Effect of Jain Fasting on Anthropometric, Clinical and Biochemical Parameters

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ABSTRACT

Background and Aims: Fasting has a long tradition in most cultures and has many health benefits. Most of the studies are from daytime fasting or intermittent fasting. There is paucity of data from complete fasting (no food and fruits, water only). This prospective study is conducted with aims to study impact of complete fasting on clinical and biochemical parameters. **Methods:** One hundred ten participants of either gender who voluntarily fasted (3-30 days) were included and underwent clinical and biochemical examination before and after fasting. **Results:** A total of 110 healthy volunteers (M: 27, F: 83) with mean age 51 ± 16 years (range 18-86) and body mass index 27.1 ± 4.9 kg/m^2 (16.1-45.2) were studied. They had undergone fast for varying duration between 3-30 days (short fast: 3-7 days = 72; prolong fast: >7 days = 38). There were significant decrease in weight (66.8 ± 11.0 to 64.7 ± 11.1 kg, $P < 0.0001$), BMI (27.1 ± 4.9 to 26.2 ± 4.9 kg/m^2, $P < 0.0001$), systolic blood pressure (130 ± 17 to 128 ± 15 mmHg, $P = 0.012$), serum globulin (3.10 ± 0.42 to 3.01 ± 0.41 mg/dl, $P = 0.024$), and serum high density lipoprotein (48.3 ± 12.2 to 45.7 ± 12.6 mg/dl, $P < 0.0001$) post fasting. However, significant increase was observed in pulse rate (81 ± 10 to 83 ± 11 beat/min, $P = 0.001$), fasting plasma glucose (102.9 ± 35.0 to 132.0 ± 42.0 mg/dl, $P < 0.0001$), serum triglycerides (137.6 ± 68.3 to 149.0 ± 67.1 mg/dl, $P = 0.031$), very low density lipoprotein (22.0 ± 10.5 to 24.2 ± 11.1 mg/dl, $P = 0.010$), and serum cortisol levels (13.5 ± 5.9 to 17.2 ± 6.3 µg/dl, $P < 0.0001$). These changes were more pronounced with prolong fasting, but were not affected by gender. **Conclusions:** Fasting results in improvement in anthropometric, physical and biochemical parameters related to physical health. It can be recommended as a mean for improving quality of life.

Keywords: Anthropometry, fasting, lipid profile, serum cortisol

INTRODUCTION

Fasting is primarily an act of voluntary abstinence or reduction of some or all food, drink, or both (absolute), for a period of time lasting typically between 12 h and 3 weeks to focus on health and/or spiritual uplift.[1-3] Fasting has a long tradition in most cultures and religions. Religious fasting is intertwined with ritual and spiritual discipline. There is a widespread practice of fasting in many religious cultures including Islam, Christianity, Judaism, Jainism and Hinduism around the world. Calorie restriction triggers a complex series of intricate events, including activation of cellular stress response elements, improved autophagy, modification of apoptosis, and alteration in hormonal balance.[4-6] Controlled studies with animals and human have found fasting protects or improves several cardiometabolic risk factors, such as diabetes, dyslipidemia, insulin resistance, inflammation cytokines, obesity, and hypertension.[5,7-9]

The challenge of long fasting is to maintain physiological homeostasis relying solely on endogenous resources.[10] There are behavioural, physiological, and biochemical responses that reduce metabolic rates, maintain tissue structure and function. During the initial few hours of fasting, liver glycogen is the source of glucose in the body and subsequently extrahepatic source comes to rescue.[5]

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Jains observe fasts of different types and of different duration.[11] Human studies have largely been limited to observational studies of religious fasting during Ramadan,[12-15] which are type of intermittent fasting, whereas Jain fast are water only fast.[11] Hence, the changes occurring with intermittent or alternate day fast[16-18] cannot be extrapolated to complete fasting.[19]

While religions have long maintained that fasting is good for the soul, but its bodily benefits were not widely recognized until the early 1900s'. The bulk of the scientific evidence for the health benefits of fasting has come from animal studies or fasting in human being in Islamic Ramadan.[12,13] There are limited number of studies conducted in Buddhist or Christian populations but none on Jain fasting. This study aims to study impact of Jain fasting on health i.e. weight, BMI, pulse, blood pressure, lipid profile, renal functions, blood sugar, hematological parameters, serum proteins, and serum cortisol.

Methods

This was a prospective study conducted to measure the effect of fasting on 110 volunteers during Paryusan parv of Jain religion. Participants gave informed consent and completed a basic demographic questionnaire including age and date of birth, gender, marital status, occupation, income, and education on a pre-structured proforma. A complete physical examination and review of their medical records were done. Basic systemic examination was done in all subjects. Subjects with neurological, cognitive or physical disability were excluded from the study. It was advised to end fast if health significantly deteriorates because of any acute illness during study period. All subjects did water only fast. In addition, they were engaged mostly in religious rituals with reduction in physical activity. Fasting was defined as short (fasting up to 7 days) and prolong (>7-30 days).

