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Phosphatidylcholine versus Caffeine in Management of Abdominal Obesity

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Abstract

Background: Mesotherapy involves the introduction of various therapeutic agents in microscopic quantity to the skin for various therapeutic applications. Phosphatidylcholine (PPC) increases the permeability of the adipocyte membrane and subsequent fat mobilization. Caffeine has an effect on adipocyte lipolysis via the inhibition of phosphoesterase, provoking an increase in adenosine mono phosphate (AMP), slow down lipogenesis (uptake of glucose and free fatty acids to synthesize triglycerides) and stimulate lipolysis. Our aim was to compare the efficacy, safety, and tolerability of phosphtidylcholine, caffeine and mesotherapeutic cocktail (Phosphatidylcholine, Organic silicium, L-Carnitine, Hyaluronic Acid, Sodium Pyruvate, Caffeine, Artichoke Extract, DMAE) in treatment of abdominal obesity. Patients and Methods: Low caloric diet, exercise and mesotherapeutic injection for abdominal subcutaneous fat: Phosphatidylcholine/Deoxycolate (PPC/DC) for group I, caffeine for group II, lipolytic cocktail for group III weekly for six weeks. Results: All groups showed statistically significant reduction regarding anthropometric measurements, ultrasonographic evaluation and lipid profile after treatment being highest in group III followed by group I followed by group II . Minimal side effects have been occurred except PPC group showed 50% local allergy. Conclusion: Mesotherapy is an effective method for adipolysis. Lipolysis cocktail allows the highest effect and the most safe drug for lipolysis.

Keywords: Mesotherapeutic cocktail, Phosphatidylcholine allergy, Caffeine.

1. Introduction

Obesity is defined as abnormal or excessive fat accumulation that may impair health **[**1]. It is the result of complex relationships between genetic, socioeconomic, and cultural influences. Consumption patterns, and lifestyle habits influence the prevalence of obesity. The condition may be the result of disease or pharmacologic treatment. Persons who are obese have less school attendance, reduced learning potential, and higher healthcare costs that may result in an economic burden on society [2].

Mesotherapy refers to minimally invasive techniques which consist of the use of intradermal or subcutaneous injections containing liquid mixture of compounds (pharmaceutical and homeopathic medications, plant extracts, vitamins and other ingredients) to treat local medical and cosmetic conditions [3]**.**

Intradermal mesotherapy is a simple , safe treatment, well-tolerated and effective alternative treatment modality for reducing the diameter of body circumferences**.** Commonly used preparations include: phosphatidylcholine(PPC), deoxychoic acid(DOA) and caffeine [4].

Ultrasound (US) is a useful method to monitor intradermal mesotherapy and assess its efficacy and results **[**5]. It is an accurate technique for thickness measurements of subcutaneous adipose tissue (SAT) layers. It is cheaper and more safe than (CT) and (MRI) because it allows no exposure to radiation **[**6].

2. Aim of the work

The aim of this work was to compare the efficacy, safety, and tolerability of phosphtidylcholine, caffeine and mesotherapeutic cocktail (Phosphatidylcholine, Organic silicium, L-Carnitine, Hyaluronic Acid, Sodium Pyruvate, Caffeine, Artichoke Extract, DMAE) in treatment of abdominal obesity.

3. Patients and Methods

This study was conducted on: thirty mild to moderate obese female patients whose body mass index (BMI) was (30- 34.9 kg/ m²) suffering from local abdominal obesity . Patients were recruited from those attending the outpatient's clinic of the Rheumatology ,Rehabilitation and Physical medicine department of Benha University Hospitals between May 2019 to October 2019 .

All participants were subjected to (weight, height, BMI, WC, HC, WHR, U/S assessment of anterior abdominal fat thickness, lipid profile, SGPT, SGOT, s. creatinine) before and after treatment.

Our program was: low caloric diet, physical training exercise and mesotherapy injection for abdominal subcutaneous fat weekly for six weeks. Patients were classified into three groups each included 10 patients, group (I) underwent mesotherapy of (phosphatidylcholine and deoxycholate), group (II) Caffeine and group (III) mesotherapeutic cocktail.

