

# The Effect of Interval Training and Nettle Supplement on Glycemic Control and Blood Pressure in Men With Type 2 Diabetes

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## Abstract

**Introduction:** Exercise and herbal medicine are therapeutic approaches used to control blood sugar and blood pressure in diabetic patients. This study aimed to evaluate the effect of interval exercise and nettle supplements on blood glucose, and its role on blood pressure control in men with type 2 diabetes.

**Methods:** In this quasi experimental study, 40 men with type 2 diabetes aged 30-50 years old who were qualified based on our inclusion criteria were chosen and randomly divided into 4 groups (interval training [IT], nettle supplement [NS], nettle supplement combined with interval training [IT+NS], and control). Blood pressure (BP) and fasting blood glucose (FBS) were measured at pre-test and post-test conditions. Paired sample t test and one-way analysis of variance (ANOVA) were used as statistical tests. Significance level was considered at  $P \leq 0.05$ .

**Results:** Significant differences were detected regarding FBS levels in the three experimental groups in comparison with the control group ( $P < 0.05$ ). Diastolic BP of the both IT and IT+NS groups was significantly different from the control group ( $P < 0.05$ ). We also detected a significant difference in the diastolic BP between the IT+NS and the control group.

**Conclusion:** According to our results, aerobic IT and nettle supplementation are effective methods for controlling blood sugar and BP in patients with type 2 diabetes. We also showed that using the combination of the 2 methods was more effective than using the either method alone.

**Keywords:** Type 2 diabetes, Interval training, Nettle, Blood sugar, Blood pressure.

## Introduction

Type 2 diabetes is known as a risk factor for high blood pressure (BP) and cardiovascular diseases causing dysregulation in structure and function of the cardiovascular system. Besides, type 2 diabetes has also been associated with a high rate of mortality in populations.<sup>1,2</sup> People with long-term diabetes mellitus (DM) may suffer from eye damage, kidney failure, cardiovascular failure, and central nervous system disorders.<sup>3</sup> Type 2 diabetes has been associated with higher risk of retinopathy and nephropathy; however, cardiac events and heart failure are causes of death in patients.<sup>4,5</sup>

Management of cardiovascular problems in type 2 diabetes needs a coordinated system for controlling the risk of such events. This may have beneficial therapeutic effects in patients with diabetes.<sup>6</sup>

Hypertension is a common disease in diabetes affecting 20%-60% of the cases. Different prevalence rates of hypertension have been reported in Iranian diabetic patients. Three separate studies have reported the prevalence rates of 22.2%,<sup>7</sup> 35.5%,<sup>8</sup> and 45%.<sup>9</sup> Due to the proposed associations of high BP, especially systolic BP with the diabetes related organ dysfunctions of the eyes, kidney, and the heart, controlling BP

can be beneficial in the clinical course of diabetic patients.<sup>2,10</sup> Treatment of hypertension in patients with diabetes is essential to prevent cardiovascular complications such as stroke, coronary heart disease, etc.<sup>2</sup> For achieving this purpose and facilitating treatment approaches, walking, exercising, weight control and diet modifications are crucial steps.<sup>5</sup>

Controlling blood sugar has been noted to lower the risk of cardiac abnormalities in diabetes. Congestive heart failure in diabetes (diabetic cardiomyopathy), multi-factor induced myocardial ischemia, hypertension, and myocardial cell dysfunction have been suggested to be results of chronic hyperglycemia.<sup>2</sup> Regular exercise and increasing physical activity can help prevent and manage signs of metabolic syndrome.<sup>11</sup> Exercise plays a positive role in people with type 2 diabetes through empowering the skeletal muscle for insulin independent glucose uptake.<sup>12</sup> In addition, exercise can reduce diabetic complications such as low BP.<sup>5,13</sup> Multiple studies have been performed regarding the effect of exercise and sports activities in control of diabetes and BP. In accordance, one of the significant issues in this regard is the reducing effect of exercise on the BP of diabetic patients.<sup>14,15</sup>

