



## Short communication

## Does short-term lemon honey juice fasting have effect on lipid profile and body composition in healthy individuals?

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## ARTICLE INFO

## Article history:

Received 8 April 2015

Received in revised form

10 May 2015

Accepted 18 May 2015

Available online 18 May 2016

## Keywords:

Body composition

Fasting

Lemon honey juice

Lipid profile

## ABSTRACT

Fasting is one of the fundamental treatments of naturopathy. Use of lemon and honey for various medicinal purposes were documented since ancient days but there is a lack of evidence on short-term effects of lemon honey juice fasting (LHJF). Hence, we aim at evaluating the short-term effect of LHJF on lipid profile and body composition in healthy individuals. A total of 50 healthy subjects were recruited and they received 300-ml of LHJ, 4 times a day for four successive days of fasting. Assessments were performed before and after the intervention. Statistical analysis was performed by student's paired *t*-test with the use of Statistical Package for the Social Sciences (SPSS) version-16. Our study showed significant reduction in weight, body mass index (BMI), fat mass (FM), free FM (FFM), and total serum triglycerides (TSTGs) with insignificant reduction in fat percentage and total serum cholesterol compared to baseline. Within group analysis of females showed similar results, unlike males. Our results suggest that LHJF may be useful for reduction of body weight, BMI, FM, FFM, and TSTG in healthy individuals, which might be useful for the prevention of obesity and hypertriglyceridemia.

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## 1. Introduction

Fasting is an important treatment modality of naturopathy, based on providing rest to the digestive system, diverting vital energy otherwise utilized to digest food to the process of healing body and mind [1]. Plasma level of Vitamin-C status is inversely related to body mass and degree of obesity [2]. Low plasma levels of Vitamin-C are reported to be associated with the increased body mass index (BMI), central fat distribution, increased all-cause mortality, the risk of myocardial infarction, and gallbladder disease [3]. Whereas increased Vitamin-C intake was reported to be associated with higher high-density lipoprotein cholesterol (HDL-C) levels in women and prevention of coronary heart disease (CHD) [4].

The antioxidant content of honey is found to be equivalent to that of the fruits and vegetables [5] and helps reduce lipids in

normal as well as hyperlipidemic individuals [6]. Lemon honey juice fasting (LHJF) is a commonly used treatment modality in naturopathic hospitals in obesity, hypertriglyceridemia, dyslipidemia, alcoholic liver disorders, etc. but there is a lack of evidence showing its effects on body composition and lipid profile, especially in short interval. This preliminary study aims at evaluating the short-term physiological changes of LHJF on body composition, total serum triglycerides (TSTGs), and total serum cholesterol (TSCH) in healthy individuals.

## 2. Materials and methods

## 2.1. Subjects

Fifty participants (32 females) aged 18–29 years were recruited from a residential campus of the college of naturopathy and yogic sciences. Study protocol was approved by the institutional ethics committee and written informed consent was obtained from the participants. Sample size was not calculated based on any previous studies. Participants who met the following inclusion and exclusion criteria were recruited for the study.

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Peer review under responsibility of Transdisciplinary University, Bangalore.

### 2.1.1. Inclusion criteria

Both genders, willing to participate in the study.

### 2.1.2. Exclusion criteria

Participants with a history of any systemic diseases or regular medication for any disease; females during menstruation and pregnancy; active in any exercise/sports program.

### 2.2. Study design

This was a single group study with pre- and post-design. In this preliminary study, baseline assessments were done ( $n = 50$ ) before the intervention. Forty-four participants completed the study and contributed to the second assessment after 4-day of intervention. The reason for dropouts in study group ( $n = 6$ ) was unwillingness to continue fasting due to personal problem ( $n = 5$ ) and abdominal pain ( $n = 1$ ).

### 2.3. Assessments

Assessments were done before and after 4-day of intervention. Body composition was measured using TANITA body composition analyzers SC-330 (Japan) which is an automatic instrument. TANITA is used to measure body composition especially when monitoring modest changes in fat [7]. The measurement was taken by asking the participants to stand barefoot and erect on the foot plate of the analyzer. TSTG and TSCH were measured by an institutionally qualified and well experienced technician with the use of BA-4545 semi-auto biochemistry analyzers (India).

