Effect of Indian Spices to Manage the Diabetes and Associated Metabolic Disorder

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Abstract: *India is a country, where we have more than four crores of insulin dependent diabetics and this number is growing regularly. The situation is more or less same in other developing/non developing neighboring countries and across the globe. This disease is a non-curable and the management is the only remedy using variety of systemic chemicals as drugs/insulin. The resistance to the drugs/insulin is also a challenge to strengthen the management for a longer period. At the same time higher combination of these chemicals/drugs also have to pose admissible side effect and adverse effect to various vital organs. The sustained efforts have been made by several scientist/physician to see the potential applicability of Ayurvedic herbal preparation to combat with the diabetes and other associated metabolic disorders. In order to strengthen further, we have also tried to develop a poly-herbal preparation to manage the diabetes and associated metabolic disorders using natural herbal spices being used in Asian food for the ages. The special attention has been given on the pharmacological properties and the amount ratio of the spices used in this poly herbal preparation. Our finding reveals that the formulation prepared has the significant potential to reduce the doses of allopathic drugs already taken by person of type-2 diabetes to control the glucose level. At the same time many of them (type-2 diabetic person) are managing their glucose level only from these spices/food preparation (poly-herbal preparation) and their level of blood glucose are at basal level without having any adverse effect. We believe that this herbal preparation used in this study could be applicable as one among the drug of choice to manage the diabetes type-2 and associated metabolic disorder if taken on regular basis as advised.*

Keyword: *Diabetes type-2, Herbal therapy, Glucose & Lipid metabolism.*

I. Introduction

Herbal preparations (Ayurvedic preparation) have been used since the down of civilization to maintain health and treat diseases. Herbal medicines are popular remedies for the treatment of different diseases by vast majority of world population. According WHO 65-80% of world population rely on the traditional medicines to treat the various common diseases as well as sever diseases. To date, many plants have been claimed to pose beneficial health effects such as antioxidants and antimicrobial, therapeutic, aromatic aesthetic properties [1]. Pharmaco epidermiological survey carried out by Karandikar et.al [2-3], above 60 years of age revealed that about 40% are user of herbal drugs. In china, the traditional medicines are widely used and trusted in related to cultural practice. Indian Council of Medicinal Research (ICMR) has published several booklets on the same subject and forms a scientific advisory group for traditional medicines. In 1994, Dietary Supplement Health & Education Act (DSHEA) which specially empowered the public to make informal choice about herbal product use based on accessible balanced scientifically valid information.

In India, a survey of polyherbal preparation which may be Ayurvedic / Unani / Sidha etc. available in market as a hepato protective agent [4], for cardiovascular disorder, antidiabetic agent, anti-inflamatory, for anti- laxative, anti- contraceptive cream, for urinary calculi etc. [5]. Liv 52 is a polyherbal formulation and prevents lipid peroxidation in liver damage [6 -7]. There are several polyherbal formulations available in the market to cure the diabetes and possess the anti- diabetic activity in Ayurveda [8-12]. Similarly, in Unani, several formulations used to cure the diabetics [13-16].

Diabetes a group of metabolic disorder disease in which a person has high sugar (glucose) level in blood as well as in urine in type 2 i.e. diabetes mellitus (where as in diabetes insufidus, the urine sugar not present) either because the body does not produce enough insulin or because cell do not respond to the insulin that is produced. The glucose level in blood is controlled by insulin which is released in the blood by β-cells of Langerhans and glucagon hormone. In chronic stages of such problems (type 2 diabetes), the patients face some immunological problems, cardiothoracic, cardiovascular, nephrological, respiratory, bronchial, retinopathological problem etc.

Therefore, several modern allopathic treatment process are available but after certain period the allopathic medicine are inactive and some side effects or adverse effects may also developed on another vital as well as related organs. The ayurvedic treatment process of polyherbal and another naturopathy process are very useful to cure such to sever chronic disease.

