The effect of a cryotherapy gel in localized adiposity in young women

O efeito do gel crioterápico na adiposidade localizada em mulheres jovens

Aline Fernanda Perez Machado[1,2], Mariana Veras Grieco de Carvalho[1], Daniel Antunes Alveno[3], Ivaldo Esteves Júnior[2], Pascale Mutti Tacani[1,4], Rogério Eduardo Tacani[1,4], Richard Eloin Liebano[1,2]

[1]Post Graduation Program in Physiotherapy Dermatho-functional, University of São Paulo City, São Paulo-SP, Brazil; [2]Physiotherapy School, University Paulista, São Paulo-SP, Brazil; [3]Physiotherapy Department, Mario Schenberg University, Cotia-SP, Brazil; [4]Physiotherapy Department, São Camilo University Center, São Paulo-SP, Brazil.

Abstract

Objective – The aim of this study was to verify the effects of cryotherapy with a camphor and menthol gel, used isolatedly, on the body composition, fat percentage and body self-image in young women. **Methods** – Third six women, with mean age: 21 years old, with mean body mass index: 22,92 kg/m^2 and having localized android and/or gynecoid adiposities, were selected. Volunteers were randomly divided into two groups: the one which went through treatment (Treatment Group = 20) and the one that did not (Control Group = 16). Several procedures, such as anamnesis, physical exam and body composition evaluation through the tetrapolar bioelectric impedance and the anthropometric technique, body self-image scale applied. **Results** – According to the results achieved, cryotherapy was ineffective, as the body mass and the body mass index kept unchanged and the body perimeter measures (except the arm measure) and the cutaneous folds (except the axillary fold) did not decrease. **Conclusions** – This study conclusion was that cryotherapy with a camphor and menthol gel, used isolatedly, decreased medial axillary, pectoral and abdominal skinfold and arm body perimeter measure, but did not change significantly the others body perimeter measures, fat percentage and body self-image in young women.

Descriptors: Cryotherapy; Adiposity; Evaluation; Body mass index

Resumo

Objetivo – Verificar o efeito da crioterapia com gel à base de cânfora e mentol, usada isoladamente, na composição corporal, porcentagem de gordura e autoimagem corporal em mulheres jovens. **Métodos** – Foram selecionadas 36 mulheres, com média de idade de 21 anos, média do índice de massa corporal de 22,92 kg/m^2, portadoras de adiposidades localizadas de características andróide e/ou ginóide. As voluntárias foram divididas randomicamente entre dois grupos: o que realizou o tratamento (Grupo Tratamento = 20) e o que não realizou o tratamento (Grupo Controle = 16). Foram realizados anamnese, exame físico e avaliação da composição corporal por meio da impedância bioelétrica tetrapolar e da técnica antropométrica, e assim pode-se obter a porcentagem de gordura e foi aplicada uma escala de autoimagem corporal. **Resultados** – De acordo com os resultados obtidos, observou-se que a aplicação de gel crioterápico foi ineficaz na modificação da massa e índice de massa corporal, na diminuição das perimetrias (exceto a de braço); e na redução das dobras cutâneas (exceto a dobra cutânea axilar). **Conclusões** – Conclui-se que a crioterapia à base de cânfora e mentol, utilizada isoladamente, diminuiu as dobras cutâneas axilar média, peitoral e abdominal e a perimetria de braço, porém não modificou os valores das outras perimetrias, porcentagem de gordura e escala de autoimagem corporal.

Descritores: Crioterapia; Adiposidade; Avaliação; Índice de massa corporal

Introduction

Localized adiposity is a condition characterized by the increase in thickness and in consistency of the subcutaneous adipose tissue in certain parts of the body[1].

In women, fat usually accumulates in the lower part of their bodies, and that is called a gynecoid distribution. When the fat deposit occurs predominantly in the upper part of their bodies, it is an android distribution, which is more associated with the male gender[2-4].

Currently, in the search for a social aesthetic standard, the number of women who turns to these therapies, hoping to minimize the dysfunctions of the somatic characteristics of fat distribution has increased; however, they are not aware of the real risks they are taking in order to achieve this goal[5-6].

The typical treatment for localized adiposities is the surgical fat removal through liposuction[6-8]. However, in spite of being a safe procedure if carried out by a well-trained surgeon, operating in an environment adequate to this type of surgery, it is not free of risks (severe or mild ones), which can occur in any kind of surgery[6-9].

