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Dehydroepiandrosterone Behavior and Lipid Profile in Non-Obese Women undergoing Abdominoplasty

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Background: The aim of this study was to determine any change in dehydroepiandrosterone (DHEA) and lipid profile in non-obese women after abdominoplasty.

Methods: An auto-controlled clinical trial was carried out. 9 women aged 35 to 40 years with BMI 22-25 kg/m^2 were studied. Basal lipid profile and DHEA were performed and repeated 1 month postoperatively. Statistical analysis used Wilcoxon signed-ranks test (two-tailed).

Results: Weight of resected specimen was 606.11 ± 143.4 grams. No significant changes were observed in high-density cholesterol (48.0 ± 9.6 vs 48.8 ± 11.0 mg/dl; *P*=0.106) or in triglycerides (119.2 ± 50.9 vs 148.4 ± 45.8 mg/dl; *P*= 0.139). Significant increases were obtained in DHEA (3.69 ± 3.05 vs 11.09 ± 6.3 ng/ml; *P*<0.008), low-density cholesterol (LDL) (87.4 ± 23.5 vs 108.5 ± 28.3 mg/dl; *P*<0.008 and total cholesterol (155.1 ± 30.6 vs 186.6 ± 33.1 mg/dl; *P*<0.008).

Conclusion: Excision of subcutaneous abdominal fat in studies 1 month later increased DHEA, whose role is controversial in visceral fat distribution, and increased LDL cholesterol and total cholesterol, both risk markers for cardiovascular illness.

Key words: Dehydroepiandrosterone, abdominoplasty, risk markers, cardiovascular disease

Introduction

Cosmetic surgery and especially abdominal subcutaneous fat excision by abdominoplasty is frequently performed. It has been estimated that in the last 7 years, abdominoplasty has increased by 344%.[1] The metabolic effect of removing subcutaneous fat is controversial and has been evaluated for its effects on insulin resistance, lipid profile and cytokines.

In the hamster, removing >50% of subcutaneous fat leads to hypertriglyceridemia, increase of intra-abdominal adipose tissue and insulin resistance.[2] However, in the Zucker rat, which is an ideal model for the study of obesity and diabetes mellitus, there was no modification in serum glucose or insulin levels after excision of 10% of subcutaneous fat. There was, however, a significant improvement in lipid profile with a decrease in total cholesterol persisting for 15 weeks and a significant decrease of triglycerides persisting for 24 weeks postoperatively.[3]

In humans, the effect of excision of subcutaneous abdominal fat is controversial, with contradictory results. Some reports demonstrate improvement in lipid profile and insulin sensitivity.[4-6] However, there are other reports that show no beneficial effects after liposuction.[7]

The effect of surgical removal of subcutaneous adipose tissue on dehydroepiandrosterone (DHEA) levels has not been reported. There is only one study reporting that after liposuction there are no modifications in DHEA levels.[8]

Materials and Methods

This study was carried out in the Jalisco Reconstructive Surgery Institute "Dr. Jose Guerrero Santos" in Mexico. We included nine women who

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were seen for plastic surgery consultation for abdominoplasty. The patients were candidates for abdominoplasty according to the Matarasso classification.[1] All patients were classified as Matarasso III–IV. Patients had no history of smoking or evidence of chronic illness. All subjects signed informed consent. Patient characteristics were evaluated at baseline and again 30 days after abdominoplasty. These included vital signs and clinic characteristics such as weight, height and body mass index (BMI, kg/m^2). All tests were carried out after a 12-h overnight fast. Whole blood was obtained and centrifuged to obtain serum to determine lipid profile including total cholesterol, high-density cholesterol (HDL), low-density cholesterol (LDL) and triglycerides, which were performed with the enzymatic colorimetric assay as well as DHEA concentrations performed with radioimmunoassay. After this, abdominoplasty with lipectomy was performed, and after a 30-day follow-up period, lipid profile and DHEA were performed.

Statistical analysis was performed with Wilcoxon test; $P<0.05$ was considered statistically significant.