There is much evidence to indicate that many medicinal plants can be useful for treating diabetes and preventing its complications. Nettle is the traditional term referring to a medicinal plant with scientific name of *Urtica dioica* from the family of *Urticaceae*. Nettle has traditionally been used to control blood sugar in Turkey and Morocco. In European countries, nettle is also used to reduce inflammation, and to treat rheumatoid arthritis.<sup>16</sup> Some studies have also showed the effects of this plant on lowering the fasting blood sugar (FBS). Nettle leaves constitute several natural compounds (flavonoids, peptides and amines) that are known to have anti-diabetic effects. Some mechanisms including glycogenesis stimulation, block of potassium channels in the pancreatic beta cells, and interfering with the absorption of glucose from the intestinal wall have been mentioned underlying these anti-diabetic effects.<sup>17</sup> Studies have shown positive effects of using decoction of nettle leaves or other plant parts either as infusion or oral use in diabetes.<sup>18,19</sup> In vitro researches on animals,<sup>20</sup> as well as some studies on humans<sup>16</sup> have shown that nettle active compounds can be effective on BP, nevertheless, limited studies have been done on role of these in this area.

Due to lack of information surrounding the effects of exercise and consumption of nettle on BP and FBS levels in type II diabetic patients, this study aimed to evaluate the effects of eight weeks of interval training (IT) and use of nettle supplements (NSs) (individually and simultaneously) in controlling the FBS and BP in male participants with type 2 diabetes.

## Materials and Methods

### Subjects

In this interventional study, 40 men who suffered from type 2 diabetes were selected by purposive sampling

method and were randomly divided into 4 groups (10 patients as IT, NS, combined IT+NS, and the control). The number of units and formulas to estimate the sample size was calculated according to previous reports (the following equation).<sup>5</sup>

$$n = \frac{(z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2 (s_1^2 + s_2^2)}{(\bar{x}_1 - \bar{x}_2)}$$

### Inclusion Criteria

Men with age of 30-50 years old diagnosed with type 2 diabetes, having FBS below 200 mg/dL, normal BP, non-smoker, insulin-independent, without acute cardiovascular diseases, and respiratory disease and musculoskeletal problems were included in the study. Other inclusion criteria included a sedentary lifestyle, lack of regular physical activity during the past six months, and lack of recurrent hypoglycemia at rest or during exercise.

### Exclusion Criteria

Missing of more than 2 consecutive sessions of the exercise, change of drug regimen, regular participation in exercise sessions other than the specified sports sessions in the case group, and regular exercise in the control group were among the exclusion criteria.

### Measurements

After confirmation of the disease and agreement of the center physician to perform exercise, participants were thoroughly informed about the purposes of the study, and were trained in connection with the procedure (written and verbally). After obtaining written consent, basal measurements were taken, and interventional exercise was conducted under the researcher's supervision in the case group for eight weeks. The parameters were re-measured 2 days after the exercise session and nettle administration.

### Anthropometric Indicators

In this study, standing height of the subjects without shoes was measured by a stadiometer. Their weight was measured by SECA scales with the least possible clothing. In order to calculate the body mass index, weight (kilograms) was divided by the square of the height (meters). As previously described, we applied the multicomponent prediction equation and skin-fold thicknesses to extrapolate the body fat percentage (PBF) using. The Lafayette Caliper (Model 01127) instrument was used for obtaining skin-fold thicknesses at three different locations including abdomen, thigh, and the chest. We performed all the mentioned assessments twice. The measurements were done on the right side of the body while the patients were standing and breathing normally.<sup>21</sup> The equation for calculating body density is as follows:

Body Density = 1.10938 - (0.0008267 × sum of chest, abdomen and thigh skinfolds in mm) + (0.0000016 × square

of the sum of chest, abdomen and thigh) - (0.0002574 × age)

Percentage of Body Fat = (4.95/BD - 4.5) × 100

### Blood Pressure

Systolic and diastolic BP were measured in compliance with standard criteria.<sup>22</sup> This was in an upright position following 15 minutes of rest before using a Hansen mercury sphygmomanometer (made in German) and Littmann stethoscope (made in USA). Rockport test was used to measure aerobic capacity (VO<sub>2</sub>max) in the patients.<sup>23</sup>

### Blood Glucose

In this study, pre-test FBS was measured after 10-12 hours of fasting at the day before starting the training programs. Blood samples (5 mL) were taken with a syringe based on standard procedure in the sitting position. Post-test FBS was measured 2 days after the last session of exercise using the same protocol. For determining the values, blood samples were centrifuged within 30-45 minutes after obtaining and FBS was measured by a standard biochemistry autoanalyzer and Pars Azmoon kit (made in Iran).

