Effect of Naturopathic Based Fasting Therapy on Liver Enzymes, Electrolytes, Fasting Blood Glucose, Weight And Perceived Stress Among Healthy Individuals - A Randomized Controlled Trial

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Abstract

Background and aim: Calorie restrictionhas been shown to be beneficial oncardiovascular risk factors,glucose regulatory function, weight reduction and reduction in oxidative stress. In this study, we aimed to find the role of Naturopathic based fasting therapy on Liver enzymes, Fasting blood glucose, weight and perceived stress among healthy individuals.

Materials and Methods: Healthy subjects were screened and recruited from the students of SDM College of Naturopathy and Yogic Sciences, Ujire. Subjects were randomized into either of two groups, fasting therapy group (n=30) and control/routine diet group (n=30) after taking written informed consent. Subjects aged between 18 and 23 years, fasting naïve for at least past 6 months were included in the study. Fasting therapy group underwent fasting therapy for 7 days with minimal activities and control group had no change in their dietary pattern and other activities for the same duration. All the subjects in fasting therapy and control group were assessed by the Naturopathy and Yoga Physician at the baseline and after 7 days with Body weight, Liver enzymes, Fasting blood glucose, weight and perceived stress.

Results: There was a significant reduction in weight, Chlorine and SGPT,with fasting therapy group observing a higher reduction than the routine dietary pattern group. In contrast to this, alkaline phosphatase levels rose after fasting therapy than the routine dietary pattern.

Conclusion: The findings support that naturopathic based fasting therapy is useful for enhancing liver function and reducing weight among healthy individuals.

Key words: naturopathy, fasting therapy, liver enzymes, electrolytes

Introduction:

Naturopathy based Fasting therapy and diet therapy are among the non-pharmocological treatment modalities widely used as a part of naturopathic treatment (1). Naturopathic diet plays an important role on health of an individual (2). Causes of disease according to Naturopathy are Lowered Vitality, Accumulation of Morbid Matter and abnormal composition of blood and lymph (1). In other words, accumulation of toxic waste is the maincause of disease and cure is to eliminate the toxic substances from the system (1).Fasting is considered as one of the main eliminative therapeutic measure used in Naturopathy (3).Fasting has been practiced since ages for both religious and spiritual purposes in Hindu, Muslim, Christian and other religions(4-7). The therapeutic application of fasting was mainly practiced by the western and Indian Naturopaths like Shelton, Henry Lindlahr, Rao, Gala etc(1, 8-10). Itmay be practiced as dry fast, water fast and juice fast(10). For therapeutic purposes, juice fasting has been commonly practiced in Naturopathy

hospitals using Lemon juice with honey (11).

According to Trepanowski and Bloomer, fasting is defined as partial or total abstention from all foods, or select abstention from prohibited foods (7). Some research has been done on three kinds of fast such as Calorie Restriction (CR), Alternate Day Fasting (ADF) and Dietary Restriction (DR). Calorie restriction is nothing but reduction of calorie intake by 20-40%. Calorie restricted diet have been widely practiced in Naturopathy hospitals as a part of fasting therapy, though the method of the fast differs. Reasonable research has been done on calorie restriction. Review suggests,CR shows improvement in cardiovascular risk factors, glucose regulatory function, weight reduction and reduction in oxidative stress. ADF showed no change in fasting blood glucose and blood pressure but insulin sensitivity and HDL increased while triacylglycerol decreased. Ramadan fasting showed improvement in the lipid profile, however patients with diabetes mellitus fail to show improvement in lipid parameters. Body weight / BMI remain largely unchanged or decreased (12).Another study reported that regularity in the diet plan is important for weight reduction, weight maintenance and other health benefits (13).

Though there are studies on beneficial effects on health outcomes of calorie restriction, Ramadan fasting and intermittent fasting (ADF),which is evident from several animal and human studies, there have been no studies for establishing the effects of naturopathic therapeutic fasting as prescribed in Naturopathy in either healthy or diseased population. By considering the review of literature, viewing the extent of problem and understanding the advantages of therapeutic fasting, we felt there is a pressing need to undertake this study to elucidate the effects of Naturopathic based therapeutic fasting therapy on liver enzymes, electrolytes, fasting blood sugar, weight and perceived stress among healthy individuals.