Cryotherapy is a comprehensive term which refers to many cold application techniques which result in the decrease of tissue temperature[10]. The body temperature is controlled through the balance between heat production and heat loss[11]. The thermoregulator center of the body is located in the hypothalamus. Therefore, when the skin of the whole body becomes cold, immediate reflex effects occur and start to raise the body temperature in many ways: they provoke an intense stimulus to produce chills, inhibit sudoresis and promote skin vasoconstriction[12-13].

Lesser *et al.*[8] (1999), Guirro and Guirro[14] (2002) and Bacelar *et al.*[13] (2005) affirm that the use of a cryotherapy gel with a camphor and menthol is restricted due to the absence of scientific literature about its specific applications which corroborates its real results and its efficacy.

This study aimed to verify the effects of cryotherapy with a camphor and menthol gel, used isolatedly, on the body composition, fat percentage and body self-image in young women.

Methods

Thirty-six women with ages varying from 18 to 29 years old, with body mass index (BMI) between 18.5 kg/m^2 and 29.9 kg/m^2 and having localized android and/or gy-

necoid adiposities, were selected. Volunteers were randomly divided into two groups: the one which went through treatment (Treatment group; TG = 20) and the one that did not (Control group; CG = 16).

This project was approved by the local Ethics Committee of University of São Paulo City (UNICID). All volunteers signed a consent term to participate in the study.

Volunteers were submitted to pre- and post-treatment evaluations. The pretreatment evaluation consisted of anamnesis, physical exam and body composition analysis through doubly indirect methods: the tetrapolar bioelectric impedance (TBI) and the anthropometric technique. This way, it was possible to determine the fat percentage (%F) and a body self-image scale described by Kakeshita and Almeida[15] (2006) was applied. The anthropometric evaluation procedures were the following: body perimeter measurement; seven skinfolds; body density estimate; body fat percentage. The post-treatment evaluation was composed of the same items of the pretreatment evaluation; besides, possible changes in the subjects' physical activity level, life habits and menstrual cycle were investigated.

Evaluations were carried out by a blind assessor in a temperature-controlled laboratory (22ºC).

The exclusion criteria were the following: sensitivity to any component of the gel formula; cutaneous wounds and lesions; Raynaud´s disease or other vasospastic diseases; circulatory, cardiac, gastric and/or dermatologic disorders; superficial sensitivity alterations; cold hypersensitivity; pregnancy[8], women in treatment for weight loss and/or aesthetic and postoperative period less than six months.

Volunteers underwent to an average of 8,45 applications, three or four times a week, with a one- or two-day interval between the applications. The post-treatment evaluation always occurred on the day subsequent to the last application.

The treatment consisted of the application of a thin layer of gel (carbomer, glycerin, triethanolamine, phenoxyethanol/methyldibromoglutaronitrile, alcohol, camphor, menthol, menthe piperita extract, zingiber officinale extract, cinnamomum zeylanicum extract, CI 42090 1%, water)[16], on the body perimeter (after the skin had been cleaned and dried) from the xiphisternum to the supramalleolar region of the ankles, from the proximal to the distal portion. Volunteers wore bathing suits with two parts. Afterwards, they could choose to remain in supine on a plinth or in a sitting or orthostatic position for 30 minutes.

The gel was removed by the volunteers themselves with a dry towel or absorbent paper. Shortly after that, a body hydration lotion was applied. All volunteers were oriented about the need of not taking a shower during the two hours subsequent to the gel removal, in order to avoid possible unpleasant sensations.

To verify if there were any differences between the TG's pretreatment and post-treatment measures and differences between the CG's pretreatment and post-treatment measures, Paired T test or Wilcoxon's test was applied. The level of significance adopted for the statistical tests was $p < 0.05$.

Results

Mean age in both groups was 21 years old. Adiposities were classified according to their consistency and biotype. As to their consistency, in the TG 10% (n = 2) were compact and 90% (n = 18) were flaccid; in the CG, 100% were flaccid. In relation to the TG's adiposity biotype, 10% (n = 2) were android (Figure 1), 65% (n = 13) gynecoid (Figure 2) and 25% (n = 5) mixed; in the CG, 6% (n = 1) were android, 69% (n = 11) gynecoid and 25% (n = 4) mixed. In the post-treatment, no changes in both groups as to the adiposity characteristics were found.