### Exercise Training

In this quasi-experimental study, IT as the intervention (in IT and NS + IT groups) consisted of "running" in compliance with the recommendations of the American Diabetes Association (ADA)<sup>15</sup> and American College of Sports Medicine (ACSM).<sup>15,24</sup> The IT group was safely performed under supervision of the researcher. At the beginning of each session, aerobic exercises (2 steps 3 minutes fast walk and jogging) and then static stretching were performed as warm up.<sup>5</sup> The main exercise program was designed according to the exercise recommendations for diabetics (Table 1).<sup>15,24</sup> Training intensity was based on subjects' heart rate reserve and was controlled by applying the Karvonen method (20). After completing the basic training, fast walking and stretching for 5 minutes, cooling down was performed. To prevent possible risks during exercise, a nurse attended practice sessions and referred the patients to the doctor in case of any problems. It was also advised that patients have sweet snacks to prevent possible hypoglycemia. Before each training session, blood glucose (digital glucometer GC model) and BP (digital sphygmomanometer, BM1004) were measured.

**Table 1.** Interval Training Program in Type 2 Diabetes Patients

Week	No. of Sessions/Week	No. of Cycles	Interval Activity Time (min)	Intensity (Percentage of Heart Rate Reserve)	Rest to Practice Ratio
1	3	2	5	50%-60%	1:1
2	3	3	5	50%-60%	1:1
3	3	3	5	50%-60%	1:1
4	3	4	5	50%-60%	1:1
5	3	4	5	60%-70%	1:1
6	3	5	5	60%-70%	1:1
7	3	5	5	60%-70%	1:1
8	3	6	5	60%-70%	1:1

### Nettle Supplementation

In the experimental groups (NS and NS + IT), Nettle supplements were consumed 15 minutes before 3 main meals (breakfast, lunch and dinner) for 8 weeks. *Urtica dioica* dose was calculated based on previous studies (10 g/d) which was divided into 3 parts.<sup>16,25</sup>

### Statistical Methods

Normality of the data was checked using the Kolmogorov-Smirnov and Levene test of homogeneity. Paired samples *t* test and one-way analysis of variance (ANOVA) were used to compare pre-test and post-test FBS and BP between the groups and within-groups. All results are shown as mean ± SD and *P* values ≤0.05 were considered statistically significant.

### Results

According to the findings, no significant differences were seen in the demographic characteristics (age, weight, height, body mass index, body fat percent, aerobic capacity and the time from the diagnosis of diabetes) between the groups at pre-test (Table 2).

Comparison of pre-test and post-test data showed a significant reduction of FBS in all 3 experimental groups (*P*<0.001). Systolic BP decreased significantly in the IT group (*P*<0.05) and IT+NS group (*P*<0.001). A significant decrease in diastolic BP was also observed between groups of IT (*P*<0.05), NS (*P*<0.05), and IT+NS (*P*<0.01) (Table 3).

One-way ANOVA test showed significant differences for post-test FBS (*P*<0.001), systolic BP (*P*<0.001) and diastolic BP (*P*<0.05) between the studied groups (Table 4).

Post hoc Tukey test results showed a significant difference in levels of FBS in the intervention groups compared to the control group (*P*<0.01). However, there was no significant difference between the experimental groups (*P*<0.05, Table 5). A significant difference in systolic BP changes was seen comparing either IT or IT+NS groups compared to the control group (*P*<0.05). Diastolic BP was also significantly different between the IT+NS group and the control group (*P*<0.05).