Methodology:

Sampling: Healthy subjects were screened from the students of SDM College of Naturopathy and Yogic Sciences, Ujire. Subjects were randomized into either of two groups, fasting therapy group (n=30) and control/routine diet group (n=30) after taking written informed consent. Randomization was done using computerized random number table. Subjects aged between 18 and 23 years, subjects who have given written informed consent, fasting naïve for at least past 6 months were included in the study. Individuals with any medical conditions, substance use such as nicotine, alcohol and others, females during menstruation, subjects under any medications BMI <16 (severe thinness) were excluded from the study. The duration of fasting and routine diet was for 7 days. Fasting therapy group underwent fasting therapy for 7 days with minimal activities and control group had no change in there dietary pattern and other activities. The study was approved by the Institutional ethics committee.

Intervention

Fasting Intervention: Subjects were asked to gather in the hall, where fasting therapy was administered to the subjects. Subjects were kept away from daily routine so that there won't be any interference with their thoughts and emotions. They had to maintain complete physical, mental and sensorial rest during the session. Throughout the intervention period, subjects were staying together in allotted hall under observation from 6 am till 8 pm and then asked to go back to their residential hostel. Even in the residential hostel, they were under observation from a trained Naturopathy and Yoga Physician for 7 days. No supplementary diet was given to the subjects. Along with the juice,

the subjects were asked to drink plenty of water (approximately 3 liters/day). The physician monitored the progress of subjects carefully. Subjects were taught general yogic relaxation techniques. Certain Naturopathic treatments were administered to manage acute symptomsfor 3 subjects during the course of the fasting therapy, mainly headache, dizziness, vomiting & diarrhea. Subjects underwent enema as colon cleansing procedure every day during fasting period. The details of day by day food for 7 days with their calorific values are enlisted in the table (1).

Routine Diet Group (Control Group):They had routine diet for 7 days along with regular activities.

Assessment

All the subjects in fasting therapy and control group were assessed by the Naturopathy and Yoga Physician with the following parameters at the baseline and after 7 days. Body weight was measured in subjects while wearing light clothing using a digital weighing machine. BMI was calculated using the following equation: BMI = weight (kg)/height^2 (m^2). The Perceived Stress Scale (PSS)was used, which is the most widely used psychological instrument for measuring stress levels. The scale includes a number of direct queries about current levels of experienced stress, and questions in the PSS are all about feelings and thoughts during the last month.

Assessment of Liver enzymes, electrolytes and Fasting blood sugar level (At baseline and at eighth day): Five ml venous blood was drawn in plain vacutainer from the fasting and routine diet group subjects. Sample was allowed to clot and the serum was separated within 30 minutes. Coded serum samples were stored at -40 degree centigrade. Assay was done on the same day. Analytes were analyzed in a chemistry auto analyzer (Olympus AU 400) and performed in a National Accredited Laboratory (KMC, Mangalore) with the help of a biochemist. Methods used are shown in Table 2. Bio-Rad Quality controls were used to check accuracy and precision.

Data analysis

A statistical analysis was performed using SPSS version 19.0. Kolmogorov–Smirnov test was used to check for normal distribution, which suggests data is normally distributed. As our objective was to compare the changes after fasting therapy with that of routine diet, parametric analysis was done by using Independent sample T test to compare difference scores (delta change) between the two groups wherein difference score was calculated by subtracting pre from post values for each variable. Paired sample T test was done to compare pre and post scores within the groups. Baseline difference was done by Independent sample T test for continuous variables. Statistical significance was set up at $p<0.05$.

Results

A Total of 60 healthy subjects eligible were included at the outset. All of them had accepted for randomization. Out of 60 subjects, 30 were randomized into fasting therapy group and 30 were into control group. Their mean age was 20.53± 1.73 (Fasting therapy: 21.3±1.25; Control: 19.96 ±2.02). Among them 20 were females (Fasting therapy: M: F 19:11; Control: M: F 21:9) respectively. However, two of them dropped out in the fasting group from the study due to the acute symptoms occurred during fasting therapy. One experienced vomiting and headache and another one experienced diarrhea with weakness. Fifty eight subjects remained at the end for the post analysis.