Ethical considerations

All patients were given an informed written consent prior to participation in this study and consents for photos were also obtained and it was approved by the ethical committee of Benha University Faculty of Medicine.

Exclusion criteria

Patients were excluded from this study if they had:

- Age < 16 years.
- Patients already participating in other weight loss regimen**.**
- Patients with morbid obesity BMI > 40.
-Patients with known bleeding tendency or receiving oral anticoagulants.
-Patients suffering from skin disease or active skin lesions.
- Patients taking antidepressant, steroid or contraceptive pills.
- Pregnant females.
- Lactating females.

- Patients with any systemic diseases such as hypertention, heart, kidney and liver diseases, uncontrolled diabetes, endocrinal disorders, autoimmune diseases and those with active infections.
- Patients known to had hypersensitivity to any of the used preparations.
- Patients with epilepsy.

All participants of this study were subjected to the following

1- Full history taking: With special focus on Sex, Age, Smoking, Diabetes Mellitus, Hypertension, drugs as corticosteroid, antidepressant Cause of obesity (e.g. increase food intake, decreased physical activity, drugs, pregnancy, endocrinal disorders, etc.).

General Examination: Height, Weight, Vital signs: (Pulse – Temperature - Blood pressure – and Respiratory rate) , General appearance and body built.

Assessment of obesity: Weight, height, BMI, WC, HC, WHR, U/S evaluation of abdominal fat thickness.

Laboratory investigations Fasting blood sugar, (CBC), Lipid profile, Liver function tests: SGPT, SGOT, Serum creatinine. Thyroid Functions: TSH, T3 , T4 .

Mesotherapy injection Steps:

1. The area to be treated was exposed and marked while the patient was standing.
2. Then patient lied supine in comfortable position.
3. Infrared was applied for about 15 minutes before injection.
4. The area needed to be treated was sterilized by alcohol.
5. It is important that the needle was inserted as rapid as possible but gently and that the syringe was emptied slowly to be less painful.
6. The marked area was injected by multiple injections by insulin syringe, 1cm apart, 45 degrees to the skin and the treated area was sterilized again.
7. Group **(I)** was injected 0.2 ml in each injection, Group**(II)** was injected 0.1 ml in each injection and Group **(III)** was injected 0.4 ml in each injection.
8. Then massage after injection for 5 minutes.
9. Patients were observed for 1 hour after injection searching for any adverse reaction or allergy.
10. We repeated these above steps for six successive weeks with one session per week.

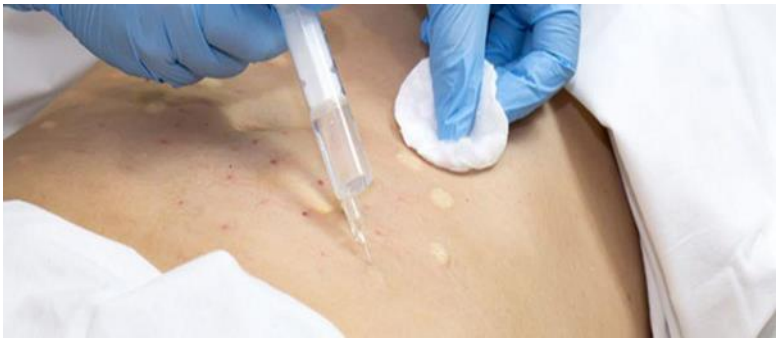

Fig. (1) Injection Technique

4. Results

Table (1) Comparison between the studied groups regarding anthropometric measurements before and after treatment