### Discussion

#### Fasting Blood Glucose

Our results showed a significant decrease in FBS ratio as

**Table 2.** Demographic, Clinical and Laboratory Characteristics of Subjects With Type 2 Diabetes

	IT	NS	IT+NS	Control	F	P
Age (y)	41.80 ± 3.99	44.30 ± 2.63	40.40 ± 4.70	41.80 ± 3.94	1.745	0.175
Height (cm)	170.16 ± 5.51	169.17 ± 6.25	167.35 ± 5.44	168.43 ± 6.54	0.397	0.756
Weight (kg)	77.27 ± 4.10	75.53 ± 5.45	76.13 ± 6.01	78.71 ± 7.51	0.564	0.642
BMI (kg/m <sup>2</sup> )	26.72 ± 1.71	26.44 ± 2.13	27.15 ± 0.95	27.70 ± 1.41	1.166	0.336
Vo <sub>2</sub> max (mL/kg/min)	33.31 ± 4.58	31.65 ± 5.69	31.87 ± 2.83	32.22 ± 3.67	0.052	0.984
Time from diabetes diagnosis (y)	2.80 ± 1.55	2.40 ± 1.35	2.20 ± 1.40	3.30 ± 1.16	1.254	0.305
FBS (mg/dL)	151.60 ± 6.59	159.00 ± 9.10	158.60 ± 11.30	151.70 ± 5.58	1.375	0.266
Systolic BP (mm Hg)	135.40 ± 5.25	136.60 ± 3.69	137.30 ± 3.95	134.50 ± 5.48	0.714	0.550
Diastolic BP (mm Hg)	85.50 ± 4.74	85.10 ± 3.14	86.60 ± 3.13	84.60 ± 3.20	0.551	0.650

Abbreviations: IT, interval training; NS, nettle supplemented; BMI, body mass index; FBS, fasting blood sugar; BP, blood pressure.

**Table 3.** Comparison of Pre-test and Post-test Values of FBS, and systolic and diastolic BPs in 3 Experimental and Control Groups

Variable	Group	Pre-test	Post-test	t	P
FBS (mg/dL)	IT	151.60 ± 6.59	136.30 ± 6.15	14.81	0.000 <sup>c</sup>
	NS	159.00 ± 9.10	146.80 ± 8.73	12.37	0.000 <sup>c</sup>
	IT+NS	158.60 ± 11.30	142.40 ± 16.09	5.922	0.000 <sup>c</sup>
	Control	151.70 ± 5.58	149.50 ± 10.64	0.628	0.545
Systolic BP (mm Hg)	IT	135.40 ± 5.25	130.30 ± 4.88	3.104	0.013 <sup>a</sup>
	NS	136.60 ± 3.69	133.50 ± 4.79	1.718	0.120
	IT+NS	137.30 ± 3.95	127.50 ± 6.49	5.838	0.000 <sup>c</sup>
	Control	134.50 ± 5.48	138.30 ± 5.68	-1.610	0.142
Diastolic BP (mm Hg)	IT	85.50 ± 4.74	82.20 ± 4.24	2.262	0.028 <sup>a</sup>
	NS	85.10 ± 3.14	83.10 ± 3.70	2.449	0.037 <sup>a</sup>
	IT+NS	86.60 ± 3.13	83.00 ± 2.75	3.959	0.003 <sup>b</sup>
	Control	84.60 ± 3.20	84.50 ± 2.99	0.218	0.832

Abbreviations: IT, interval training; NS, nettle supplemented; FBS, fasting blood sugar; BP, blood pressure.

<sup>a</sup>Significance level  $P < 0.05$ ; <sup>b</sup>Significance level  $P < 0.01$ ; <sup>c</sup>Significance level  $P < 0.001$ .

**Table 4.** Mean Differences of FBS, Systolic and Diastolic BPs Between Experimental And Control Groups.

Variable	IT	NS	IT+NS	Control	F	P
FBS (mg/dL)	-15.30 ± 3.27	-12.20 ± 3.12	-16.20 ± 8.65	-2.20 ± 11.07	7.556	0.000 <sup>b</sup>
Systolic BP (mm Hg)	-5.10 ± 5.20	-3.10 ± 5.71	-9.80 ± 5.31	3.80 ± 7.47	8.895	0.000 <sup>b</sup>
Diastolic BP (mm Hg)	-3.30 ± 3.97	-2.00 ± 2.58	-3.60 ± 2.88	-0.10 ± 1.45	3.091	0.039 <sup>a</sup>

Abbreviations: IT, interval training; NS, nettle supplemented; FBS, fasting blood sugar; BP, blood pressure.

<sup>a</sup>Significance level  $P < 0.05$ ; <sup>b</sup>Significance level  $P < 0.001$ .