Table1: Seven days diet pattern for fasting therapy group

Fasting therapy Pattern	Type of diet and quantity taken	Days	Calories (Approximate)
Day of Admission	Naturopathic boiled diet consisting of fresh bland, vegetarian diet consisting of 2 chapatis or daliya, boiled vegetables, and buttermilk	1 day	1500-200 K Cal
Juice Fasting	Lemon honey juice 250 ml * 4 times daily (half lemon and a teaspoon of honey in 230 ml of water)	4 days	600 K Cal / day
Juice Fasting (Breaking of Fasting Ist stage)	Musumbi Juice 250 ml* in the morning time followed by Fruit Diet (papaya)	1 day	800 K Cal
Breaking of Fasting (2nd stage)	Fruit Diet (papaya) and Raw Diet (sprouts, and raw vegetable and fruit Salad)	1 day	1000 K Cal

Table 2: Following were the methods used for analytes.

Analytes	Method and References
FBS	God-Pod (30)
ALP	PNP-calorimetric (31)
AST (SGOT)	UV-Kinetic (32)
ALT (SGPT)	UV-Kinetic (33)
Sodium	ISE (34)
Potassium	ISE (35)
Chloride	ISE (35)
Bicarbonate	PEPC-Enzymatic (35)

FBS: Fasting Blood Sugar; ALP: Alkaline Phosphates

AST (SGOT):Aspartate aminotransferase (serum glutamic oxaloacetic transaminase)
ALT (SGPT):Alanine transaminase (serum glutamic-pyruvic transaminase)

Table3: Baseline Socio demographic, Clinical details & outcome measures

Measures Mean (SD)	Fasting Group	Routine Diet Group	T	P
Age	21.03(1.2)	19.96(2.02)	2.46	0.017*
Education in number of years	15.87(0.346)	16.00(0.000)	-2.002	0.050*
Height	166.10(9.3)	166.88(8.2)	-0.324	0.747
Weight	56.62(7.4)	56.74(8.5)	-0.054	0.957
BMI	20.78(2.60)	20.43(3.55)	0.407	0.686
Perceived stress	15.76 (5.22)	16.78 (4.91)	-0.720	0.475
SGOT Pre	21.38(6.69)	22.23(5.78)	-0.527	0.600
SGPT Pre	18.19(15.1)	18.73(8.3)	-0.172	0.864
ALP Pre	72.74(21.64)	95.23(27.94)	-3.52	0.001*
NA pre	140.29 (1.2)	141.66(1.21)	-4.27	0.001*

K Pre	4.45(0.313)	4.36(0.388)	0.75	0.45
CL Pre	100.3(1.92)	100.4(1.52)	-0.02	0.97
Bicarbonate Pre	27.4(4.79)	28.3(1.91)	-o.97	0.33

ALP-Alkanine Phosphatase*p<0.05 significant level

Table 4: Outcome variables at base line and after 7 days - Inter Group Difference

