EFFICACY OF ELECTRICAL AND THERMOGENIC STIMULATION ON WEIGHT REDUCTION AMONG OBESE FEMALES

by

NICK MENTZ

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The epidemic of obesity and inactivity is just as deadly –
if not more so – than any virus, but it receives less
attention because it acts slowly and because we
have adjusted to its presence among us.

Like infectious disease epidemics, this epidemic can
be stopped in its tracks – not with a vaccine,
but with a formula of healthier eating and
more activity that is well within our reach.
(Koplan, 2000)

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THE ALMIGHTY: In Him everything is possible.

SYNOPSIS

TITLE	:	Efficacy of Electrical and Thermogenic Stimulation on Weight Reduction among Obese Females
CANDIDATE	:	N. W. Mentz
PROMOTOR	:	Dr H.J. van Heerden
DEGREE	:	D.Phil

The primary aim of this study was to evaluate the effect of an eight-week programme of electrical muscle stimulation (EMS) performed on Slimline Slimming Machines in conjunction with (Group EST), and without (Group ESP), a thermogenic agent (Thermo Lean) and following a standardized diet (Group TS). In order to achieve this goal a pre-test-post test experimental groups design, with three levels of the independent variable, was adopted for the study. A group of 69 females between the ages of 25 - 40 years (mean age = 35.26 ± 6.02 years), who were recruited through newspaper advertisements, served as subjects. To be included in the study, subjects were required to be physically suitable for the intervention programmes; pre-menopausal; obese (BMI > 30); sedentary; and amenable to being assigned to any of three study groups. The following categories of dependent variables were measured: Anthropometry; Morphology; Ultrasound Sonography; Respiratory Quotient; Pulmonary Function; Haematology; Cardiovascular Responses; and Musculoskeletal Function.

There was a statistically significant difference between groups ($p \leq 0,05$) in the reduction of abdominal body girths measured at three different body sites viz. abdominal (level of greatest anterior protrusion); abdominal AB-1 (midway between the xyphoid process and the umbilicus); and abdominal AB-2 (level of the umbilicus). Group EST (6.02%) had the greatest reduction in girth at the abdominal body site. This reduction was significantly ($p \leq 0,05$) better than the reduction found in group ESP (4.79%) and group TS (4.69%). The same tendency was found at the abdominal AB-1 body site. Group EST (6.42%) had the greatest reduction in girth which was significantly ($p \leq 0,05$) better than the reduction found in group TS (4.35%) and group ESP (4.28%). Group ESP had the greatest reduction in girth at

the umbilicus level (7.39%). This reduction was significantly ($p \leq 0,05$) better than the reduction found in group TS (4.85%).

The greatest reduction of skinfold measurements was found at the tricep skinfold. Group EST had the greatest reduction (12.75%). This reduction was significantly ($p \leq 0,05$) better than the reduction found in both groups TS (9.27%) and ESP (6.63%). The second greatest reduction in skinfolds was found at the abdominal skinfold. Group EST had the greatest reduction (12.14%). This reduction was significantly ($p \leq 0,05$) better than the reduction found in both groups TS (11.80%) and ESP (10.36%). The third greatest skinfold reduction was found at the subscapular skinfold. Group EST had the greatest reduction (9.70%). This reduction was significantly ($p \leq 0,05$) better than the reduction found in both groups TS (8.64%) and ESP (3.93%). The observed significantly ($p \leq 0,05$) greater reduction in skinfold measurement at the abdominal site in group EST corresponded with the same significantly ($p \leq 0,05$) greater reduction in girth measurements at the abdominal body sites in the same group.

Whith respect to saggital height measurements, at the umbilicus body site (saggital umbi), group ESP (11.48%) had the greatest reduction. This reduction was similar to the reduction found in group EST (11.02%). At the saggital ½ umbi body site, group EST (13.52%) had the greatest reduction in saggital height. This reduction was significantly ($p \leq 0,05$) greater than that found in both groups ESP (10.61%) and TS (10.60%). This significantly ($p \leq 0,05$) greater reduction in saggital height at the saggital ½ umbi body site in group EST, corresponds with the significant ($p \leq 0,05$) decreases found in body girths and skinfolds in the same group.

