

Comparative Study of *Kundur* (*Boswellia serrata*) and *Tareeq* (Diaphoresis) in the Management of *Samne Mufrit* (Obesity): A Randomised Clinical Trial

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ABSTRACT

Background & Objectives: Obesity is emerging as a major health problem worldwide which still defies all sorts of treatment approaches and stares in face attending morbidity and mortality. The aim of the study was to evaluate the efficacy and safety of *Kundur* (*Boswellia serrata*) and *Tareeq* (Diaphoresis) in the management of *Samne Mufrit* (Obesity).

Methods: In this randomised three arm comparative clinical study, 48 consecutive obese adults (BMI 30-39.9 kg/m²) aged 20-60 years of either gender were randomly allocated (1:1:1) into three groups. Group A treated with (*Kundur* gum resin powder 3 gm orally once in the morning, group B treated with (*Tareeq* through steam bath for 15 min every 4th day in first 4 weeks then once weekly in next 4 weeks) and group C provided with (*Kundur* along with *Tareeq* with same dose and duration as mentioned in group A and B) for consecutive 8 weeks. Calorie controlled diet and brisk walk for 30 minutes advised to each group. Efficacy assessment based on subjective and objective parameters determined on baseline, 28th and 56th day, while safety assessment done only at baseline and after the treatment. One-way ANOVA, student paired t test, Chi square and Fisher Exact tests used for data analysis.

Results: Among 45 patients who completed the study, statistically significant weight reduction (p<0.01) occurs in the consequential order as group C > group A > group B. Significant (p<0.01) reduction in anthropometric indices (body mass index, waist circumference, waist hip ratio, skin-fold thickness) and improvement in obesity-associated symptoms (restriction of movement, joint pain, breathlessness, fatigue) found in all groups. None of the parameters has exhibited any side effects due to these interventions.

Conclusion: The findings illustrated that use of either *Kundur* or *Tareeq* or *Kundur* along with *Tareeq* appears safe and effective for the management of obesity.

Key words: *Samne Mufrit*, Obesity, *Tareeq*, *Kundur*, Management

INTRODUCTION

Obesity is the fifth leading risk worldwide and its allied health problems have exploded in the past two decades. [1] Obesity is defined by excessive accumulation of fat in the body. [2,3] Unani scholars have described obesity in terms of *Samne Mufrit*,

Farbahi, *Motapa* which signifies excessive fat in the body. [4] The worldwide prevalence of obesity has more than doubled since 1980. [1,5] Unani physicians asserts that *Sue Mizaj Balghami* (immoderate phlegmatic temperament) of the body is due to innate cold temperament or by adopting excessive

barid tadabeer (cold practices) or sedentary lifestyle. This leads to decreased improper dissolution, substitution, and assimilation of nutrient (fat) in the body causing *Samne Mufrit*. [4,6-8]

Dilemma of obesity afflict is dealt with in the most wide-ranging fields, though it remains unsolved, but to some extent it has been inferred that the interference of those mechanisms which causes an increase in energy intake and a decrease in energy expenditure, may lead to obesity. [9] Excessive body fat accumulations contribute to multiple organ-specific consequences. [1,2] Incredibly, modest weight loss can reduce visceral fat and improve comorbid conditions. [10,11] Guideline recommendations for modest weight loss are determined as 5% to 10% reduction of baseline weight within 6 months to individuals with a BMI up to 40. [12-15] Though management of obesity comprises of multiple techniques and strategies but modern era is gaining fast acceptance towards regimens and drugs. [16,17] Sibutramine and orlistat had been approved by FDA (Food and Drug Administration) for long-term use in weight loss management. Both have many unwanted side effects, sibutramine cause headache, insomnia, increase blood pressure, tachycardia while orlistat lead to oily spotting, flatus with discharge, and fecal urgency. [14,17] Because of the inconsistent results and side effects, use of traditional and alternative medicines are fast gaining popularity, thus justifying extensive research in this field. [16] Unani physicians have mentioned various regimens and measures in management of obesity so as to prevent and combat this disease without any significant side effects on the body. Inclusive weight-loss regimen impending Unani principle of treatment includes modification in *Asbab-e Sitta Zaruriya* (six essential factors) in particular *Makoolat wa Mashroobat* (diet), *Riyazat* (exercise); use of appropriate drug along with an appropriate regimen. As obesity is under *balghami amraaz* (phlegmatic diseases), to reduce body weight *Ilaj bil zid* (heteropathy) is