Weight		**Pre intervention**	**Post intervention**	**P value**	**Percentage of weight reduction**
Group (I) (n=10)	Median	91.00	84.00	0.004 (S)	8.421
	IQR	81.50-93.50	75.00-85.50		7.332-8.553
Group (II) (n=10)	Median	89.00	81.00	0.005 (S)	8.258
	IQR	83.00-93.00	76.53-86.00		7.452-9.001
Group (III) (n=10)	Median	80.00	72.50	0.004 (S)	8.847
	IQR	79.50-90.00	72.00-82.38		8.409-10.000
BMI		Pre intervention	Post intervention	P value	Percentage of BMI reduction
Group (I) (n=10)	Median	31.47	29.06	0.005 (S)	7.658
	IQR	30.77-33.69	28.52-31.42		6.295-8.034
Group (II) (n=10)	Median	32.93	30.15	0.005 (S)	8.262
	IQR	31.00-34.76	28.60-31.74		7.471-9.047
Group (III) (n=10)	Median	33.48	30.84	0.005 (S)	8.914
	IQR	31.64-34.06	28.47-31.05		8.331-10.019
WC		Pre intervention	Post intervention	P value	Percentage of WCreduction
Group (I) (n=10)	Median	94.00	85.00	0.005 (S)	9.575
	IQR	88.75-97.75	83.00-86.50		8.223-11.506

Group (II) (n=10)	Median	98.20	88.80	0.004 (S)	9.069
	IQR	95.00-102.00	86.00-92.00		8.000-10.614
Group (III) (n=10)	Median	97.90	86.30	0.004 (S)	11.451
	IQR	88.00-102.50	78.00-92.00		10.974-13.861
HC		Pre intervention	Post intervention	P value	Percentage of HC reduction
Group (I) (n=10)	Median	117.00	109.00	0.004 (S)	6.838
	IQR	113.00-120.00	105.75-111.50		5.994-7.361
Group (II) (n=10)	Median	118.00	110.00	0.004 (S)	6.782
	IQR	115.25-121.50	107.50-113.25		6.549-6.958
Group (III) (n=10)	Median	113.00	104.00	0.004 (S)	7.135
	IQR	99.00-122.75	92.00-114.50		6.942-7.965
WHR		Pre intervention	Post intervention	P value	Percentage of WHR reduction
Group (I) (n=10)	Median	0.805	0.770	0.025 (S)	4.310
	IQR	0.790-0.840	0.753-0.738		1.274-6.173
Group (II) (n=10)	Median	0.835	0.825	0.004 (S)	1.752
	IQR	0.805-0.870	0.785-0.850		1.201-3.437
Group (III) (n=10)	Median	0.865	0.830	0.005 (S)	5.214
	IQR	0.810-0.890	0.796-0.840		2.469-6.742

Table (1) showed that there were statistically significant differences regarding percentage of reduction of anthropometric measurements before and after treatment
In all groups, being highest in group III followed by group I followed by group II.

Table (2) Comparison between the studied groups regarding Lipid Profile pre and post intervention:

Group		**TG Pre intervention**	**TG Post intervention**	**P value**	**Percentage of TG reduction**
Group (I) (n=10)	Median	98.00	84.00	0.005 (S)	16.346
	IQR	91.50 -106.75	73.00-90.75		13.540-20.520
Group (II) (n=10)	Median	109.00	95.00	0.005 (S)	14.608
	IQR	102.00-118.00	86.75-98.00		12.844-16.949
Group (III)	Median	97.00	85.00	0.005 (S)	13.780
(n=10)	IQR	95.00-114.00	97.00-98.5		12.371-16.842
Group		TC Pre intervention	TC Post intervention	P value	Percentage of TC reduction
Group (I) (n=10)	Median	151.00	131.00	0.005 (S)	10.405
	IQR	143.25-158.00	125.75-137.00		10.113-14.758
Group (II) (n=10)	Median	157.00	129.00	0.005 (S)	15.436
	IQR	149.00-171.00	125.25-155.00		9.357-18.000
Group (III)	Median	156.50	114.50	0.004 (S)	13.221
(n=10)	IQR	149.00-170.50	130.00-148.50		12.232-14.102
Group		HDL Pre intervention	HDL Post intervention	P value	Percentage of HDL increase
Group (I) (n=10)	Median	44.00	52.00	0.006 (S)	19.368
	IQR	42.00-52.00	50.50-58.00		16.667-23.913
Group (II) (n=10)	Median	58.00	62.00	0.036 (S)	19.368
	IQR	48.50-60.00	54.75-69.50		16.667-23.913
Group (III)	Median	48.00	58.00	0.004 (S)	21.569
(n=10)	IQR	44.25-52.75	55.75-61.75		4.009-29.836
Group		LDL Pre intervention	LDL Post intervention	P value	Percentage of LDL reduction
Group (I) (n=10)	Median	98.00	80.00	0.005 (S)	12.088
	IQR	90.50-126.00	78.75-113.25		10.119-14.117
Group (II) (n=10)	Median	116.50	109.00	0.005 (S)	12.088
	IQR	111.50-121.75	103.75-110.50		10.119-14.117
Group (III)	Median	103.00	90.50	0.004 (S)	10.000
(n=10)	IQR	100.00-109.50	86.00-96.00		2.655-12.600