### 2.4. Intervention

Participants were asked to gather in the hall, where fasting therapy was administered. To prepare and during fasting, the participants were kept away from daily routine to avoid interference by thoughts and emotions. The participants received 300-ml of LHJ (half lemon and a teaspoon of honey with 290-ml of water), 4-times (8.00–8.30-am, 11.30–12.00-am, 3.00–3.30-pm, and 6.30–7.00-pm) a day for four successive days of fasting [8]. The participants were staying together in allotted hall under observation from 6 am to 8 pm and then asked to go back to their residential hostel and kept under observation. We used Western Ghats of Karnataka (Dharmasthala) honey, which is dark yellow color multifloral honey, has mixed flavor and aroma. Its physiochemical analysis was: pH = 3.48, ash (%) = 0.60, moisture (%) = 15.54, acidity (meq/kg) = 20.0, total sugar (%) = 75, protein (mg/g) = 0.80, phenol (mg/g) = 0.67, alkaloid (%) = 10.6. This honey was reported to have good quality and can be used in traditional medicine [9]. Drinking water (whenever thirsty) was allowed during the fasting period, and the participants were instructed to avoid any vigorous physical activities to avoid the risk of hypoglycemia [10]. On day-5, the fast was broken with 300-ml of sweet lime juice (morning) followed by fruit diet (papaya 200-g) at afternoon, raw diet (sprouts 50-g and raw vegetables 100-g, and fruit salad 100-g) at night, and normal routine boiled diet from the next day [8].

### 2.5. Data analysis

Data were statistically analyzed using SPSS for Windows, Version 16.0. Chicago, SPSS Inc. Descriptive analysis was done for demographic variables of the study group ( $n = 44$ ) and sub-groups (male [ $n = 14$ ] and female [ $n = 30$ ]). Student's paired samples *t*-test was performed to analyze baseline and post assessments of both study-group and sub-groups.  $P < 0.05$  was considered as significant.

## 3. Results

Of 50 participants, 44 successfully completed the study. Data assessment was done before and after intervention. Demographic variables were age in years (both genders [ $20.68 \pm 1.95$ ], male [ $20.71 \pm 1.59$ ], female [ $20.67 \pm 2.12$ ]), and height in centimeters (both genders [ $162.43 \pm 8.45$ ], male [ $171.79 \pm 6.74$ ], female [ $158.07 \pm 4.86$ ]). Baseline and post assessments of study-group ( $n = 44$ ) and sub-group (male [ $n = 14$ ] and female [ $n = 30$ ]) are in Tables 1 and 2, respectively.

Our study showed significant reduction in weight, BMI, fat mass (FM), free FM (FFM), muscle mass (MM), total body water (TBW), and TSTGs in study-group compared to baseline (Table 1). In sub-group analysis, significant reduction in weight, BMI, FM, FFM, MM, TBW, and TSTG in females were observed similar to study group, whereas in males, significant reduction was observed only in weight, BMI, FFM, and MM (Table 1). Though there were no significant reductions in fat percentage and TSCH, a trend toward reduction was observed (Tables 1 and 2).

## 4. Discussion

Our study showed a significant reduction in weight, BMI, FM, FFM, MM, TBW, and TSTG in study-group compared to baseline. Significant reduction in weight and BMI might attribute reduction of FM and FFM during fasting. Reduction in weight might possibly be due to LHJ as well, due to its Vitamin-C content, which was shown to have an association with weight loss [2]. Reduction in FM (significant) and fat% (insignificant) and TSTG (significant) compared to baseline indicates fat utilization during fasting because adipose tissue triglyceride mobilization during fasting is an important adaptive response and it is the major source of body's energy during food deprivation. This result might be attributed to the effect of fasting on plasma insulin concentration which was reported to have an inverse correlation to antilipolytic activity in adipose tissue during fasting [11] or due to the effect of Vitamin-C, an essential factor for biosynthesis of carnitine, useful for subsequent fat oxidation by shuttling long chain fatty acids across the mitochondrial membrane [2] or due to the effect of honey, which has lipid-lowering property in normal and hyperlipidemic participants [6].

Significant reduction in FFM such as MM and TBW indicates the utilization of muscle tissues and body fluids for energy requirement during the latter period of fasting where normal food intake was restricted. Though normal food intake was restricted, none of the participants reported any adverse effects except mild tiredness and mild giddiness in few subjects, which indicates the safety of short-term LHJF among healthy individuals.

**Table 1**

Baseline and post assessment of study group ( $n = 44$ ) (Students paired-*t*-test).

Variables	Baseline	Post treatment	<i>t</i>	<i>P</i>
Weight (kg)	54.28 ± 12.93	52.11 ± 12.65	13.334	<0.001
BMI (kg/m <sup>2</sup> )	20.46 ± 3.57	19.64 ± 3.54	11.749	<0.001
Fat (%)	17.26 ± 8.30	16.69 ± 8.97	1.565	0.125
FM (kg)	9.93 ± 7.46	9.33 ± 7.84	2.999	<0.01
FFM (kg)	44.35 ± 7.68	42.78 ± 7.30	6.337	<0.001
MM (kg)	42.10 ± 7.32	40.60 ± 6.94	6.300	<0.001
TBW (kg)	31.16 ± 6.08	30.09 ± 6.05	5.758	<0.001
TSTG (mg/dL)	95.50 ± 30.65	78.18 ± 20.44	3.889	<0.001
TSCH (mg/dL)	147.77 ± 24.91	143.07 ± 23.63	1.646	0.107

All values are as mean ± SD. BMI: Body mass index, FM: Fat mass, FFM: Free fat mass, MM: Muscle mass, TBW: Total body water, TSTG: Total serum triglycerides, TSCH: Total serum cholesterol, SD: Standard deviation.