Measures Mean (SD)	Fasting pre	Fasting post	Fasting Group (Change: Pre-post)	Control Group pre	Control Group post	Routine Diet Group (Change: Pre-post)	T	P
FBS	87.51 (6.12)	84.34 (6.11)	3.17 (6.35)	87.12 (11.89)	84.32 (5.69)	2.80 (10.1)	0.164	0.870
Weight	56.73 (7.68)	55.43 (7.28)	1.29 (0.90)	56.74 (8.55)	56.62 (8.41)	0.12 (0.94)	4.61	0.001*
BMI	20.70 (2.67)	20.19 (2.52)	0.50 (0.31)	20.43 (3.55)	20.46 (3.37)	-0.02 (0.47)	4.687	0.001*
Perceived stress	15.68 (5.29)	15.06 (4.90)	0.62 (3.40)	16.78 (4.91)	20.82 (21.98)	-4.04 (22.07)	1.123	0.26
Total Bilirubin	0.58 (0.23)	0.67 (0.27)	-0.08 (0.20)	0.65 (0.29)	0.61 (0.30)	0.03 (0.16)	-2.414	0.019*
Direct Bilirubin	0.17 (0.06)	0.23 (0.08)	-0.06 (0.07)	0.18 (0.08)	0.21 (0.10)	-0.02 (0.05)	-1.957	0.056
Total Protein	7.10 (0.39)	7.23 (0.32)	-0.12 (0.31)	7.25 (0.26)	7.28 (0.33)	-0.02 (0.29)	-1.251	0.216
Albumin	4.72 (0.22)	4.71 (0.32)	0.003 (0.20)	4.90 (0.17)	4.77 (0.22)	0.13 (0.26)	-2.028	0.048*
Globulin	2.45 (0.50)	2.51 (0.26)	-0.057 (0.45)	2.39 (0.28)	2.47 (0.26)	-0.08 (0.25)	0.262	0.795
SGOT	21.44 (6.82)	18.82 (4.62)	2.6 (4.03)	22.44 (6.18)	21.36 (5.70)	1.08 (6.46)	1.067	0.291
SGPT	17.96 (15.44)	13.20 (10.01)	4.75 (5.90)	18.84 (8.95)	18.24 (10.15)	0.600 (4.47)	2.87	0.006*
ALP	74.00 (21.57)	78.17 (22.42)	-4.17 (6.48)	96.04 (30.30)	96.84 (32.73)	-0.800 (6.62)	-1.88	0.065
NA	140.31 (1.31)	138.86 (2.34)	1.44 (2.22)	141.68 (1.21)	140.64 (1.28)	1.04 (1.42)	0.78	0.43
K	4.44 (0.32)	4.22 (0.47)	0.220 (0.48)	4.37 (0.40)	4.23 (0.37)	0.14 (0.31)	0.71	0.47
CL	100.41 (1.99)	99.58 (3.21)	0.827 (2.45)	100.40 (1.55)	101.40 (2.10)	-1.00 (1.55)	3.21	0.002*
Bicarbonate	27.35 (4.93)	27.05 (1.83)	0.306 (4.91)	28.20 (1.95)	26.39 (1.58)	1.81 (1.64)	-1.46	0.15

FBS-Fasting Blood Sugar Level; ALP-Alkaline Phosphatase; K-Potassium; Cl-Chlorine
*p<0.05 significant level

There were no baseline differences between two groups with respect to all the parameters except age, education, Alkaline Phosphatase (ALP) and Sodium (NA) respectively. This suggests there is not much baseline difference among many of the parameters. Age and education was higher in study group in comparison with control group (Table 3). Within group comparison using paired sample test showed significant difference observed with respect to reduction in weight, fasting blood sugar, NA ($p=0.002$), K ($p=0.02$), SGOT ($p=0.002$) & SGPT ($p<0.001$) levels in the fasting therapy group. Trend level was observed for Cl ($p=0.08$). In contrast to this ALP ($p=0.002$) levels rose significantly after fasting therapy. However, no difference was observed with respect to other parameters. In control group also there was a significant reduction in Na ($p=0.001$), K ($p=0.03$) and Bicarbonate ($p<0.001$) levels.

However, there was a significant increase in chlorine ($p=0.004$) levels. Independent sample t test was used to compare difference scores (delta change) between the two groups, which showed significantly different scores between two groups onweight, Chlorine and SGPT with fasting therapy group observing a higher reduction than the routine dietary pattern group. In contrast to this alkaline phosphatase levels rose after fasting therapy compared to the routine dietary pattern. No group difference was observed in rest of the parameters (Table 4).

Discussion:

Our results suggest, fasting therapy is more useful in reducing weight, chlorine and SGPT levels than the routine diet. In contrast to this alkaline phosphatase levels ($p=0.065$) rose after fasting therapy than the routine dietary pattern, though trend level of significance was observed. Reduction in fasting blood glucose, NA, K, SGOT, SGPT levels was observed in fasting group on within group comparison. Reduction in electrolytes, weight and ALP rise is consistent with the previous caloric restriction studies (14-19).These results suggest fasting reduces the electrolytes level and enhances liver function among healthy volunteers.This is the first study of its kind to look at the influence of naturopathy based fasting therapy on liver enzymes, electrolytes, fasting blood glucose, weight and perceived stress.