recommended to ameliorate the derangement of temperament by drugs having *muhazzil* (antiobesity), *musakhkhin* (calorific), *muhallil* (resolvent), *mulattif* (demulcent), *mulayyin* (laxative), *mujaffif* (desiccant), along with *qawi mudir baul* (strong diuretics) properties and regimens which increased *tahleel* (dissolution) and brings *yaboosat* (dryness) via eliminating excess *ratoobat* (moistness). [18] A single Unani drug *Kundur* (gum) was selected as its efficacy has not been evaluated scientifically so far. [19,20] *Kundur* has been indicated in *balghami amraaz* and so as in weight loss. [18,19,21] It exhibits expectorant, stimulant, diuretic, diaphoretic, anti-inflammatory, antioxidant, hypoglycemic, hypolipidemic and anti-atherosclerotic activities. [22] Among *tadabeer* (regimens) *Tareeq* has been mentioned as a treatment modality to control the progress of *Samne Mufrit*. [18,23,24] *Tareeq* through steam bath was chosen as it causes profuse sweating resulting in loss of *ratoobat* (moistness), elimination of *mawaade fasida* (toxins) from body. This results in increased dryness and temperature of the body, thereby correcting *Sue Mizaj Balghami* (immoderate phlegmatic temperament) of the obese person. [4,23,25-27] This forms the coherent foundation for our working hypothesis. The objectives of the study was to evaluate the efficacy and safety of *Kundur* (*Boswellia serrata*) and *Tareeq* (diaphoresis) separately and synergistic effect of both in the management of *Samne Mufrit* (obesity). In addition to evaluating effectiveness in management of obesity, this provides a comparative evaluation of the interventions on the basis of primary and secondary outcomes.

MATERIALS AND METHODS

Study design and participants: A parallel, three arm, randomized clinical study was performed from January 2015 to January 2016 at National Institute of Unani Medicine hospital. The protocol was approved by the Institutional ethical committee of N.I.U.M, Bengaluru (Ref no. NIUM/IEC/2013-14/005/Moal/05 dated 24.04.2014). The

research was performed on 45 patients with duration of protocol fixed as 8 weeks. The inclusion criteria comprise of patients of either gender aged 20 to 60 years, [28] BMI range from 30-39.9 kg/m² and who signed the written consent. We excluded pregnant and lactating women, people with cardiovascular disorders, thyroid and adrenal dysfunction, with severe systemic illnesses and malignancies, on anti-obesity or weight gain promoting drugs. The patients attending at N.I.U.M hospital screened and recruited in accordance with preset selection criteria. The screening visit consists of general physical and systemic examination along with vital signs, and laboratory investigations. Obesity-specific investigation includes fasting blood sugar (FBS), lipid profile (S. cholesterol, S. triglyceride, HDL, and LDL), thyroid profile (T₃, T₄, and TSH), electrocardiography, liver function test (AST, ALT, Alkaline phosphate), renal function test (Blood urea & S. creatinine). For safety assessment complete haemogram (Hb%, TLC, DLC, ESR), urine routine & microscopic was done. Selected

patients were informed about the purpose and procedure of the research and written consent was obtained before enrolling in the study.

Sample size estimate: Sample of 15 in each arm from the 3 groups was obtained using PASS Software by NCSS. The total sample of 45 subjects achieves 81% power to detect differences among the means versus the alternative of equal means using an F test with a 0.05 significance level. The common standard deviation within a group was assumed to be 11.45 (data from the earlier study). [29] Due to the practical reasons the sample size was increased to 48 patients (16 in each arm) with added provision of dropout (10%).