Results

BMI was not modified after the surgical procedure (25.3 ± 2 vs 25.1 ± 2 kg/m^2), and blood pressure was not changed (115/70 vs. 110/70 mmHg).

The amount of fat obtained (in grams) was 606.11 ± 143.4. There were no significant changes in high-density cholesterol (mg/dl) (48.0 ± 9.6 vs 48.8 ± 11.0; $P=0.106$) or in triglycerides (mg/dl) (119.2 ± 50.9 vs 148.4 ± 45.8; $P= 0.139$) (Table 1). A significant increase was obtained in DHEA ng/ml (3.69 ± 3.05 vs 11.09 ± 6.3; $P<0.008$) (Figure 1), total cholesterol (mg/dl) (155.1 ± 30.6 vs 186.6 ± 33.1; $P<0.008$) (Figure 2) and low-density cholesterol (LDL) (mg/dl) (87.4 ± 23.5 vs 108.5 ± 28.3; $P<0.008$) (Figure 3).

Discussion

A significant increase in DHEA was observed after abdominoplasty. These results differ from those reported by Giese et al[8] in which no modifications in the concentrations of DHEA were found after liposuction.

Table 1. Metabolic profile

	Before	After	*P**
Total cholesterol (mg/dl)	155.1 ± 30.6	186.6 ± 33.1	0.008
HDL cholesterol (mg/dl)	48.0 ± 9.6	48.8 ± 11.0	n/s
LDL cholesterol (mg/dl)	87.4 ± 23.5	108.5 ± 28.3	0.008
Triglycerides (mg/dl)	119.2 ± 50.9	148.4 ± 45.8	n/s
DHEA (ng/ml)	3.69 ± 3.05	11.09 ± 6.3	0.008

*Wilcoxon test. n/s, not significant.
DHEA, dehydroxyepiandrosterone.

DHEA has been studied because it acts directly on fat tissue and metabolism. In an *in vivo* study by biopsy of subcutaneous and visceral fat, a higher concentration of DHEA was demonstrated in visceral fat than in subcutaneous fat.[9]

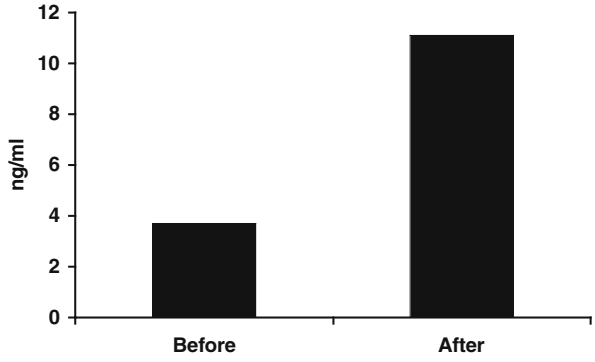

Figure 1. Dehydroxyepiandrosterone behavior in abdominioplasty.

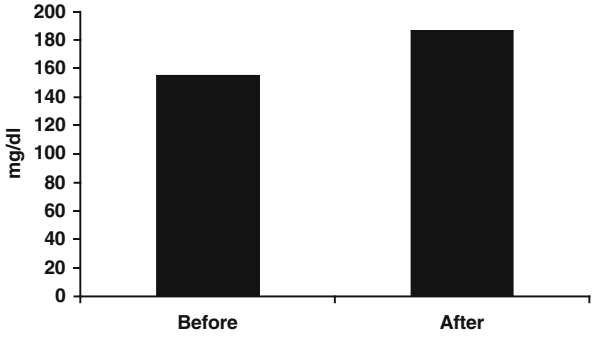

Figure 2. Total cholesterol in abdominoplasty.

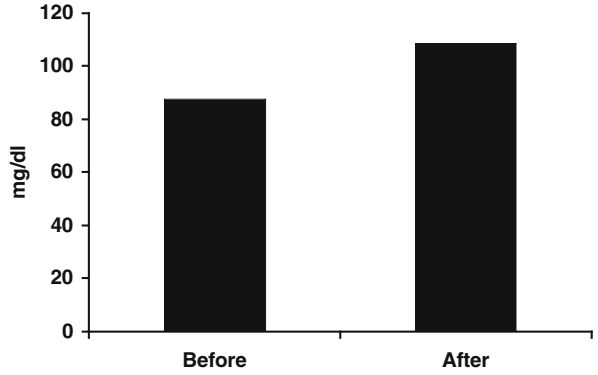

Figure 3. LDL cholesterol in abdominoplasty.