A significantly reduced ($p \leq 0,05$) waist-to-hip ratio (WHR) was observed within two of the three experimental groups. The greatest reduction was found in group EST (2.53%) and this reduction was significantly ($p \leq 0,05$) better than the reduction found in group TS (1.27%) and group ESP (1.27%). The largest (3.03%) reduction in body surface area (BSA) was seen in group EST and this reduction was significantly greater ($p \leq 0,05$) than in group ESP (1.96%).

The ultrasound sonographic subcutaneous fat layer in group EST (21.22%) showed the greatest reduction. This reduction was significantly ($p \leq 0,05$) greater than the reduction in subcutaneous fat found in both groups TS (18.04%) and ESP (12.11%). The visceral fat layer

in group EST (27.74%) also showed the greatest reduction. This reduction was significantly ($p \leq 0,05$) greater than that found in both groups ESP (22.82%) and TS (21.87%). This significantly ($p \leq 0,05$) greater reduction in subcutaneous and visceral fat found in group EST, corresponds with the significant ($p \leq 0,05$) decreases found in body girths, skinfolds and saggital height in the abdominal area in the same group.

In conclusion, obese females participating in a program of dietary restriction, thermogenic or electrical muscle stimulation with the aim of achieving weight-loss should note that: diet with or without electrical muscle stimulation (EMS) proved effective, but these modalities in conjunction with thermogenic stimulation proved the most effective intervention program after eight weeks.

KEY WORDS: ELECTRICAL MUSCLE STIMULATION; THERMOGENIC STIMULATION; CALORIE RESTRICTION; OBESE FEMALES; ABDOMINAL; SUBCUTANEOUS; VISCERAL; WEIGHT-LOSS.

SINOPSIS

TITEL	:	Effektiwiteit van Elektriese en Termogenetiese Stimulasie op Gewigsverlies by Obese Dames
KANDIDAAT	:	N. W. Mentz
PROMOTOR	:	Dr H.J. van Heerden
GRAAD	:	D.Phil

Die primêre doel van hierdie studie was om die effek te evalueer van ‘n agt-weke program van elektriese spierstimulasie (ESS), uitgevoer op Slimline Verslankingsapparate, tesame met (Groep EST), en sonder (Groep ESP), ‘n termogenetiese middel (Thermo Lean) asook ‘n gestandaardiseerde dieet (Groep TS). ‘n Voortoets- natoets eksperimentele groepsontwerp, met drie vlakke van die onafhaniklike veranderlike, is gebruik vir die studie. ‘n Totaal van 69 vroulike proefpersone tussen die ouderdom van 25 – 40 jaar (gemiddelde ouderdom 35.26 ± 6.02 jaar), wie deur koerantadvertensies gewerf is, het as proefpersone gedien. Insluitingskriteria vir die studie het vereis dat proefpersone fisies geskik was vir die intervensieprogramme, en premenoposaal; obees (LMI > 30); sedentêr en bereid moes wees om by enige van die drie studiegroepe ingedeel te word. Die volgende afhanklike veranderlikes is gemeet: Antropometrie; Morfologie; Ultraklank Sonografie; Respiratoriese Kwosiënt; Pulmonêre Funksie; Hematologie; Kardiovaskulêre Respons; en Muskuloskeletale Funksie.

Daar was ‘n statisties beduidende verskil tussen groepe ($p \leq 0,05$) met die afname in abdominale liggaamsomtrekke by drie verskillende anatomiese liggings naamlik; abdominaal (vlak van grootste anterior uitsetting; abdominaal AB-1 (halfpad tussen die xiphoid proses en die umbilicus); en abdominaal AB-2 (vlak van die umbilicus). Groep EST (6.02%) het die grootste afname getoon by die abdominale ligging. Hierdie afname was beduidend ($p \leq 0,05$) beter as die afname in groep ESP (4.79%) en groep TS (4.69%). Dieselfde tendens is gevind by die abdominale AB-1 ligging. Groep EST (6.42%) het die grootste afname in omtrekke getoon wat beduidend ($p \leq 0,05$) beter was as die afnames in groep TS (4.35%) en groep ESP

(4.28%). Groep ESP het by die umbilicus die grootste afname in omtrekke getoon (7.39%). Hierdie afname was beduidend ($p \leq 0,05$) beter as die afname in groep TS (4.85%).