**Table 2**

Baseline and post assessment of study group male ( $n = 14$ ) and female ( $n = 30$ ) (Students paired- $t$ -test).

Variables	Gender	Baseline	Post treatment	$t$	$P$
Weight (kg)	Male	62.48 ± 18.23	60.10 ± 17.54	9.804	<0.001
	Female	50.47 ± 7.17	48.39 ± 7.35	9.852	<0.001
BMI (kg/m <sup>2</sup> )	Male	21.09 ± 5.22	20.30 ± 5.02	10.290	<0.001
	Female	20.17 ± 2.53	1.934 ± 2.65	8.599	<0.001
Fat (%)	Male	12.80 ± 8.73	11.58 ± 10.36	1.211	0.247
	Female	19.35 ± 7.35	19.09 ± 7.26	1.036	0.309
FM (kg)	Male	9.35 ± 11.03	8.54 ± 12.11	1.413	0.181
	Female	10.20 ± 5.28	9.71 ± 5.01	3.932	<0.001
FFM (kg)	Male	53.13 ± 7.83	51.56 ± 6.15	2.355	<0.05
	Female	40.27 ± 2.37	38.68 ± 2.73	7.688	<0.001
MM (kg)	Male	50.45 ± 7.46	48.94 ± 5.86	2.388	<0.05
	Female	38.20 ± 2.25	36.71 ± 2.60	7.506	<0.001
TBW (kg)	Male	38.14 ± 6.08	37.32 ± 5.30	1.620	0.129
	Female	27.91 ± 1.93	26.72 ± 2.17	8.412	<0.001
TSTG (mg/dL)	Male	100.57 ± 32.38	83.71 ± 19.28	1.842	0.088
	Female	93.13 ± 30.08	75.60 ± 20.76	3.465	<0.01
TSCH (mg/dL)	Male	153.14 ± 24.26	147.57 ± 27.66	0.804	0.436
	Female	145.27 ± 25.22	140.97 ± 21.70	1.551	0.132

All values are as mean ± SD. BMI: Body mass index, FM: Fat mass, FFM: Free fat mass, MM: Muscle mass, TBW: Total body water, TSTG: Total serum triglycerides, TSCH: Total serum cholesterol, SD: Standard deviation.

Total serum cholesterol reduced (not statistically significant) compared to baseline, which indicates LHJF may be useful to maintain TSCH level. This result is supported by a previous study on the administration of ascorbic acid in individuals with TSCH level <200 mg/dl, where it did not produce the consistent effect [4].

Vitamin-C accounted for 35–75% of antioxidant power of food [12] and thus was shown to have protective effect on lipid-peroxide induced endothelial injury [13] and oxidative damage which are believed to play a key role in cardiovascular disease, cancer initiation, inflammatory diseases, neurologic disorders, and aging process in general [12].

In sub-group analysis reduction in variables such as FM, TBW, and TSTG were observed in both genders, but were significant only in females, indicating LHJF might be more beneficial to females than males in reducing FM and TSTG, which in turn might be useful for prevention of major diseases such as obesity, hypertension, and other cardiovascular diseases. The previous studies on the intake of Vitamin-C in American men and women appeared to benefit only women [13,14] and were associated with a reduced risk of death from CHDs in Finnish women and not in men [13,15]. These evidences support the gender difference results of this study.

#### 4.1. Limitations of the study

We did not measure HDL, LDL to obtain complete lipid profile; hormones such as plasma insulin and norepinephrine, which are shown to play an important role in the lipolysis in various studies [11]. Due to the absence of a control group, the result of our study may not primarily be attributed to the effect of LHJ during fasting. Disproportionate number of males with that of females could be of the limitation.

#### 4.2. Strengths of the study

Intervention is cost effective and short duration of the intervention makes it easily acceptable, adaptable, and feasible to

practice even at home. No serious adverse effect was found. The intervention might possibly be used as a preventive measure for the modern public health problems such as obesity, hypertriglyceridemia, etc. Further studies (randomized control trials) with the larger sample size are required to warrant these effects and to evaluate the mechanism behind the effect of LHJF on lipid profile and body compositions, in healthy as well as in various disease conditions.

## 5. Conclusion

The result of our study suggests that 4-day of LHJF may be considered as an effective and safe method in reducing body weight, BMI, FM, and TSTG in healthy individuals, which might be useful in prevention of obesity and hypertriglyceridemia.

## Source of support

Nil.

## Conflict of interest

None declared.

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