Figure 1. The volunteer has localized android adiposity
Figure 2. The volunteer has localized gynecoid adiposity

The Table 1 shows the means, standard deviations (SD) and level of significance pre- and post-treatment of the TG.

The Table 2 shows the means, SD and level of significance pre- and post-treatment of the CG.

The TG's mass in the pre- was 59.18 (± 6.98) kg and in the post-treatment it was 59.15 (± 6.76) kg; the CG's mass in the pretreatment was 56.11(± 4.14) kg and in the post-treatment it was 56.43 (± 4,37) kg. Therefore, the TG's BMI remained 22.92 (± 2.67 in the pre- and ± 2.61 in the post-treatment) kg/cm^2; in the CG, it increased from 20.62 kg/cm^2 in the pretreatment to 20.73 kg/cm^2 in the post-treatment (± 1.12 and ± 1.16, respectively); in both groups, no significant alteration was observed.

Concerning the TBI evaluation, the TG had a significant increase in the fat percentage ($p< 0.001$) and in the fat weight ($p< 0.001$) and a reduction in the lean mass weight ($p = 0.004$). The CG did not demonstrate statistically important changes.

The arm perimeter measure in the TG presented a statistically significant reduction ($p = 0.001$), while the others did not show considerable alterations. In the CG, all the body perimeter measures increased, being the following ones statistically important: waist ($p = 0.015$), abdomen at the level of the xiphoid process ($p = 0.018$), medial ($p = 0.018$) and distal thigh ($p = 0.009$).

All the TG's skinfold had a significant reduction, except the TG's suprailiac one. All the CG's skinfold decreased considerably, except the suprailiac and the axillary ones.

The fat percentage diminished significantly both in the TG and in the CG ($p< 0.001$ and $p = 0.001$, respectively).

Regarding the body self-image scale, no statistically meaningful alterations in both groups ($p = 0.331$ in the TG; $p = 0.058$ in the CG) were detected.

Table 1. Pre- and post-treatment data in the TG (Mean ± SD)

Data	TG (n = 20)				P
	Pre		Post		
	Mean	±SD	Mean	±SD	
Mass (kg)	59.18	6.97	59.15	6.76	0.556 [b]
BMI (kg/m^2)	22.92	2.67	22.92	2.61	0.679 [b]
TBI					
%F	27.71	4.10	30.33	4.22	<0.001* [a]
FW	16.56	3.92	18.22	4.29	<0.001* [b]
LMW	42.65	4.10	41.43	4.85	0.004* [b]
Body perimeter measures					
Arm	26.73	2.22	26.24	1.98	0.001* [a]
Waist	71.66	6.69	71.37	6.60	0.446 [b]
Hip	98.82	5.45	99.54	5.78	0.059 [a]
Abdomen at the level of the xiphoid process	78.22	7.26	78.29	7.19	0.955 [b]
Abdomen at the level of the umbilicus	80.02	7.86	80.13	7.85	0.494 [b]
Abdomen at the level of the SIAS	87.49	6.69	87.72	6.58	0.602 [a]
Proximal thigh	57.64	4.63	57.39	4.31	0.162 [a]
Medial thigh	51.56	3.97	52.22	4.13	0.150 [a]
Distal thigh	38.55	2.33	38.59	2.20	0.871 [a]
Cutaneous folds					
Tricipital	28.78	6.42	25.49	6.68	0.002* [b]
Subscapular	28.23	11.61	24.21	9.95	<0.001* [b]
Medial axillary	20.80	11.49	15.34	8.05	<0.001* [b]
Pectoral	15.04	6.12	13.11	5.53	0.042* [a]
Suprailiac	24.10	9.46	23.51	9.63	0.351 [b]
Abdominal	31.51	9.04	29.73	8.01	0.003* [b]
Femoral	41.90	8.78	38.44	7.10	0.001* [a]
%F	32.07	5.90	29.78	5.72	<0.001* [a]
Body self-image scale	5.95	1.61	5.75	1.48	0.331 [b]

Legend: BMI = body mass index; TBI = tetrapolar bioelectric impedance; %F = fat percentage; FW = fat weight; LM = lean mass weight
* indicates difference statistically significant; a = Paired T test; b = Wilcoxon's Test

Table 2. Pre- and post-treatment data in the CG (Mean ± SD)