Allocation of subjects: Out of the total number of patients screened (n=109) the eligible patients (n=48) randomized using computer-generated numbers and allocated (1:1:1) consecutively into three groups (A, B & C) comprising 16 patients in each group. The flowchart (Figure-1) describing the progress of the patients through the trial.

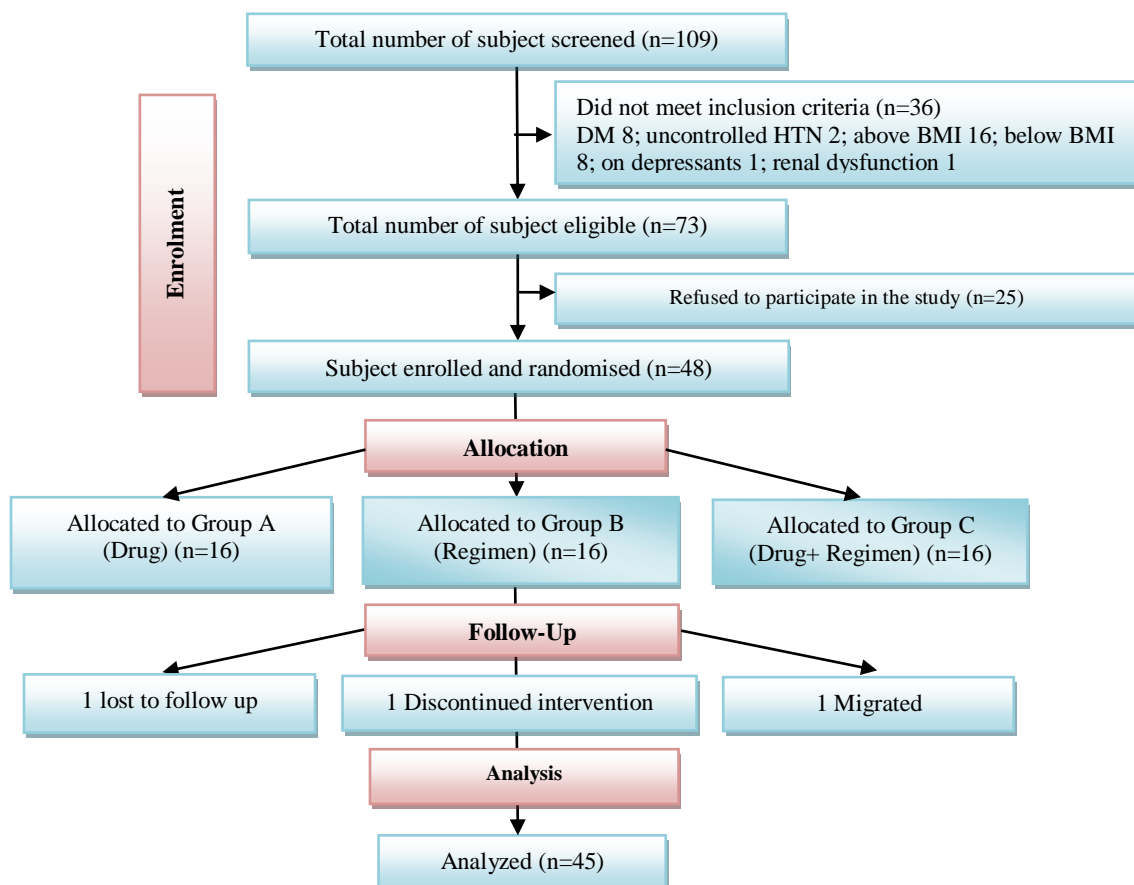


Figure-1 Flow chart of the study

Study Interventions: Patients were provided treatment for 8 weeks continuously on the basis of group allocated to them as follows:

Group A: *Kundur* gum resin 3gm in a powdered form orally once daily in the morning.