Effects of DHEA in fat distribution and proliferation have been studied. It was observed that in cell cultures of the vascular stroma of pigs, as in humans, DHEA produces attenuation in preadipocyte proliferation.[10] It has been proposed that DHEA may have an impact over the transcription of the resistin gene by a mechanism where the peroxisome proliferator-activated receptor (PPARγ) is involved and the resistin increase can lead to inhibition of adipogenesis and a lower fat mass.[11] It is interesting to note the positive effect of DHEA over the expression of the adiponectin gene by increasing the expression of the peroxisome proliferator-activated receptor (PPARγ). In this way, insulin sensitivity is increased at the hepatic level.[12] DHEA has been demonstrated to have beneficial effects in glucose metabolism, because it increases glucose uptake in humans and in 3T3-L1 adipocytes by stimulating GLUT4.[13]

A beneficial effect was demonstrated on insulin sensitivity and a reduction of both subcutaneous and visceral fat after the oral administration of 50 mg/day of DHEA.[14]

Similar effects have been demonstrated with DHEA pomade, where in a study 15 postmenopausal women were included and applied DHEA pomade daily for 12 months. Adiposity was measured and decreased 9.8%, but this adiposity was regained 3 months after treatment suspension. A significant decrease of glucose was also demonstrated.[15]

Other authors encountered an inverse correlation utilizing ultrasound and measuring DHEA concentrations: the higher the DHEA concentration, the lower the amount of visceral fat.[16] In relation to the increase of the total cholesterol and LDL cholesterol, our results were similar to those previously reported in another patient series in which after subcutaneous fat excision by means of liposuction of 4.3 L and a postoperative time of 27 weeks, we observed a slight increase in total cholesterol, LDL, HDL, triglycerides and HDL/cholesterol relation.[17] Nevertheless, other series report a decrease in lipid profile after liposuction and lipectomy.[18-20] In another report, no modifications were found in total cholesterol, high-density cholesterol and triglycerides 4 months after liposuction.[8]

A possible explanation for the C-LDL elevation after lipectomy may be due to an acute decrease in subcutaneous fat with a proportional increase of visceral fat, which is associated with metabolic detriment. The duration of our survey was 1 month, and it would be interesting to determine the metabolic effect of lipectomy after a longer period, eg. 6 months. We determined DHEA 30 days after lipectomy in order to avoid the bias of the metabolic response to surgical stress. In a previous study with a group of postmenopausal patients undergoing cholecystectomy or mastectomy, a slight increase in DHEA was demonstrated preoperatively and returned to basal concentrations postoperatively.[21] In another investigation in patients undergoing aortic abdominal surgery, DHEA showed a slight increment on postoperative day 8 and later returned to basal preoperative concentrations.[22]

It would be interesting if the DHEA increase lasted for a longer period of time, because this hormone is associated with an increment in adiponectin and also with an improvement in insulin sensitivity.

In conclusion, subcutaneous fat excision increases DHEA, which plays an important role in decreasing visceral fat and increasing insulin sensitivity. Both are beneficial in preventing the development of metabolic syndrome. Nevertheless, the effect of lipectomy on lipid profile is controversial. Future investigations are necessary in relation to subcutaneous fat function as an independent marker of visceral fat in development of metabolic syndrome.