There are so many medicinal plants available in literature to cure such problems. Generally, Cinnamom species are C. verun, C. burmani, C. laureiroi, C. aromaticum are found in Ceylon, Indonesia, Vietnam and china respectively and are used as a medicine to cure most of the disease in possesses a miracle result to cure several problems related to the metabolic disorder [17]. Similarly, Occimum sanctum Linn. (Holly basil, Tulsi)[18] and Aegle marmelose Corr. (Bael, Bilb) are the cultivated holly plant/tree which are used in India as a spices/food and also as a medicin to cure several problems in India [19-27]. The Ayurvedic properties of these plants [28] are as follows –

The Cinnamom belong to the botanical family Lauraceae and Ayurvedic properties are Guna-Laghu, Ruksha Tikshana., Rasa- Katu, Tikta, and Madhur. Vipaka- Katu and Virya – Usna. The holy basil (O. sanctum) belong to the Labiateae family and Ayurvedic propertis are Guna – Laghu , Ruksha., Rasa – Katu ,Tikta., Vipak- Usna and Virya – Katu. Bilb (Aegle marmelose Corr.) belongs to the botanical family Rutaceae and its Ayurvedic properties are Guna – Laghu, Ruksha., Rasa – Kasaya, Vipak – Katu and Virya – Usna.

In the present paper, effects of three traditional herbal plants products in human on metabolic disorder disease viz. diabetes type-2 has been observed and analysed up to 90 days under the supervision of an ayurvedic physician. The different biochemical/physiological data have been collected and analyzed in present research work to standardize the effect of this herbal preparation.

II. Materials And Methods

Persons who are suffering from such metabolic disorder problem i.e. diabetes type-2, to control the disease, the different materials & methods have been applied by them. The material of Cinnamom bark collected from the market and Occimum sanctum Linn. leaves as well as Aegle marmelose Corr. leaves collected directly from cultivated plants and dried at room temperature to make their powder separately. All these herbal products taken together in the ratio of 1:2:2(i.e. 40mg: 80mg: 80mg) respectively according to their Ayurvedic and chemical properties. A single adult dose i.e. 200mg of the above ratio was taken with a cup of sugar free cow milk or cow milk cream (malai) thrice a day (anupan in Ayurveda).The non-diabetic persons who does not report any problems, also taking the same preparative dose as a food/spices daily thrice a day.

The blood samples of diabetic and non-diabetic persons for the analysis of different biochemical parameters e.g., plasma glucose (fasting/post prandial), serum cholesterol, HDL- cholesterol, triglyceride, blood urea nitrogen (BUN), serum creatinine, serum bilirubin (total), serum alanine transaminase, serum aspartase transaminase enzyme, serum protiens, serum albumine and electrolyte serum Na^+ & K^+ were collected in different vials. The plain vials used for biochemical/ electrochemical parametres. The auto analyzer, Erbacam, EM-360 analyser of Transacia Co. was used for complete biochemical parameters observations. The serum Na^+& K^+ were analysed by using the PSR on Universal Reagent Pack. The physiological parameter e.g. body weight/ blood pressure(systolic/diastolic), pulse rate, Spo2 were also observed under the supervision of qualified physician for complete observations.