Group B: *Tareeq* for 15 min through steam bath as per schedule (given below).

Group C: *Kundur* gum resin 3gm in a powdered form orally once daily along with regimen *Tareeq* for 15 min by steam bath.

The sittings for regimen *Tareeq* of included patients were scheduled as follows: [29]

Days	0	4	8	12	16	20	24	28	35	42	49	56
Sittings	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th

Good quality test drug was provided by the pharmacy of NIUM, Bengaluru after authentication from CSIR-National institute of science communication and information resources. A quality of the test drug was validated by Raw Material Herbarium and Museum, Delhi (RHMD) with ref no: NISCAIR/RHMD/Consult/2014/2549-128. After validation drug was cleaned and makes powder in pharmacy adopting standard operative procedures under the supervision to the chief pharmacist. The drug was supplied in transparent small bags and patients were advised to take the dose of 3gm once a day orally. [22] For *Tareeq*, the patient clad in minimum loin cloth or underwear, was made to sit on a stool inside a portable steam bath available in regimenal therapy unit (RTU) for the duration of 15 minutes. Before taking a steam bath, the patient was advised to drink

one or two glasses of water and protect the head with a cold towel. [30]

Assessment of subjects: Complete history regarding patients demographic, a presence of any past illness, treatment and family history; personal and socioeconomic history was taken. Socioeconomic status was assessed by Kuppaswamy's Socioeconomic Status Scale Modified 2014. [31] Obesity-specific information of interest taken includes the onset of obesity, duration of suffering, current and past medications, dietary habits, physical activity level, weight loss attempts, co morbidities and subjective symptoms present. The subjective parameters assessed include increasing body weight, restriction of movement, joint pain, breathlessness, palpitation and fatigue. As subjective parameters vary in severity between patients an arbitrary verbal rating scale (Table-1) was made having 5 grade points.

Table- 1 Five Point verbal rating scale

S.N	Nature	Grade	Nature of severity
1	None	0	No symptoms
2	Mild	1	Remedial therapy not require for continuing routine work (quality of life not impacted)
3	Moderate	2	Require remedial therapy for continuing routine work (quality of life impacted).
4	Severe	3	Unable to continue routine work despite of taking remedial therapy(quality of life significantly impacted)
5	Very severe	4	Symptoms present even at rest.

Along with general and systemic examination, obesity-specific examination for objective assessment was done. The objective parameter includes anthropometric indices: weight, BMI, waist circumference, waist-hip ratio and skin fold thickness (summation of mid triceps, biceps, sub scapular, and supra iliac). All the anthropometric measurements of patients were taken in an efficient standardized way.

[14,32] Weighing scale used was LAICA Mod PL8033 and skin fold thickness was measured by using a Harpenden caliper. Obesity class was determined by WHO classification of BMI. Health risk profile was assessed by Edmonton Obesity Staging System (EOSS). [1,33,34] Total energy expenditure (TEE) was determined from estimates of resting energy expenditure (REE) by Mifflin equation plus the energy

needed for various levels of physical activity (PAL) associated with lifestyles of the individuals. [2] The balanced eating plan providing 55-75% of calories from carbohydrate, 10-15 % from protein and 15-30% percent from fat and the moderate level of physical activity (brisk walk for 30 minutes) consistent with guidelines was advised to all the patients. [13,14,35] The diet plan was not allowed to reach less than 1200 calories per day. Diary to maintain a daily record of diet and exercise was handed to every patient; further physician assessment diary for monitoring weekly calories and physical activity was maintained to countercheck the extraneous factors. [36] The Mizaj of the patient was determined by the assessment of *Ajnaas-e-Ashara* (ten temperament determining signs) mentioned in the classical Unani literature. Clinical assessment was done on 0th day, 28th day and 56th day. During the follow-up assessment of disease progression or regression in their symptoms and changing anthropometric measurements was done. Compliance was monitored by asking them to bring the remaining medicine and food activity diaries at each visit. Consumption of 90% of the drug was considered as adequate compliance. Concomitant treatment in any form was not allowed during the study other than antihypertensive drugs. Baseline and post treatment diagnostic laboratory tests were done for screening and understanding the patient's medical condition; for future monitoring of potential complications from the treatment plan and health outcomes of interest. [37]