All participants were examined at start of fast and after termination of fast in the fasting state. Height was measured without shoes to the nearest 0.5 cm. Body weight (BW) was measured (to the nearest 0.1 kg) with a calibrated digital weighing scale (Tanita BWB-800A; Tanita, Corp., Tokyo, Japan) in the morning in light clothing without shoes. Body mass index (BMI) was calculated using the BMI formula, wherein BMI = Weight (kg)/height squared (m^2). Pulse was measured for one minute while lying down after 5 min of rest in a quiet environment. At the same stage, systemic arterial systolic (SBP) and diastolic blood pressure (DBP) (in millimeter of mercury) was recorded in the right upper limb by auscultatory method using a mercury sphygmomanometer.

Fasting venous blood samples were collected and was analysed for complete blood count, plasma glucose, blood urea, serum creatinine, serum protein (including albumin and globulin levels), serum lipid profile (total cholesterol-TC, low density lipoprotein-LDL, very low-density lipoprotein-VLDL, high-density lipoprotein-HDL, triglyceride-TG) by autoanalyzer. Serum cortisol was measured by Auto

Immunoassay Analyzer (Cobas E 411, Roche) and Cortisol reagent (Roche) with intra-assay and inter-assay coefficient of variation <5% and <10% respectively. The present study aimed to study effect of fasting on anthropometric, clinical and biochemical parameters during Paryusan parva.

Statistical analysis

Statistical analysis was done using SPSS version 16. All the data passed the normality test. All paired parameters (pre- and post-fasting) were analysed by paired 't' test. Significance of changes in all parameters between genders and duration of fast were calculated by Students 't' test. All tests were two-sided, and the probability (*P*) level of less than 0.05 was considered as significant.

Results

A total of 110 subjects (M: 27, F: 83) in the age range of 13-86 years (average 50.2 years) participated in the study. While 72 subjects did short fasting (average 3.4 days), 38 did prolong fasting (average 10.1 days). Mean BMI of participants was 27.08 (16.1-45.2).

There was significant decrease in weight, BMI, SBP, serum globulin and serum HDL post fasting. However, significant increase was observed in pulse rate, fasting plasma glucose, blood urea, albumin globulin ratio, serum TG, VLDL, and serum cortisol levels [Table 1]. These changes were similar in both genders (data not shown).

Prolong fast lead to significantly higher weight loss, decrease in BMI and fall in hemoglobin, serum total protein and serum globulin when compared to short fasting. Serum triglycerides levels and albumin globulin ratio increased significantly with prolong fast when compared to short fast. On the contrary, fasting plasma glucose was significantly increased after short fast than prolong fast. Several parameters e.g. pulse rate, blood urea, serum creatinine, serum albumin, serum total cholesterol and serum LDL showed increase with short fasting, whereas decreased significantly with prolong fasting. There was no significant difference in SBP, DBP, serum HDL, serum VLDL and serum cortisol between short fasting and prolong fasting [Table 2].

Discussion

Fasting is practiced in various religion all around the world, however, type of fasting differs among religion. Fasting during Ramadan period is intermittent with fasting duration of 12-18 hours each day,[19] whereas it is water only for the duration of fasting in the Jain religion.[11] Calorie intake during Ramadan is usually normal[20] or may exceed from pre-Ramadan period,[21] but there is total calorie restriction during Jain fast.

Body weight and BMI

In the present study, we have observed significant reduction in mean body weight -2.1 ± 1.0 Kg following fast. A similar trend was observed for BMI also. In various meta-analysis a significant weight loss of 1.24 kg [95% confidence

Table 1: Change in anthropometric, clinical and biochemical parameters with fasting

Parameters	Pre Fasting	Post Fasting	P (Paired 't' Test)
BMI (kg/m²)	27.1±4.9	26.2±4.9	<0.0001
Pulse Rate (beat/min)	81±10	83±11	0.001
Systolic BP (mmHg)	130±17	128±15	0.012
Diastolic BP (mmHg)	81±10	81±9	0.301
Haemoglobin (gm/dl)	13.2±1.5	13.2±1.5	0.907
Fasting Plasma Glucose (mg/dl)	102.9±35.0	132.0±42.0	<0.0001
Blood Urea (mg/dl)	24.9±8.0	28.6±14.3	0.014
S. Creatinine (mg/dl)	0.75±0.19	0.73±0.19	0.339
S. Total Protein (gm/dl)	7.47±0.54	7.37±0.62	0.109
S. Albumin (gm/dl)	4.40±0.35	4.37±0.39	0.408
S. Globulin (gm/dl)	3.10±0.42	3.01±0.41	0.024
Albumin/Globulin Ratio	1.44±0.19	1.48±0.21	0.012
S. Triglycerides (mg/dl)	137.6±68.3	149.0±67.1	0.031
S. Total Cholesterol (mg/dl)	203.0±46.9	203.9±49.1	0.736
S. HDL (mg/dl)	48.3±12.2	45.7±12.6	<0.0001
S. LDL (mg/dl)	132.8±37.8	132.8±37.8	0.585
S. VLDL (mg/dl)	22.0±10.5	24.2±11.1	0.010
S. Cortisol (µg/dl)	13.5±5.9	17.2±6.3	<0.0001