III. Results And Discussion

Total 40 diagnose cases (Male & Female) of diabetes type-2 were enrolled in the study and dose with the poly-herbal preparation for 90 days taken three time daily under the kind supervision of qualified Ayurvedic physician. Out of 40 cases, 34 persons (28 Males & 6 Females) of type-2 diabetes were showing significant depletion in the level of blood glucose (plasma glucose) "Fig. 1&2", while 6 persons (2 Males & 4 Females) did not respond the treatment significantly. In the insignificant response, the female persons were more than the male persons; it may be due to the female endocrine system. The non-diabetic persons (10 Nos.) also taking the same herbal preparation under identical situation were not showing any significant depletion in the glucose level before and after meals i.e. at fasting level as well as in post-prandial (PP) condition in the experimental dose "Fig. 1 & 2". The cholesterol level also found decreases in both diabetic and non-diabetic significantly "Fig. 3 & 4". The Low Density Lipid (LDL) values simultaneously decreases and High Density Lipid (HDL) values slightly increases 'Fig. 3 & 4". The higher value of S. triglyceride also exhibits the decreasing trends. But after long term of treatment i.e. up to 90 days, the S. triglyceride value was found decreasing significantly "Fig. 3 & 4". It is clearly indicated that the cinnamom, tulsi (Occimum sanctum Linn.), bael (Aegle marmelos Corr.) powder combination exhibits better effect to lower sugar level as well as cholesterol level in blood sample collected from diabetic persons in comparison to control. It may occur due to the presence of an Aegeline adrenergic receptors in Aegle marmelos which allocated on the membrane surface of the β-cells of pancreas, regulate the insulin release [29]. The α-2 adrenergic receptors are the major adrenergic receptors to involve in β-cells of pancreas [30].
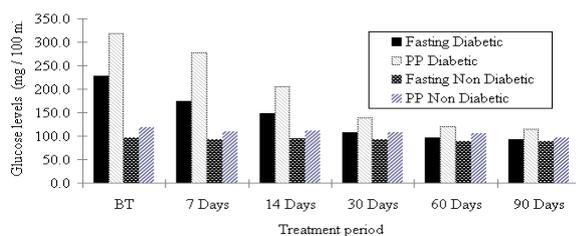
Fig. 1: Effect of Cinnamon, O. sanctum Linn and A. marmeloes corr. on glucose level of male person
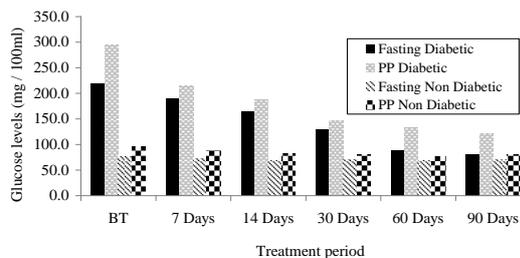
Fig.2:Effect of Cinnamon, O. sanctum Linn and A. marmelose corr. on glucose level of female person

The blood Urea Nitrogen (BUN) value, S. creatinine, sodium/potassium ion and other liver enzymatic parameters were also found normal "Table-1&2". In few diabetic persons, who reported the liver problems before the treatment process, such problems were removed i.e. elevated level of AST and ALT value were found decreases. Some persons who were suffering from bronchial allergy and respiratory problems, the physiology parameters such as (SpO_2, BP and Pulse Rate) were also found normal after the treatment process.
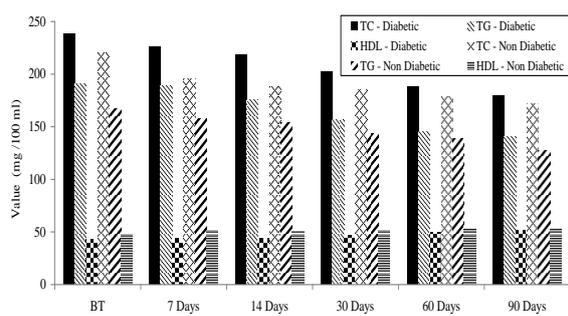
Fig.3: Effect of Cinnamon, O. sanctum Linn and A. marmelose corr. on TC, TG and HDL level of male person
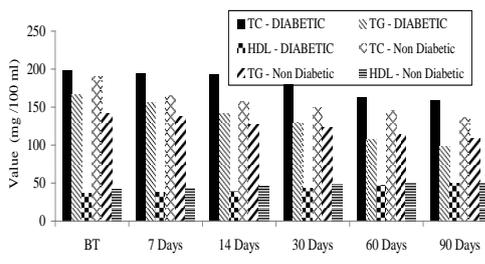
Fig.4: Effect of Cinnamon, O. sanctum Linn. and A. marmelose corr. on TC, TG and HDL level of female person

In non-diabetic persons the effect of this herbal preparation did not show any hypoglycemic effect "Fig. 1&2". However, the S. cholesterol and S. triglyceride level in serum of non-diabetic person were found decrease that has the higher value of serum lipid. The HDL level slightly increases "Fig. 3&4". It is clearly indicate that the herbal combination exhibits the antidiabetic activity not hypoglycemic i.e. it regulates the pancreatic cells to control the glucose metabolism in human beings. Antidiabetic activity of these herbal product may occur due to their action on β-cells of pancreas. Those patients were found insulin resistant, showing also a significant reduction in blood sugar it may occur by the breakage action of antigen body complex (develop due to the plasma protein factor in diabetic persons) [31]. Similarly the decreases level of S. cholesterol and S. triglyceride level of both diabetic and non-diabetic persons is a phenomenon of better metabolism of lipid i.e. it activate the metabolic cells/body organ which involve in lipid metabolism in human body and remove the bad cholesterol. It has been concluded that the poly herbal preparation of cinnamom, Occimum Sanctum Linn. (tulsi) and Aegle marmelose Corr. and bael powder is very useful to control the glucose and lipid metabolism in human beings and behave the anti-hyper tension activity of such preparation. It may occur due to the synergize action of herbal Ayurvedic properties in all three ingredients (herbal spice / food) i.e. due to the Guna & Rasa of these herbal preparations.