Outcomes: The assessment of efficacy was based on the primary and secondary outcome. The primary outcome was considered as the change in weight while the change in the other anthropometric indices (Basal metabolic index, waist circumference, waist-hip ratio, skinfold thickness) and obesity associated symptoms like a restriction of movement, joint pain, breathlessness, palpitation, and fatigue were considered as secondary outcomes with reference to baseline to 56th day. The safety assessment

was done on the basis of clinical symptoms; adverse drug reaction reported and changes in biochemical parameters.

STATISTICAL ANALYSIS

The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word, Excel has been used to generate graphs and tables. Significance is assessed at 5 % level of significance (p value < 0.05). Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups, and Student t-test (two tailed, dependent) has been used to find the significance of study parameters on a continuous scale within each group. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on a categorical scale between two or more groups.

RESULTS

Statistical analysis was carried out only of those patients that completed the trial. The demography data of the study population is illustrated in [Table-2](#). On intragroup analysis results were indicative of statistically significant reduction in weight, and other anthropometric indices (BMI, WC, WHR and SFT) among all the three groups. On intergroup analysis, group C followed by group A in comparison to group B had exhibited substantial decrease in weight and waist circumference only ([Table- 3](#)). The improvement in obesity associated symptoms (restriction of movement, joints pain, breathlessness and fatigue) were statistically significant in all the groups except in palpitation ([Table- 4](#)).

From the findings of the study it can be inferred that the primary and secondary outcome of this study was achieved thereby validating the efficacy of the *Kundur*, *Tareeq* and the synergistic effect of both correspondingly. None of the parameters exhibited any adverse change during protocol therapy due to any of them.

Table- 2: Demographic characteristics

Parameter	Group A	Group B	Group C	P value	
Age (years)	34.67 ± 7.88	39.13 ± 9.91	38.53 ± 11.27	0.41	
Gender	Male	1 (6.7%)	3 (20%)	2 (13.3%)	0.67
	Female	14 (93.3%)	12 (80%)	13 (86.7%)	
Marital status	Married	15 (100%)	15 (100%)	13 (86.7%)	0.32
	Unmarried	0 (0%)	0 (0%)	2 (13.3%)	
Habitat	Rural	2 (13.3%)	3 (20%)	5 (33.3%)	0.74
	Semi Urban	4 (26.7%)	5 (33.3%)	3 (20%)	
	Urban	9 (60%)	7 (46.7%)	7 (46.7%)	
Dietary pattern	Mixed	11 (73.3%)	11 (73.3%)	12 (80%)	1.00
	Veg	4 (26.7%)	4 (26.7%)	3 (20%)	
Lifestyle	Moderately active	2 (13.3%)	2 (13.3%)	2 (13.3%)	1.00
	Sedentary	13 (86.7%)	13 (86.7%)	13 (86.7%)	
Family history		10 (66.7%)	12 (80%)	13 (86.7%)	0.55
Socioeconomic status	Lower middle	2 (13.3%)	4 (26.7%)	3 (20%)	0.44
	Upper Middle	10 (66.7%)	10 (66.7%)	12 (80%)	
	Upper	3 (20%)	1 (6.7%)	0 (0%)	
Temperament	Balghami	11 (73.3%)	11 (73.3%)	12 (80%)	1.00
	Damvi	4 (26.7%)	4 (26.7%)	3 (20%)	
Weight (kg)	80.97 ± 9.85	87.56 ± 11.11	79.26 ± 7.89	0.06	
BMI (kg/m ²)	35.58 ± 3.35	35.58 ± 3.20	34.07 ± 2.58	0.31	
Obesity class	I	6 (40%)	6 (40%)	8 (53.3%)	0.54
	II	9 (60%)	9 (60%)	7 (46.7%)	
EOSS	1	4 (26.7%)	2 (13.3%)	3 (20%)	0.73
	2	11 (73.3%)	13 (86.7%)	11 (73.3%)	
ACI Kcal/day	1313.33 ± 251.17	1428.06 ± 278.70	1314.20±217.98	0.36	
APA minute	180.00 ± 34.40	184.67 ± 24.09	190.27±31.29	0.65	