References

1. Matarasso A, Swift RW, Rankin M. Abdominoplasty and abdominal contour surgery: a national plastic sur-

gery survey. Plast Reconstr Surg 2006; 117: 1797-808.
2. Weber RV, Buckley MC, Fried SK et al. Subcutaneous lipectomy causes a metabolic syndrome in hamsters. Am J Physiol Regul Integr Comp Physiol 2000; 279: R936-43.
3. Liszka TG, Dellon AL, Im M et al. Effect of lipectomy on growth and development of hyperinsulinemia and hyperlipidemia in the Zucker rat. Plast Reconstr Surg 1998; 102: 1122-7.
4. González-Ortiz M, Robles-Cervantes JA, Cárdenas-Camarena L et al. The effects of surgically removing subcutaneous fat on the metabolic profile and insulin sensitivity in obese women after large-volume liposuction treatment. Horm Metab Res 2002; 34: 446-9.
5. Giugliano G, Nocoletti G, Grella E et al. Effect of liposuction on insulin resistance and vascular inflammatory markers in obese women. Br J Plast Surg 2004; 57: 190-4.
6. Rizzo MR, Paolisso G, Grella R et al. Is dermolipectomy effective in improving insulin action and lowering inflammatory markers in obese women? Clin Endocrinol 2005; 63: 253-8.
7. Klein S, Fontana L, Young VL et al. Absence of an effect of liposuction on insulin action and risk factors for coronary heart disease. N Engl J Med 2004; 17;350: 2549-57.
8. Giese SY, Bulan EJ, Commons GW et al. Improvements in cardiovascular risk profile with large-volume liposuction: a pilot study. Plast Reconstr Surg 2001; 108: 510-9.
9. Belanger C, Hould FS, Lebel S et al. Omental and subcutaneous adipose tissue steroid levels in obese men. Steroids 2006; 71: 674-82.
10. McIntosh MK, Lea-Currie YR, Geigerman C et al. Dehydroepiandrosterone alters the growth of stromal vascular cells from human adipose tissue. Int J Obes 1999; 23: 595-602.
11. Kochan Z, Karbowska J. Dehydroepiandrosterone upregulates resistin gene expression in white adipose tissue. Mol Cell Endocrinol 2004; 218: 57-64.
12. Karbowska J, Kochan Z. Effect of DHEA on endocrine functions of adipose tissue, the involvement of PPAR gamma. Biochem Pharmacol 2005; 70: 249-57.
13. Perrini S, Natalicchio A, Laviola L et al. Dehydroepiandrosterone stimulates glucose uptake in human and murine adipocytes by inducing GLUT 1 and GLUT 4 translocation to the plasma membrane. Diabetes 2004; 53: 41-52.
14. Villarreal DT, John OH. Effect of DHEA on abdominal fat and insulin action in elderly women and men. JAMA 2004; 18: 2243-48.
15. Diamond P, Cusan L, Gómez JL et al. Metabolic effects of 12-month percutaneous dehydroepiandrosterone replacement therapy in postmenopausal women. J Endocrinol 1996; 150: S43-S50.
16. De Pergola G, Triggiani V, Giorgino F et al. The free testosterone to dehydroepiandrosterone sulphate molar ratio as a marker of visceral fat accumulation in premenopausal obese women. Int J Obes 1994; 18: 659-64.
17. Mentz HA. Changes in diet, excercise, weight, and serum lipids following liposuction. Semin Plastic Surg 2002; 16: 183-5.
18. Robles-Cervantes JA, Yáñez-Díaz S, Cárdenas-Camarena L. Modification of insulin, glucose and cholesterol levels in nonobese women undergoing liposuction: is liposuction metabolically safe? Ann Plast Surg 2004; 52: 64-7.
19. Cazes L, Deitel M, Levine RH. Effect of abdominal lipectomy on lipid profile, glucose handling and blood-pressure in patients with truncal obesity. Obes Surg 1996; 6: 159-66.
20. Hong YG, Kim HT, Seo SW et al. Impact of large-volume liposuction on serum lipids in orientals: a pilot study. Aesthetic Plast Surg 2006; 30: 327-32.
21. Adami HO, Axelsson O, Carlstrom K et al. Serum levels of cortisol dehydroepiandrosterone, dehydroepiandrosterone sulphate, estrone and prolactin after surgical trauma in postmenopausal women. Ups J Med Sci 1982; 87: 201-13.
22. Lindh A, Carlstrom K, Eklund J et al. Serum steroids and prolactin during and after major surgical trauma. Acta Anaesthesiol Scand 1992; 36: 119-24.

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