IV. Conclusions

Results clearly indicate that the poly herbal formulation (traditional Ayurvedic treatment process) is very useful because of its synergizing action of polyherbal preparation in comparison to a single product action on the human body. The glucose metabolism is disturbed at the kreb cycle level. The basic action in this cycle is oxidative phosphorylation, seems to take place in mitochondria of lever cells. Whereas the β-cells of pancreas control the oxidatory phosphorylation. That means herbal product may act on oxidative phosphorylation activity and control the glucose metabolism and also regenerate the β-cells which are responsible for insulin secretion. Some metabolic, physiological and psychological conditions e.g. insomnia, anxiety, apprehension and dependence condition automatically recover after some time and patient get relief. It may be due to the saturation of O_2 level in brain cells (nerve cells). Due to this, CNS may become healthy by proper circulation of oxygenated blood in blood stream of the human. So, we can say that the traditional Ayurvedic treatment is more useful at lower cost in comparison to the allopathic treatment process without any adverse effect.

Acknowledgement

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Table 1: Effect of Cinnamon, Occimum sanctum Linn and Aegle marmelos on biochemical parameters of treated person

Parametes	DIABETIC PERSON											
	Male						Female					
	Control 0 D	After 7 D	After 14 D	After 30 D	After 60 D	After 90 D	Control	After 7 D	After 14 D	After 30 D	After 60 D	After 90 D
BUN (mg100ml⁻¹)	17.0 ±3.50	16.8 ±3.33	14.0 ±2.63	13.54 ±2.24	12.84 ±1.82	11.20 ±0.70	19.14 ±1.28	18.91 ±0.91	16.92 ±0.79	14.71 ±0.84	11.4 ±0.98	10.8 ±0.84
S.Creatinine (mg100ml⁻¹)	1.36 ±0.35	1.20 ±0.30	1.05 ±0.25	1.05 ±0.15	0.90 ±0.10	0.85 ±0.05	1.30 ±0.28	1.18 ±0.16	1.05 ±0.12	0.93 ±0.09	0.81 ±0.07	0.75 ±0.07
ALT(IU)	46.5 ±1.65	45.5 ±2.15	41.0 ±1.75	32.5 ±1.45	26.6 ±1.30	24.2 ±1.15	42.5 ±1.55	37.0 ±1.80	31.2 ±1.45	26.5 ±1.12	23.7 ±1.15	22.5 ±1.05
AST(IU)	41.8 ±2.10	38.5± 2.35	34.6 ±1.55	30.0± 1.30	22.5 ±1.10	21.5 ±1.30	38.7 ±1.85	33.5 ±1.45	30.7 ±1.12	25.5 ±1.30	24.6 ±1.15	23.5 ±1.05
Bilirubin (mg 100 ml⁻¹)	1.25 ±0.25	1.10 ±0.15	1.05 ±0.09	0.95 ±0.08	0.60 ±0.10	0.50 ±0.10	1.08 ±0.17	0.90 ±0.12	0.75 ±0.10	0.70 ±0.05	0.50 ±0.10	0.50 ±0.05
Protein (g 100 ml⁻¹)	6.95 ±0.15	6.98 ±0.15	7.10 ±0.25	7.45 ±0.18	7.48 ±0.15	7.45 ±0.09	6.45 ±0.25	6.50 ±0.22	6.56 ±0.30	6.48 ±0.15	6.60 ±0.15	6.58 ±0.17
Albumin (g 100 ml⁻¹)	3.55 ±0.25	3.70 ±0.15	3.92 ±0.18	4.07 ±0.16	4.28 ±0.15	4.35 ±0.20	3.45 ±0.18	3.48 ±0.15	3.45 ±0.20	3.85 ±0.25	3.80 ±0.15	3.95 ±0.18
Na+ (mEq/l)	136.0 ±1.50	137.0 ±1.25	139.0 ±1.70	138.0 ±1.50	142.5 ±1.35	140.2 ±1.15	137.5 ±0.50	139.0 ±0.80	139.0 ±1.70	140.5 ±1.50	138. ±1.10	139. ±0.50
K+ (mEq/l)	3.85 ±0.45	3.95 ±0.20	4.15 ±0.15	4.05 ±0.28	4.12 ±0.19	4.16 ±0.17	4.05 ±0.45	3.95 ±0.18	4.15 ±0.15	4.05 ±0.22	4.08 ±0.12	3.92 ±0.08