Table-3: Changes in objective parameters

Objective parameters	Group A	Group B	Group C	P value	
BW (kg)	0 th d	80.97±9.85	87.56±11.11	79.26±7.90	0.06
	28 th d	78.79±9.87	85.89±11.15	76.79±8.00	0.04
	56 th d	76.90±9.95	84.57±11.53	74.07±8.03	0.02
	Diff (0-56 th)	4.067	2.993	5.193	
	P value	<0.001	<0.001	<0.001	
BMI (kg/m ²)	0 th d	35.58±3.35	35.58±3.20	34.07±2.58	0.31
	28 th d	34.66±3.50	34.96±3.17	33.01±2.69	0.20
	56 th d	33.83±3.57	34.35±3.44	31.88±2.74	0.10
	Diff (0-56 th)	1.755	1.227	2.198	
	P value	<0.001	<0.001	<0.001	
WC (cm)	0 th d	97.10±7.49	99.87±10.15	97.52±6.04	0.60
	28 th d	93.51±7.07	98.35±9.93	93.67±6.35	0.18
	56 th d	89.93±7.36	96.48±10.61	89.33±5.76	0.04
	Diff (0-56 th)	7.173	3.393	8.187	
	P value	<0.001	<0.001	<0.001	
WHR	0 th d	0.86±0.05	0.88±0.05	0.86±0.04	0.54
	28 th d	0.85±0.05	0.87±0.05	0.85±0.04	0.47
	56 th d	0.84±0.05	0.85±0.06	0.83±0.03	0.48
	Diff (0-56 th)	0.023	0.023	0.027	
	P value	<0.001	0.003	<0.001	
SFT (mm)	0 th d	128.13±21.78	138.47±11.92	131.60±13.47	0.22
	28 th d	123.07±21.56	133.73±11.52	126.13±13.23	0.19
	56 th d	118.60±21.18	129.33±11.15	117.53±13.16	0.09
	Diff (0-56 th)	9.533	9.133	14.067	
	P value	<0.001	<0.001	<0.001	

DISCUSSION

Obesity is a complex issue; its causes, consequences, and management continue to be an area of considerable debate. [38] Due to increased risk of mortality and morbidity there has been a growing need for sound research in the area

of obesity and weight management. To date, regarding weight loss effects only one published animal trial of *Kundur* and one human trial of *Tareeq* by steam bath has been reported, hence there is lack of evidence based clinical trials. [29,39] Among *Asbab-e-Sitta Zaruriya* (six essentials

factors), emphasis was given on modifiable risk factors like overconsumption of food and physical inactivity by advising calorie

controlled diet and brisk walk for 30 minute in each group for weight maintenance. [13] [1,6]