10.08%, 7.67%, and 10.40% reduction in the IT group, the NS group, and the IT+NS group respectively. The difference was statistically significant between the intervention groups and the control group. However, this was no statistical significance when comparing between treatment groups. Our findings on the effect of exercise on blood sugar were similar with previous findings.<sup>5,21,26-30</sup> Nevertheless, results of a study by Karstoft et al differed from our findings.<sup>31</sup> These differences may be due to the participant's characteristics. The study of Karstoft et al consisted of elderly patients (over 57 years) with high BMI (29 kg/m<sup>2</sup>) which could lead to muscle weakness and the failing to exercise with desired intensity. Furthermore, their research protocol included four months of walking, while running aerobic exercise was not used in the recent study. Physical activity has a positive effect on insulin resistance in patients with type 2 diabetes, and exercise can decrease insulin resistance.<sup>32,33</sup> The accumulation of free fatty ac-

ids in muscle cells disrupts the transmission of glucose transferase-4 (GLUT4) to cell surface membrane. Aerobic exercise may increase the oxidation of fatty acids, and prohibit their accumulation in muscle cells.<sup>33</sup> Increased capillary density, increased sensitivity of insulin receptors, a change in the composition of phospholipid sarcolemma, increased glycogen synthase enzyme activity and increased enzyme oxidative activity are also important factors in lowering blood sugar.<sup>34</sup> Increased insulin action and increased insulin signals are other regulating factors of glucose metabolism.<sup>35,36</sup>

Our observation regarding significant decreases in blood sugar levels in the intervention groups were similar to the findings of other studies,<sup>37-40</sup> reporting the efficacy of nettle administration on glycemic control. In spite of this, some studies showed no positive correlation between the use of nettle and declining of blood sugar.<sup>41,42</sup>

Studies have shown the positive effect of the injectable or

**Table 5.** Results of Post Hoc Tukey Test

Group I	Group J	FBS	Systolic BP	Diastolic BP
		P	P	P
IT	NS	0.784	0.877	0.742
IT	IT+NS	0.993	0.311	0.995
IT	Control	0.002 <sup>a</sup>	0.011 <sup>a</sup>	0.077
NS	IT+NS	0.623	0.077	0.601
NS	Control	0.022 <sup>a</sup>	0.065	0.458
IT+NS	Control	0.001 <sup>a</sup>	0.000 <sup>b</sup>	0.046 <sup>a</sup>

Abbreviations: IT, interval training; NS, nettle supplemented; FBS, fasting blood sugar; BP, blood pressure.

<sup>a</sup>Significance level  $P < 0.05$ ; <sup>b</sup>Significance level  $P < 0.001$ .

oral forms of the decoction of nettle leaves or other plant parts on diabetes.<sup>18,19</sup> Animal studies have shown that nettle active compounds can increase insulin levels in natural diabetes and diabetes caused by streptozotocin.<sup>39,43,44</sup> Three possible mechanisms have been suggested for the blood glucose lowering effects of Nettle by Fakhræe and colleagues.<sup>19</sup> These suggestions include (a) enhancing glucose uptake by muscles through increasing formation of permeable pores, (b) stimulating the release of insulin from pancreatic beta cells, and (c) inhibiting the activity of alpha-amylase, a carbohydrate hydrolysis inhibitor, which ultimately leads to modulation of blood sugar in type 2 diabetes.

Several natural compounds are present in the leaves of stinging nettle (flavonoids, peptides and amines). Some of them are known to present anti-diabetic effects. The combined effect of the above mentioned mechanisms include stimulation of glycogenesis, blocking of potassium channels in the pancreatic beta cells, and interference with the absorption of glucose from the intestinal wall.<sup>17</sup> In a study on the effect of nettle on lowering blood glucose by Kavalalı et al, protective effects of nettle were shown against histologic deterioration of pancreatic cells in rat models of streptozotocin-induced diabetes.<sup>38</sup> Bnouham et al also reported the effect of nettle in reducing blood sugar by decreasing the intestinal absorption of glucose.<sup>37</sup> We noticed a slight difference of blood sugar between the 2 experimental groups; IT and IT+NS. In accordance, Dabagh et al showed that alternation magnitude of blood glucose level was higher in the group with combination of nettle and exercise training compared to separate individual groups. This difference was attributed to the cumulative effect of aerobic training and nettle.<sup>45</sup> Low magnitude difference between the 2 groups observed in the present study may be explained by more energy cost in IT, conducted in our study, compared to continuous training performed in the above-mentioned studies.

### Blood Pressure

Significant reductions in systolic BP as high as 3.69%, 2.21%, and 7.14% were recorded in IT, NS, and IT+NS groups respectively. In the control group, a non-significant increase (2.97%) was observed in the level of systolic BP. When comparing the changes between the groups, significant differences were seen between the interven-

tion groups (IT and IT+NS) and the control group. A significant decrease in the systolic BP was consistent with the findings of some previous reports.<sup>1,21,46</sup> On the other hand, Shenoy et al<sup>34</sup> reported no significant differences in systolic BP after sixteen weeks of aerobic training. This may be due to the differences between the subjects participated in the recent study with our study, or the effect of nutritional intervention in study of Shenoy et al.