Table 2 Effect of Cinnamon, Occimum sanctum Linn and Aegle marmelos on biochemical parameters of treated person

Parameters	NON DIABETIC PERSON											
	Male						Female					
	Control 0 D	After 7 D	After 14 D	After 30 D	After 60 D	After 90 D	Control 0 D	After 7 D	After 14 D	After 30 D	After 60 D	After 90 D
BUN (mg 100 ml⁻¹)	10.74 ± 0.70	9.10 ±0.51	8.63 ± 0.58	8.73 ± 0.39	8.40 ± 0.42	8.49 ± 0.42	12.37 ± 0.98	10.50 ±0.86	8.96 ± 0.74	9.62 ± 0.51	9.15 ± 0.39	9.24 ± 0.40
S. Creatinine (mg 100ml⁻¹)	0.85 ± 0.10	0.70 ±0.15	0.60 ±0.10	0.68 ±0.09	0.65 ±0.08	0.70 ±0.08	0.90 ±0.16	0.85 ±0.12	0.80 ±0.09	0.70 ±0.08	0.80 ±0.15	0.78 ±0.10
ALT(IU)	39.0 ±2.15	35.0 ±1.75	27.0 ±1.25	25.0 ±0.80	21.0 ±1.15	19.0 ±1.50	40.0 ±2.35	31.0 ±1.55	30.0 ±1.40	26.0 ±1.15	21.0 ±0.75	21.5 ±0.50
AST(IU)	33.0 ±3.50	27.0 ±3.10	26.5 ±1.56	23.0 ±1.40	20.0 ±1.50	18.0 ±1.30	30.0± 2.80	27.0 ±2.15	26.0 ±1.55	21.0 ±1.30	18.5 ± 0.70	18.2 ±0.60
S.Bilirubin (mg 100 ml⁻¹)	0.45 ±0.10	0.40 ±0.10	0.45 ±0.15	0.49 ±0.07	0.40 ±0.05	0.40 ±0.05	0.65 ±0.20	0.55 ±0.15	0.50 ±0.10	0.55 ±0.10	0.40 ±0.15	0.45 ±0.12
Protein (g 100 ml⁻¹)	6.85 ±0.25	6.90 ±0.15	6.92 ±0.35	7.15 ±0.10	7.25 ±0.25	7.30 ±0.20	6.35 ±0.45	6.49 ±0.30	6.58 ±0.17	6.78 ±0.25	6.85 ±0.15	6.90 ±0.30
Albumin (g 100 ml⁻¹)	4.05 ±0.10	4.18 ±0.15	4.23 ±0.09	4.30 ±0.08	4.37 ±0.15	4.35 ±0.20	3.90 ±0.10	4.05 ±0.15	4.08 ±0.10	4.15 ±0.15	4.20 ±0.10	4.15 ±0.15
Na+(m Eq/l)	139.0 ±1.20	139.5 ±1.10	138.6 ±1.21	140.0 ±1.00	138.5 ±0.50	141.0 ±0.30	143.0 ±2.5	139.0 ±1.50	138.0 ±1.00	139.0 ±1.50	137.0 ±1.00	138.5 ±1.15
K+(m Eq/l)	3.95 ±0.20	3.85 ±0.15	4.05 ±0.20	3.90 ±0.15	3.88 ±0.09	4.22 ±0.08	3.75 ±0.10	3.70 ±0.10	3.80 ±0.15	3.90 ±0.10	3.95 ±0.10	4.10 ±0.15