Rise in alkaline phosphatase could be attributed to the adaptation and enhancement of enzyme activity during decreased food intake as observed in obese rats (17). Reduction in glucose level may be due to decreased dietary carbohydrate intake, with metabolism depending on the glycogen store within 12-48 hours after fasting (20). Also there was increased beta oxidation observed during fasting (21).Fasting process spares essential tissue (e.g. vital organs) while utilizing non-essential tissue (e.g. adipose tissue, muscle contractile fibers) for fuel. Unlike fasting, starvation is a process in which the body uses essential tissue for fuel. During starvation, the body relies on protein as a major fuel source, as most fat stores have been depleted. If an organism does not receive food at the end of the maximum fasting period (several weeks to months depending on fat stores, metabolism, stress, and activity), starvation follows and death will ensue(22)

For therapeutic purposes, juice fasting has been commonly practiced in Naturopathy hospitals using Lemon juice with honey (11).Though no studies have been done on lemon juice fasting, orange juice, which is quite similar in regard to the nutritional value, has shown certain benefits. Consumption of 750 ml of orange juice daily improved blood lipid profiles in hypercholesterolemic subjects (23). Regular consumption of 1 fl.oz (2 teaspoon) orange juice for two weeks effectively reduced a marker of lipid peroxidation in plasma (24). Lemon juice is a rich source of polyphenols (25). Diets

rich in polyphenols improve lipid levels and reduce oxidative stress (26). Antioxidant properties of polyphenols could play an important role in the prevention of various diseases associated with oxidative stress, such as cancer and cardiovascular and neurodegenerative diseases (27).Also lemon is rich in antioxidants, which have been shown to reduce oxidative stress and enhance liver function. This is evident with 4 months antioxidant supplementation like vitamin C (500mg), vitamin E (400 IU), and selenium (50 µg), among overweight or obese children and adolescents, which showed decreased oxidative stress and modestly improved liver function tests (28).This explains some of the mechanisms of our study, though we need to understand the proper mechanisms in the future studies with randomized controlled trials.

Liver has to perform various kinds of bio chemical, synthetic and excretory functions. Hence no single test could detect the overall function of the liver and usage of battery of liver function test gives a highly sensitive position. Liver enzymes such as amino transferases and alkaline phosphatase levels are tested to detect injury to hepatocytes. Elevations of Alkaline phosphatase and amino transferaces were seen in liver disorders mainly.ALT is primarily present in the liver but the AST is present in various tissues and organs like heart, skeletal muscle, kidney, brain and liver (Thapa and AnujWalia, 2007).

Two of the subjects dropped out from the study due to acute symptoms of being unwell,like headache, nausea, vomiting, diarrhoea or fever. Such acute symptoms are considered as body's efforts to eliminate the toxins from the system and are encouraged in Naturopathy. However, discomfort due to such crises can be managed well using simple naturopathic treatments like enema, hip bath, hot foot bath, drinking copious amount of water, etc. (1).In our study we have given enema, ice water sipping, application of ice bag on the abdomen, hot foot bath and drinking copious amount of water to combat vomiting, diarrhea, headache, body weakness. Proper breaking of the fast is very essential. Breaking of the fast is considered very important in naturopathic philosophy and practice. Breaking of the fast with diluted fruit juices, tender coconut water, soup of vegetables or thin buttermilk has been recommended by LakshmanaSarma(29).Breaking of fast was carried out by administration of Musambi (Sweet lime) juice and fruit diet for a day, so that the subject's system could be prepared for the subsequent return to raw followed by boiled diet.

We have used the standardized fasting type regimen which had given equal importance with respect to beginning of fasting, during fasting, and breaking of the fast at the end without affecting the normal physiology of the individual.Also, the biochemist who analyzed the different outcome measures, was blinded to the group studies. These two are the main merits of our study. A few limitations are worth mentioning. Though proper supervision/strict vigilance was done to monitor the students who underwent fasting, there was a tendency of some students not to keep compliance with regard to food intake while residing at the hostel in the night time, which is one of the main limitations of the study. Theoretically, use of placebo-fasting therapy could have resulted in unbiased assessment of the outcome measures. However this is not possible in naturopathy and yoga research because general public are aware of fasting/diet therapy. Hence, placebo arm and double binding is not possible in fasting therapy research.

Incorporation of fasting therapy as a treatment, where liver dysfunction has occurred in Naturopathy and Yoga

hospitals or other systems of medicine and also to look at the fasting changes on other parameters such as liver function test, lipid profile, heart rate variability are the future implications of our study.

Acknowledgement
We would like to thank Mr Murthy R N, NR Group, Mysore, Karnataka forthe financial support and encouragement and also we would like to thank MrAchyuthanIshwarfor his assistance.

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