A significant decrease in diastolic BP was also detected as 3.74% in the IT group, 2.33% in NS group, and 4.10% in the IT+NS group. In the control group, diastolic BP showed an insignificant reduction of 0.10%. Significant differences were observed between IT+NS group and the control group. In line with this, Bagheri et al<sup>21</sup> reported a significant reduction in diastolic BP which is similar to the findings of the present study. In another study by Shenoy et al,<sup>34</sup> however, aerobic exercise did not inflict any significant difference in diastolic BP, while Ezema et al<sup>46</sup> showed a significant decrease in diastolic BP. Also, Yavari et al<sup>47</sup> reported a significant increase in diastolic BP after a period of aerobic exercise, however, no significant difference was reported between the exercise and control groups. In the present study, a significant difference was observed between the IT group and the control group regarding BP. The reason for these different results may root in different exercise protocols, and patients' characteristics. In addition, the role of nutrition, as a limitation of our study, should be noted. Another explanation that could be mentioned is the use of antihypertensive drugs by individuals in previous studies.<sup>1</sup> However, we managed this confounding effect by excluding patients who used these therapeutics.

Figueira et al reviewed the effect of exercise on BP in patients with type 2 diabetes. Based on this, high-intensity exercise was effective in lowering BP in patients with type 2 diabetes, especially if the exercise program sessions exceeded 150 min/wk.<sup>10</sup> Furthermore, regular exercise has been introduced as a therapeutic approach in improving BP.<sup>48</sup> Interestingly, maintaining systolic BP at 140 mm Hg, depending on age of the patients, resulted in a 28%-44% and 20%-35% decrease in the incidence of strokes and ischemic heart disease respectively.<sup>49</sup> Credible evidences suggest that exercise is a substantial factor in improving endothelial function, vascular expandability, left ventricular diastolic function, and ventricular stroke volume in lowering BP.<sup>47,50</sup>

In a clinical trial study to evaluate the effect of *Urtica dioica* on BP in diabetic patients, Kianbakht et al<sup>51</sup> reported no significant differences in systolic and diastolic BP following 3 months of the agent administration. In another study, Namazi et al administered 8 weeks of nettle with dose of 100 mg/d for patients with type 2 diabetes. A significant difference was seen in systolic BP between the 2 groups, but no significant difference was reported in diastolic BP.<sup>16</sup> These are inconsistent with the findings of our study. This can be due to the differences in administration methods of nettle.

Pilot studies have shown that nettle causes vasodilatation

and consequently reduces BP through its effects on the nitric oxide pathway.<sup>52</sup> Also, Legssyer et al showed that nettle reduced both BP and heart rate in rats.<sup>53</sup> In patients with type 2 diabetes, essential hypertension is associated with insulin resistance, increased insulin secretion, and sensitivity by acting on acetylcholine which leads to the expansion of blood vessels and lowering BP.<sup>54</sup> Due to the presence of a combination of flavonoids in nettle, it is likely that herbs can lower systolic BP by mentioned mechanisms.<sup>55</sup>

Significant differences in BP were not observed between the experimental groups, however, considering bigger changes in groups of IT+NS respective to either IT or NS groups, it can be said that the combination of these interventions is more effective in controlling BP in type 2 diabetic patients. This observation may indicate a synergistic effect of the 2 methods (IT+NS) probably through adjustment on cardiovascular system by diuretic and natriuretic effects of nettle.<sup>47</sup> In previous studies, diuretic effects of *Urtica dioica*, and its beneficial role on renal function have been reported.<sup>56,57</sup> Finally, combined IT+NS can improve cardiovascular function in type 2 diabetic patients. It is recommended to investigate the role of these potential interventions on the clinical course of diabetes in more details.

### Conclusion

Overall, the findings of this study indicated the positive effect of IT and nettle consumption on the improvement of glycemic control and BP in men with type II diabetes. Comparing the three experimental groups, no significant difference was seen regarding BP, however, simultaneous use of both interventions (IT and NS) seemed to be more effective than individual interventions.

### Ethical Approval

Our study was approved by the ethics committee of Abadan Branch, Islamic Azad University (Grant No. 1140).

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