Table-4: Changes in subjective parameters

Subjective parameters (%)		Group A			Group B			Group C			P value
		None	Mild	Moderate	None	Mild	Moderate	None	Mild	Moderate	
Restriction of movement	0 th d	26.7	13.3	60	13.3	13.3	73.3	13.3	20	66.7	0.90
	28 th d	40	53.3	6.7	20	80	0	20	66.7	13.3	0.42
	56 th d	73.3	26.7	0	86.7	13.3	0	80	20	0	0.89
	P value	0.002			<0.001			< 0.001			
Joint pain	0 th d	13.3	20	66.7	0	13.3	86.7	13.3	13.3	73.3	0.67
	28 th d	13.3	53.3	33.3	0	60	40	26.7	46.7	26.7	0.37
	56 th d	40	60	0	26.7	73.3	0	40	60	0	0.79
	P value	0.003			<0.001			0.001			
Breathlessness	0 th d	46.7	20	33.3	33.3	33.3	33.3	40	40	20	0.77
	28 th d	53.3	46.7	0	46.7	53.3	0	73.3	26.7	0	0.41
	56 th d	93.3	6.7	0	93.3	6.7	0	100	0	0	1.00
	P value	0.001			<0.001			0.004			
Palpitation	0 th d	80	13.3	6.7	73.3	20	6.7	73.3	20	6.7	1.00
	28 th d	86.7	13.3	0	80	20	0	80	20	0	1.00
	56 th d	100	0	0	100	0	0	93.3	6.7	0	1.00
	P value	0.36			0.22			0.48			
Fatigue	0 th d	33.3	20	46.7	6.7	33.3	60	6.7	20	73.3	0.27
	28 th d	53.3	46.7	0	20	66.7	13.3	6.7	86.7	6.7	0.24
	56 th d	80	20	0	40	60	0	66.7	33.3	0	0.10
	P value	<0.001			0.001			<0.001			

In our study most of the patients were in progressive age between 31-50 years coinciding with Kaniyappan et al. and the data of NFHS III (Karnataka). [40,41] Majority of females and married patients in the study is in agreement with Daud Antaki edict and various studies reported in India. [29,40,42-44] Factors held responsible may be body-image distress, weight gain during pregnancy, oral contraceptive therapy and menopause. [2,10] Regarding habitat the obesity was found more among patients from urban areas, such an increasing trend were also reported by Pradeepa et al., Ramachandran et al., likely due to the epidemiological and nutritional transition. [42,43] The data showed greater prevalence of obesity in patients having mixed type of dietary habit coinciding with the observation of Asim et al. and Shrivastava et al. [45,46] Majority of patient having sedentary lifestyle supports the findings mentioned by Misra et al.; Ibn Sina and Rabban Tabri that leisurely lifestyle results in obesity. [6,7,33] Among maximum patients positive family predilection was found which imply either genetic or environmental

influences depicting multifactorial association in support of the data available. The observation regarding strata is contrary to the relationship mentioned by Misra et al. Association between SES and obesity, in India is observed to be complex as middle and low socioeconomic strata are gradually afflicted toward western foods available at relatively low prices. [33] Maximum number of patients had *Balghami Mizaj* which is in conformity with the description by Unani scholars. [4,25,26,47] Few patients also exhibit *Damvi Mizaj*, which is in consonance with the statement of Aqsarai. [4] Maximum patients were from obesity class II and EOSS stage 2, suggesting maximum patients at increased mortality risk and in the greatest need of weight management. In group A improvement in restriction of movement, joint pain was due to *muhallil, dafe fasad balgham* action of the *Kundur*. [6,21] The significant results of *Kundur* in reducing restriction of movement and joints pain strongly coincides with the various clinical studies conducted in the management of osteoarthritis. [48,49] In group B, reduction in restriction of movement and