TG: Triglyceride **TC**: Total Cholesterol **HDL**: High Density Lipoprotein. **LDL**:Low Density Lipoprotein

Table (2) showed that there were statistically significant differences regarding percentage of change of regarding Lipid Profile pre and post intervention between the studied groups.

Table (3) Comparison between the studied groups regarding liver enzymes and S. Creatinine pre and post intervention

Variable	**Group (I) (n=10)**		**Group (II) (n=10)**		**Group(III) (n=10)**		**P**
	Median	IQR	Median	IQR	Median	IQR	
SGPT pre-intervention	23.00	17.75-30.00	27.00	19.00-34.25	31.00	23.50-35.00	0.200 (NS)
SGPT post-intervention	23.00	17.75-26.25	25.50	19.00-31.25	35.00	22.75-40.00	0.075 (NS)
SGOT pre-intervention	27.00	20.25-31.75	22.00	21.00-27.25	26.00	23.00-29.50	0.346 (NS)
SGOT post-intervention	20.00	19-26.25	20.00	20.00-27.25	25.50	22.00-29.50	0.111 (NS)
S. CreatininePre intervention	0.700	0.675-0.975	0.800	0.675-1.100	0.800	0.800-1.150	0.166 (NS)
S. CreatininePost intervention	0.700	0.675-0.900	0800	0.75-1.100	0.800	0.800-1.150	0.097 (NS)

SGPT: Serum Glutamic -Pyruvic Transaminase. **SGOT:** Serum Glutamic -Oxaloacetic Transaminase.

Table(3) showed that there were no statistically significant differences between the studied groups regarding liver enzymes and S. Creatinine pre and post intervention

Table (4) Comparison between the studied groups regarding Rt,Lt(Supra and Infra umbilical) fat thickness measurements by US pre and post intervention

Rt. Supra-umbilical(US)	**Group (I) (n=10)**		**Group (II) (n=10)**		**Group(III) (n=10)**		**P**
	Median	IQR	Median	IQR	Median	IQR	
Pre intervention	2.480	1.928-2.928	2.550	2.340-3.240	2.795	2.730-2.988	0.126(NS)
Post intervention	1.460	1.388-1.560	1.640	1.440-2.100	1.030	0.958-1.058	<0.001
Percentage of decrease	39.516	30.511-45.186	38.462	34.081-40.800	63.604	62.319-66.288	<0.001 (S)
Lt. supra-umbilical US	Group (I) (n=10)		Group (II) (n=10)		Group (III) (n=10)		P
	Median	IQR	Median	IQR	Median	IQR	
Pre intervention	2.530	1.943-2.883	2.475	2.320-3.210	2.825	2.750-3.008	0.082 (NS)
Post intervention	1.420	1.363-1.570	1.580	1.410-2.000	1.060	1.010-1.180	0.001 (S)
Percentage of decrease	39.921	30.623-46.110	38.395	36.604-39.224	62.405	60.192-63.986	<0.001 (S)
Rt infra-umbilical US	Group (I) (n=10)		Group (II) (n=10)		Group (III) (n=10)		P
	Median	IQR	Median	IQR	Median	IQR	
Pre intervention	3.200	2.165-3.400	3.260	2.690-3.663	3.435	3.065-3.770	0.124 (NS)
Post intervention	1.670	1.423-2.125	2.190	1.580-2.540	1.185	1.040-1.303	<0.001 (S)
Percentage of decrease	39.394	30.923-41.886	33.699	29.186-41.264	64.183	57.988-72.407	<0.001 (S)
Lt infra-umbilical US	Group (I) (n=10)		Group (II) (n=10)		Group (III) (n=10)		P
	Median	IQR	Median	IQR	Median	IQR	
Pre intervention	3.300	2.335-3.418	3.210	2.370-3.625	3.440	3.055-3.765	0.134 (NS)