Table 2: Change in anthropometric, clinical and biochemical parameters according to fasting duration

Parameters	Short Fasting (3-≤7 days, n=72)	Prolong Fasting (>7-30 days, n=38)	P
BMI	-0.75±0.35	-1.1±0.40	<0.0001
Pulse Rate (beat/min)	3.2±6.3	-0.5±4.9	0.003
Systolic BP (mmHg)	-2.4±9.2	-1.7±7.9	0.674
Diastolic BP (mmHg)	0.9±5.0	-0.3±4.9	0.248
Haemoglobin (gm/dl)	0.24±0.57	-0.42±1.20	<0.0001
Fasting Plasma Glucose (mg/dl)	39.7±40.7	8.8±30.0	<0.0001
Blood Urea (mg/dl)	8.8±15.5	-6.2±8.7	<0.0001
S. Creatinine (mg/dl)	0.02±0.13	-0.08±0.15	<0.0001
S. Total Protein (gm/dl)	7.47±0.54	7.37±0.62	<0.0001
S. Albumin (gm/dl)	0.09±0.22	-0.24±0.39	<0.0001
S. Globulin (gm/dl)	0.03±0.35	0.01±0.12	<0.0001
Albumin/Globulin Ratio	0.01±0.12	0.07±0.16	0.026
S. Triglycerides (mg/dl)	7.6±45.6	18.7±68.9	0.003
S. Total Cholesterol (mg/dl)	10.5±21.4	-17.3±29.1	<0.0001
S. HDL (mg/dl)	-2.1±6.2	-3.8±10.0	0.275
S. LDL (mg/dl)	9.8±19.6	-14.7±28.0	<0.0001
S. VLDL (mg/dl)	2.8±7.5	1.2±11.0	0.364
S. Cortisol (µg/dl)	3.5±6.0	3.9±6.2	0.749

interval (CI), −1.60 to − 0.88 kg] and 1.46 kg in overweight and obese subjects were observed during Ramadan[21,22] and Christian fast.[18,23] In our study, weight loss sustained was more than reported during Ramadan, which is due to total restriction of calories than intermittent fasting. A similar trend in weight loss with fasting has been observed by many other workers also.[12,23,24] In the initial period, major contributor for weight loss with fast is loss of water; body fat and muscle mass rescue the calorie deficiency in later stage.

Blood glucose

In the present study, we have observed a significant increment in fasting sugar level at pre-fast level to post-fast level. This increment was significantly more with shorter duration of fast than with longer duration fast. Most of the studies and a meta-analysis showed decrease in blood glucose level during Ramadan.[12,25,26] A study from Thailand reported increase blood glucose levels during Ramadan particularly in women.[27] Many of the participants had blood glucose higher than normal and may have undiagnosed pre-diabetes (16 participants – 14.5%) or diabetes (21 participants – 19.15%), where fasting may lead to deterioration of metabolic control and increase in blood glucose due to increase in stress hormone.

Serum lipids

As fast progresses, fats are also mobilized in addition to carbohydrates. Thus, a significant increase in serum triglyceride levels was observed by us with longer duration of fast. While serum HDL continue to decline with different duration of fast, total cholesterol, LDL, and VLDL showed an increase during early fast but showed declining trend as fast progressed in present study. Various studies have reported inconsistent effect of intermittent fasting on lipid profile. Most of the studies have reported an increase in HDL[19,26,28-31] or no change[27,32]; increase in total cholesterol[28,29] or no change[14,27,32,33]; increase in serum LDL[28,34,35] or no change.[14,27,32,33] Serum triglycerides were not affected by intermittent fasting.[14,27,29,32,33] Increase in triglycerides was the consistent difference between our study and studies among intermittent fasting. With intermittent fasting, there is constant replacement of glycogen stores.[19,30] Hence, subjects have decreased lipolysis compared to complete fasting, which can explain this difference.[5,36]

Serum cortisol

It is an indicator of stress of both types in the body i.e., physical (metabolic) and mental. Fasting is a strong metabolic stress for the body and cortisol makes an attempt to correct glucose deficit in blood along with other counter regulatory hormones.[36] For a few subjects, even fasting is a stress on mind as well. Predictably, in this study we have observed an increase in cortisol level throughout the fast. A systemic review and meta-analysis also reported elevated plasma cortisol following caloric restriction and the meta-regression analysis showed a negative association between the serum cortisol level and the duration of caloric restriction.[35]

Main limitation of the study was inability to re-assess participants following resumption of diet after sufficient duration as other studies have reported reversal of all accrued benefit 4 weeks after Ramadan fast.[22,37]

CONCLUSION

The present study, first of its kind on prolong fasting, has convincingly demonstrated an improvement in BMI, blood

pressure, and lipid profile. Serum cortisol levels increased with duration of fast. Fasting is a cost-effective, non-invasive, has minimal risk of adverse effects for practice in most cases, and has the added benefit of improving physical fitness.

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Conflicts of interest

There are no conflicts of interest.

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