Data	CG (n = 16)				P
	Pre		Post		
	Mean	±SD	Mean	±SD	
Mass (kg)	56.11	4.14	56.43	4.37	0.094 [a]
BMI (kg/m^2)	20.62	1.12	20.73	1.16	0.679 [b]
TBI					
%F	25.72	3.27	25.51	2.34	0.532 [b]
FW	14.48	2.17	15.06	3.71	0.326 [b]
LMW	41.71	3.44	42.04	3.47	0.875 [b]
Body perimeter measures					
Arm	22.10	2.97	25.57	1.74	0.196 [b]
Waist	66.85	2.25	67.55	2.76	0.015* [a]
Hip	96.31	4.06	97.05	9.73	0.052 [b]
Abdomen at the level of the xiphoid process	74.71	3.48	75.47	2.87	0.018* [a]
Abdomen at the level of the umbilicus	76.14	5.61	76.24	4.58	0.882 [a]
Abdomen at the level of the SIAS	84.69	3.12	85.18	3.25	0.423 [a]
Proximal thigh	55.65	2.93	51.41	2.85	0.570 [b]
Medial thigh	49.58	2.89	50.84	2.84	0.018* [a]
Distal thigh	37.43	2.01	38.06	1.85	0.009* [a]
Cutaneous folds					
Tricipital	21.84	5.79	19.85	6.15	0.006* [a]
Subscapular	19.25	5.81	16.86	5.64	0.021* [a]
Medial axillary	12.47	4.10	12.26	4.29	0.560 [a]
Pectoral	11.43	3.59	12.43	3.91	0.092 [a]
Suprailiac	20.70	7.78	19.73	6.00	0.756 [b]
Abdominal	26.13	6.77	23.13	7.06	0.002* [a]
Femoral	35.78	8.55	33.73	8.76	0.028* [a]
%F	27.01	4.88	25.66	5.29	0.001* [a]
Body self-image scale	5.06	1.84	4.69	2.02	0.058 [b]

Legend: BMI = body mass index; TBI = tetrapolar bioelectric impedance; %F = fat percentage; FW = fat weight; LMW = lean mass weight * statistically significant
* indicates difference statistically significant; a= Paired T test; b= Wilcoxon's Test

Discussion

According to the analysis of the data gathered by BMI there was no statistically significant change in both groups. The mean BMI was around 20kg/m^2, classified as normal[17]. However, Camargo and Pires-de-Campos[18] (2010) verified in their study that used cryotherapy gel associated with wet bandages in men, increased basal metabolic rate in individuals of normal BMI, measured by ergoespirometric analysis.

The TBI's data in the TG there was a significant increase in the fat percentage and the fat weight and a substantial reduction in the lean mass weight. The values obtained in the CG were controversial as there was a decrease in the fat percentage and the fat weight and an increase in the lean mass weight; none of them was statistically significant. As per the comparison between the TG's and the CG's pretreatment evaluations, these groups did not present statistical differences in either of these data. In the post-treatment, statistical differences in the fat percentage and the fat weight due to an increase in the TG and a reduction in the CG were observed.

An orientation protocol[19] must be explained to the individuals who will be submitted assessment with TBI, so that results to be trustworthy. Therefore, the TBI data may not be reliable, as we do not know if all the guidelines for the application of this method were followed.

The anthropometric technique has been used worldwide, for being a quick, cheap and trustworthy procedure and for comprising non-invasive measures applicable to several groups[20-24].

In relation to the TG, the only body perimeter measure that presented a statistically significant reduction was the arm perimeter measure. However, in the CG, all the body perimeter measures increased; the measures of waist, medial and distal thighs and abdomen at the level of the xiphoid process rose significantly. It was possible to conclude that the CG demonstrated increase in some body perimeter measures when compared with the TG, then suggests that the GT was effective to unchanged the waist, abdomen at the level of the xiphoid process, medial and distal thigh perimeter measures.

In the TG, a statistically significant reduction was observed in all skinfold, except in the suprailiac one. In the CG, two of the seven skinfold measured (the suprailiac and the axillary ones) did not present a statistically substantial decrease. In the CG, the medial axillary skinfold did not alter, while in the TG they had a statistically meaningful diminishment. In the CG, the pectoral skinfold increased, while in the TG they decreased. Therefore, the skinfold, mainly the medial axillary and the pectoral ones, improved exclusively in the TG after cryotherapy gel.