Post intervention	1.830	1.498-2.118	2.165	1.490-2.473	1.250	1.050-1.490	0.006 (S)
Percentage of decrease	38.776	30.528-40.848	32.964	31.106-37.131	58.147	55.143-72.000	<0.001 (S)

Table (4) showed that there were statistically significant differences regarding percentage of reduction of Rt, Lt(Supra and Infra umbilical) fat thickness measurements by US pre and post intervention in all groups, being highest in group III followed by group I followed by group II.

Table (5) Frequency of the adverse events among the studied groups after mesotherapy injection

Side effects	Group I N =10	Group I %	GroupII N =10	GroupII %	GroupIII N =10	GroupIII %
Pain	8	80%	6	60%	8	80%
Bruises	2	20%	2	20%	3	30%
Swelling, edema	7	70%	6	60%	8	80%
Allergy	5	50%	0	0	0	0
Redness	5	50%	0	0	0	0
Vasovagal attacks, dizziness	0	0	0	0	0	0
Nausea or vomiting	0	0	0	0	0	0
Scarring	0	0	0	0	0	0
Panniculitis	0	0	0	0	0	0
Abdominal pain	0	0	0	0	0	0
Hematoma	0	0	0	0	0	0
Post inflammatory hyperpigmentation	0	0	0	0	0	0
Numbness	0	0	0	0	0	0
Intermittent diarrhea	0	0	0	0	0	0
Skin necrosis	0	0	0	0	0	0
Lichenoid eruption	0	0	0	0	0	0
Atrophy and lipodystrophy	0	0	0	0	0	0
Palpable Subcutaneous nodules	0	0	4	40%	0	0
Intermenstrual bleeding	0	0	0	0	0	0
Atypical mycobacterial infection	0	0	0	0	0	0
Ischemic colitis	0	0	0	0	0	0

Table (5) No major adverse reactions were observed following treatment with mesotherapy injection except group (I) who developed localized allergy in 50% of patients

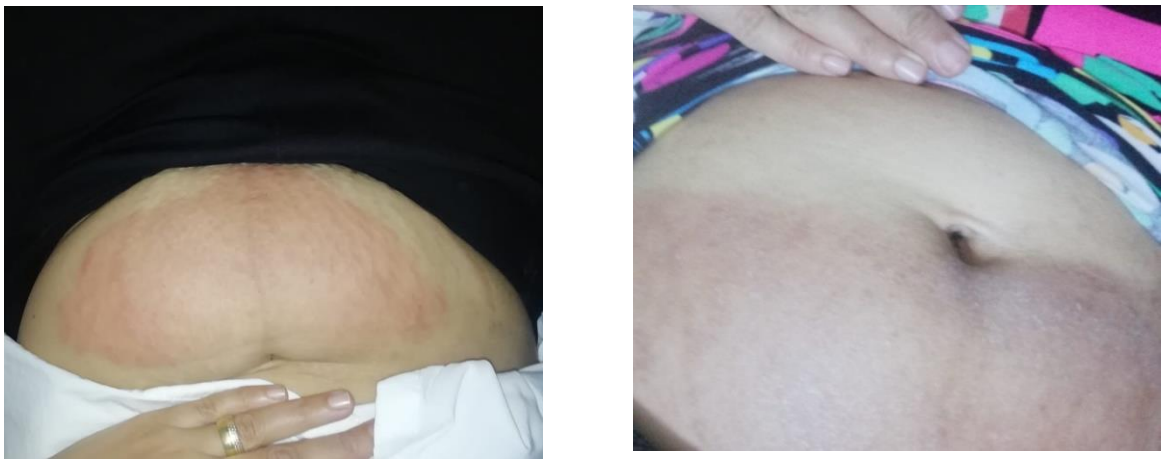

Fig. (2) PPC ALLERGY one week after injection case (1), case (2)

