and glycated haemoglobin levels. Jayshree S Dawane, et.al[24] studied that it was revealed that when all of the anomalies in Poly Cystic Ovarian Syndrome are taken into account, insulin resistance emerges as the primary disease. Similar research into Polycystic Ovarian Syndrome pathology found that as insulin resistance in Type 2 Diabetes Mellitus, a

post-receptor malfunction causes phosphorylation at a serine rather than a tyrosine residue. This flaw has been linked to an increase in oxidative stress and the development of atherosclerosis.This study assessed *Nisha-amalaki's* efficacy in Polycystic Ovarian Syndrome using a Letrozole-induced PCOS model. It was discovered that when letrozole was used, the oestrous phase of the menstrual cycle was completely absent. As a result, the regularization of menstrual periods was investigated in addition to the characteristics above.The impact on body weight was assessed. Compared to the control group, the Polycystic Ovarian Syndrome group's body weight increased on the 28th day of letrozole medication. By the 56th day, the *Nisha-amalaki*, Metformin, and combination (*Nisha-amalaki*, Metformin) groups had significantly reduced their weight. Among the test medications, the combination was the most effective. Metformin works to reduce weight by lowering glucose absorption as well as having an anorectic impact. *Nisha-amalaki,* has not shown any effect on body weight. Prashant Banarao Bedarkar et.al[25] studied that a single dose of *Nisha-amalaki* derived from 89mg of *Haridrachurna* and 121 mg of *AmalakiSwarasa triturated Amalakichurna*reduced the increased blood sugar in less than two and a half hours after its administration on anti-hyperglycemic mice model. Sushant Shengule et.al[27]studied the effect of *Nisha-amalaki* and Curcuminoids on the pharmacokinetics of metformin in normal rats. Metformin pharmacokinetic characteristics were dramatically altered by co-administration with *Nisha-amalaki* for 15 days. *Nisha-amalaki* increased the maximum concentration, duration to maximum concentration, and area under the plasma of metformin by 70.04 per cent, 43.75 per cent, and 53.0 per cent, respectively, at a dose of 200 mg/kg. It reduced the amount of distribution and clearance by 37.5 per cent and 41.45 per cent, respectively, compared to metformin. In the same way, administration of curcuminoids together showed a drastic rise of 80.82, 46.31, and 45.88 (in percentage) of maximum concentration, time to maximum concentration, and area under the plasma of metformin as compared to the metformin alone group respectively. The distribution and clearance volume were lowered by 18.03 per cent and 35.60 per cent compared to metformin. This finding revealed that curcuminoids and *Nisha-amalaki*affect the absorption and excretion of metformin and is possible because of lower excretion via the transporter system. Manish Kumar Singh et.al[28] studied Amalaki's arsenic-induced free radicals scavenging and antidiabetic activity. Mahendra Prakash Kapoor et.al[29] studied the safety and efficacy of ellagin, tannins-rich *Amalaki* (500 mg/day) in comparison to placebo therapy in healthy individuals. The presence of low molecular weight (1000 Da) hydrolyzable ellagitanninsgallic acid, ellagic acid, and their metabolites is principally responsible for the suppression of accumulation of platelets by oral administration of *Amalaki*. The study also demonstrated that four weeks of standardized *Amalaki* oral administration efficiently altered cholesterol levels by lowering low-density lipoprotein, total triglycerides, and total cholesterol while simultaneously increasing high-density lipoprotein. In contrast, the placebo had no significant effect on the study variables. Vandana Panda et.al[30] studied that all groups treated with a two-week high-fat diet had a substantial rise in blood glucose levels compared to the Controlled group. Over four weeks of therapy with metformin or conventional *Nisha-amalaki* extract "EmbliQur," which began on the 18th day of the research, there was a progressive drop in blood glucose levels before meals. Compared to the Control group, the high-fat diet/streptozotocin group's fasting blood glucose level was considerably higher at the end of the trial. Fasting blood sugar levels in the EmbliQur and Tablet Metformin treatment groups were significantly less as compared to those in the high-fat diet/streptozotocin group and comparable to those in the Normal Control group. EmbliQur 1000 mg/kg was slightly better than metformin and slightly better than the EmbliQur 500 mg/kg therapy, although not significantly different. EmbliQur was found to have a healthy blood glucose level-lowering effect. Insulin concentration was also measured at the time points for glucose determination in the Oral Glucose Tolerance Test research. EmbliQur and metformin were able to suppress the high-fat diet/Streptozotocin-induced increase in blood glucose level and insulin at all study intervals in the Oral Glucose Tolerance Test, showing their potential to treat diabetes and insulin resistance.

5. CONCLUSION

Ten articles were considered for review in search of Research Gate and PubMed. Out of them, four were animal studies, and six were analytical studies. The assessment parameters were fasting and post-meal blood sugar levels, glycosylated haemoglobin (HbA1c) levels, oral glucose tolerance test and complete blood count. The common herbs- *Curcuma longa* and *Emblica officinalis*, available worldwide, have a significant role in preventing and treating metabolic disorders. However, the maximum studies are on *Nisha-Amalaki (*a combination of *Haridra & Amalaki* along with *bhavna* [trituration process] of *Amalaki swarasa* [Juice form of *Emblica officinalis*] to *Haridra* [*Curcuma longa*]*)* which is found to be effective in Diabetes mellitus and dyslipidemia, which can be considered as the lacuna of previous reviews. Therefore, there is a need to conduct studies on *Nisha-amalaki* to explore its effect on other common metabolic disorders like PCOD, Hypothyroidism.

6. LIMITATIONS

From this review, very few studies have been conducted on only *Haridra* compared to *Amalaki* on metabolic disorders. The maximum studies are on *Nisha-Amalaki (*a combination of *Haridra & Amalaki),* which is effective in Diabetes mellitus and dyslipidemia. There is a need to conduct studies on *Nisha-Amalaki* to explore its effect on other common metabolic disorders like PCOD, Hypothyroidism etc.

7. AUTHORS CONTRIBUTION STATEMENT

All the authors gave their full contribution and support to this article. Dr Aman Chhabra collected all the relevant data needed for the article. Dr Vaishali Kuchewar verified the data and guided the article wherever required. Dr Twinkle Joshi helped in the proper framing of the article. All the authors have read and agreed to the final manuscript.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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