In this study, the body composition evaluation comprised doubly indirect methods. To quantify the body fat with the least possible margin of error, there are different developed and validated techniques. Hydrostatic weight measurement, double energy X-ray absorptiometry and plethysmography are considered indirect evaluation methods, being the hydrostatic weight measurement the golden body composition evaluation[19,25].

Tacani and Pancelli[21] (2004) investigated modifications in the subcutaneous fatty tissue of young women. Fourteen sedentary women having localized android and/or gynecoid adiposities were selected. In accordance with a cryotherapy gel protocol, a gel was applied in the subjects' abdominal region, in association with wet bandages, and maintained for forty minutes, in twelve sessions, three times a week, in a laboratory with temperature between 17ºC and 22ºC. Significant reductions of the body mass index and the body perimeter measures in all the regions analyzed were observed. A considerable diminishment of the subcutaneous adipose tissue occurred, as demonstrated by ultrasonography, in diverse points previously determined in the abdomen and thighs and, as shown by the skinfold, in the tricipital. Through the TBI, the fatty mass presented an insignificant decrease.

In a study developed by Meyer *et al.*[22] (2003), volunteers were submitted to fifteen cryotherapy gel sessions in which a package with 900g of ground ice, wrapped in a bandage, was placed and maintained in the abdominal region for thirty minutes. According to the techniques performed, which included skinfold, body perimeter measurement, ultrasonography ($p<0.08$) and tetrapolar bioelectric impedance ($p<0.56$), there was not a very significant reduction in the subjects' measures.

Pires-de-Campos *et al.*[23] (2000) carried out a study with the objective of evaluating the action of the cryotherapy gel followed by wet bandages on the stimulation of lipolysis. Five volunteers were selected and submitted to physical and photographic assessment, skinfold, tetrapolar bioelectric impedance and ultrasonography in the pretreatment and post-treatment evaluations. The study conclusion was that cryotherapy gel was efficient in the reduction of localized adiposity, but wasn't compared with the control group.

Therefore, in the studies aforementioned, a protocol including the use of cryotherapy gel associated with wet bandages was adopted. The results were significant and efficient in the reduction of localized adiposity. When compared with the present study, more significant diminishments were observed, suggesting that the protocol that comprises wet bandages is more effective.

In this study, one of the observed groups underwent treatment and the other didn't; nevertheless in none of the quoted studies there was a comparison group with the same profile.

In summary, the results found in this study observed that in the TG there was no change in body perimeter measures in the waist and abdomen at the level of the xiphoid process. The medial axillary, pectoral and abdominal skinfolds decreased, being the subjects women with localized gynecoid adiposity.

These findings denote that the localized android adiposity is more susceptible to lipolysis, because the adiposities are more responsive to lipolysis hormones, besides having pre-domain of ß-adrenergic receptors responsible for activation of lipolysis[3,24]. Thus, observing the lipolysis behavior in this region, it was expected that the volunteers had a reduction of measured values more easily in the upper body.

Moreover, the observed reduction in the medial axillary and pectoral skinfolds proves the systemic effect of cryotherapy gel, as these regions were not included in this protocol.

The results of this study may have been influenced by to the room temperature, as, during this project, there were large variations between the mean environment temperature and the mean laboratory temperature, corresponding to 19.28 ºC (± 3.27) and 23.5 ºC (± 2.30), respectively. However, good results have been observed with the laboratory temperature controlled and maintained artificially around 22º to 24°C[18].

Therefore, the protocol adopted in this study may have been partially efficient in the reduction of localized adiposity due to an inadequate environment temperature control and due to the fact that the protocol including the wet bandages (which seems to be more effective) was not followed.

We suggest further studies similar to this one, but involving a comparison between cryotherapy gel with wet bandages and cryotherapy gel without them, in order to verify if the results will resemble those of this study.

Conclusion

This study conclusion was that cryotherapy with a camphor and menthol gel, used isolatedly, decreased medial axillary, pectoral and abdominal skinfold and arm body perimeter measure, but did not change significantly the others body perimeter measures, fat percentage and body self-image in young women.

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Corresponding author:
Aline Fernanda Perez Machado
Clínica de Fisioterapia - Universidade Cidade de São Paulo
Rua Melo Peixoto, nº 448/475 - Tatuapé
São Paulo-SP, CEP 03071-000
Brazil

E-mail: lifpm@yahoo.com.br

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