5. Discussion

In the present work, there was statistically significant difference in BMI, WC, HC and WHR between pre and post intervention in all groups, However statistically insignificant differences were reported between the studied groups post intervention.

Kutlubay (2011)[4] applied a study on 75 females with mean age (33years) , he used lipolytic Mesotherapeutic substances for the abdomen*:* PPC for group I, caffeine for

group II and Conjonctyl for group III , Injections were performed for 15 treatments once a week. Seventy-two of all the patients (96%) showed a circumference loss. An average circumference reduction of 4.41 cm per site for group I, 2.99 cm for group II, and 2.10 cm for group III was achieved. Mean body circumference loss was statistically significant.

Lipolytic cocktail is highly effective for local fat reduction, this hypothesis was approved by Antonio and Trídico (2021)[7] study where they treated double chin useing Toskani Slimming Cocktail(l-carnitine, caffeine, Chinese Marigold extract, Cynara scolymus extract (artichoke), pineapple sativus extract and green tea extract). The patients completed

Regarding LFT and KFT our study showed that there was no statistically significant difference pre and post intervention ($p>0.05$).

An open-label clinical trial**,** treated 213 patients with buffalo hump, lipomas, lipodystrophy, on the chin, trunk and extremities with 0.2 ml phosphatidylcholine placed every 1.5-2.0 cm into the lipomas every 15 days up to 5 treatments. Serum laboratory tested before, 48 hours and 2 weeks post treatment were obtained. The observation was that clear majority of patients had reduction of thickness of fats after up to 5 treatments. All buffalo hump patients reported improvement. There were no significant alterations in hepatic and lipid profiles [10].

In the present work, there was statistically significant difference between groups in post intervention according to ultrasonographic imaging for abdominal fat thickness with the lowest median in the third group.

A study was performed to assess the effect of deoxycholic acid injection (intralipotherapy) to remove fat deposits on the inner side of knees guided by high-frequency ultrasound. The procedure was performed twice at 4-week intervals in each patient. Highfrequency ultrasound guidance was used to monitor such parameters as the thickness of the subcutaneous tissue , and it was performed both before and after treatment. Additionally, anthropometric measurements were taken, a questionnaire was performed, and a photographic documentation was recorded. Reduction in knee circumference and subcutaneous tissue occurred in 71.42% of patients [11].

Thirty-seven female patients were studied for the treatment of localized fat in gynoid lipodystrophy (hips and thighs). Each patient received injections of a phosphatidylcholine/sodium deoxycholate preparation on one side and sodium deoxycholate on the contralateral side. Four treatments were carried out every 8 weeks. An overall reduction of local fat was obtained in 91.9% of the patients without statistically significant differences between the treated sides ($p>0.05$). Reduction values on the phosphatidylcholine/sodium deoxycholate-treated sides were in the order of 6.46% metrically (HC) and 36.87% ultrasonographically, whereas on the deoxycholate-treated sides they were in the order of 6.77% metrically (HC) and 36.06% ultrasonographically. Both treatments proved safe and effective, and U/S evaluation is practical and feasible [12].

6. Conclusion

Mesotherapy is effective, tolerable, safe and minimally invasive method for treatment of local abdominal obesity, which gives favorable results when combined with regular low caloric diet and exercise. Mesotherapeutic cocktail (Phosphatidylcholine, Organic silicium, L-Carnitine, Hyaluronic Acid, Sodium Pyruvate, Caffeine, Artichoke Extract, DMAE) was superior to phosphatidylcholine and caffeine.

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