joint pain occur due to *musakhkhin, nuzj wa tahleel-e-ratoobat* action of *Tareeq* induced by steam bath. [9,28,29] Existing researches shows that the relaxation of muscles by heat alleviates the restricted movement of joints and pains. [4,50,51] Improvement in breathlessness, fatigue in group A was noticed as *Kundur* dries excessive *ratoobat* in lungs and has *muqawwi aazae raeesa* activity respectively. [19,21] Experimental studies revealed that gum resin of *Boswellia serrata* effective in reducing the symptoms of breathlessness in asthmatic patients and essential oils present in it have antioxidant activity which may be responsible for abating the fatigue. [50,52,53] Also in group B, complaint of breathlessness and fatigue was reduced significantly due to *tahleel ratoobat* and removal of accumulated *fuzlat* (toxins) through *Tareeq*. [4,25,26] Among group C patients, improvement in restriction of movement, joint pain, breathlessness, and fatigue occur due to synergistic action of *Kundur* and *Tareeq*. Weight reduction in each group itself contributes to the improvement in subjective parameters. The reduction in weight was 6.55 % in group C followed by 5.02% in group A and 3.41% in group B which depicts that group A and C had attained a modest weight loss of 5% recommended as per ICSI guidelines. [17] Reduction in weight in group A is attributable to the *muhazzil, mujaffife balgham, qate balgham* action of the *Kundur* by virtue of its *haar yaabis mizaj* (hot dry temperament). [19,21] This finding is in conformity with clinical trial conducted by Vyas et al. reported significant reduction ($p < 0.02$) in body weight by *Boswellia serrata* at same dosage for 7 weeks for management of osteoarthritis. [51] Weight reduction in group B was on account of the hotness of steam bath which has *tahleel wa mujaffife ratoobat* action and elimination of excess *ratoobat* through *Tareeq*. [4,26] In previous studies of weight reduction by steambath, Ansari et al. reported statistically insignificant results while significant reduction was reported by Kumar. [29,51] As per guideline minimum weight of 2 kg in

first 4 weeks illustrates response to pharmacotherapy; [13] which is in consonance with our findings at 28th day in group A and C with 2.180 kg and 2.473 kg respectively. Reduction in BMI, waist circumference, waist hip ratio, skin fold thickness is directly allied to the weight loss. Furthermore *Kundur* is specifically recommended for abdominal fat reduction by Najmul Ghani, this attributes to more waist circumference reduction in group A and C. [19] Proportion of values of complete haemogram, liver and renal functions before and after treatment were insignificant ($p > 0.05$) attesting the safety of interventions. Calorie controlled diet and brisk walk do help in weight maintenance. [13] Possible mechanisms of *Boswellia serrata* reported by Singh et al is that it help in stimulating thyroid gland leading to increase metabolic rate thereby increase in thyroid efficiency thus, reduces weight. Researchers showed no toxic effect of *Boswellia serrata* up to 500mg/kg. [39] Haughton et al. stated that medical bath (hot air baths) increases the force and rapidity of the circulation, excites the lymphatic system, produces copious perspiration, and expels various morbid products from the blood, which is sensibly marked by the rapid oxygenation which takes place in the bath eliminating oily matter from fat persons. [54] The implied mechanism behind the *Tareeq* is that steambath causes rise in the body temperature similar to a fever, accelerates metabolic rate increases the consumption of stored calories thus promoting weight loss. [51,55]

CONCLUSION

Obesity is considered as a multifactorial disorder in both conventional and Unani medicine leading to fat accumulation, caused by poor metabolic functioning. All the three interventions were found to be safe and effective in management of obesity however the combined therapy showed precedence over the *Kundur* and *Tareeq* solely. These interventions can be employed as an adjunct

to therapeutic lifestyle changes for maintaining optimal weight. Comprehensive approach should be emphasized in treating obesity by the use of antiobesity medicinal preparations, regimens along with an enhanced exercise regimen and a healthy diet. Limitations of the study were small sample size and short duration of protocol therapy. Noncompliance of the participants like inadequate adherence to dietary interventions physical activity and other lifestyle covariates was a related problem. Researchers can incorporate the supportive data in subsequent long term trials to further investigate the potential role of these treatments on weight loss as there is a strong need for replication of studies to strengthen these findings.

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Abbreviations: BMI - Body mass index, DLC - Differential Leucocytes Count, TLC -Total Leucocytes Count, T₃ - Triiodothyronine, T₄ - Thyroxine, TSH - Thyroid stimulating hormone, HDL- High density lipoprotein, LDL- low density lipoprotein, WC- Waist Circumference, WHR- Waist Hip Ratio, SFT- Skin fold thickness, AST- Aspartate transaminase, ALT - Alanine transaminase.

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