Die grootste afname in velvoumetings is gevind by die trisepvelvou. Groep EST het die grootste afname getoon (12.75%). Hierdie afname was beduidend ($p \leq 0,05$) beter as die afnames in beide groep TS (9.27%) en groep ESP (6.63%). Die tweede grootste afname is gevind by die abdominale-velvou. Groep EST het die grootste afname getoon (12.14%). Hierdie afname was beduidend ($p \leq 0,05$) beter as die afnames in beide groepe TS (11.80%) en ESP (10.36%). Die derde grootste velvou afname was by die subscapula-velvou. Groep EST het die grootste afname getoon (9.70%). Hierdie afname was beduidend ($p \leq 0,05$) beter as die afnames in beide groepe TS (8.64%) en ESP (3.93%). Die waargenome beduidend ($p \leq 0,05$) groter afname in velvoumetinge by die abdominale ligging in groep EST stem ooreen met dienooreenkomstige beduidend ($p \leq 0,05$) groter afnames in omtrekmetinge by die abdominale liggings in dieselfde groep.

Met betrekking tot saggitalehoogte metinge, by die umbilicus ligging (saggitaal umbi), het groep ESP (11.48%) die grootste afname getoon. Hierdie afname was soortgelyk aan die afnames gevind in groep EST (11.02%). By die saggitaal ½ umbi ligging het groep EST (13.52%) die grootste afname in saggitale hoogte getoon. Hierdie afname was beduidend ($p \leq 0,05$) beter as in beide groepe ESP (10.61%) en TS (10.60%). Die beduidend ($p \leq 0,05$) groter afname in saggitale hoogte by die saggitaal ½ umbi ligging in groep EST, stem ooreen met die beduidende ($p \leq 0,05$) afnames gevind in liggaamsomtrekke en velvouemetinge in dieselfde groep.

Beduidende afnames ($p \leq 0,05$) in middel-tot-heup omtrekverhouding (MHV) is waargeneem in twee van die drie eksperimentele groepe. Die grootste afname is gevind in groep EST (2.53%) en hierdie afname was beduidend ($p \leq 0,05$) beter as die afnames in groep TS (1.27%) en groep ESP (1.27%). Die grootste (3.03%) afname in liggaamsoppervlakte meting (LOM) is waargeneem in groep EST en hierdie afname was beduidend beter ($p \leq 0,05$) as groep ESP (1.96%).

Die ultraklank sonografiese onderhuidse vetlaagmeting in groep EST (21.22%) het die grootste afname getoon. Hierdie afname was beduidend ($p \leq 0,05$) beter as die afnames in onderhuidse vet in beide groepe TS (18.04%) en ESP (12.11%). Die viserale vetlaag in groep EST (27.74%) het ook die grootste verlaging getoon. Hierdie verlaging was beduidend ($p \leq 0,05$) beter as in beide groepe ESP (22.82%) en TS (21.87%). Hierdie beduidende ($p \leq 0,05$) groter afname in onderhuidse en viserale vet in groep EST, stem ooreen met die beduidende ($p \leq 0,05$) afnames gevind in liggaamsomtrekke, velvoue en saggitale hoogte in die abdominale gebied binne dieselfde groep.

Ter afsluiting, obese dames wat deelneem aan ‘n program van kalorie-inperking, termogenetiese of elektriese spierstimulasie met die oog op gewingsverlies moet kennis dra dat: dieet met of sonder elektriese spierstimulasie (ESS) effektief is, maar dat hierdie modaliteite in samewerking met termogenetiese stimulasie bewys is as die mees effektiewe intervensieprogram na agt-weke.

SLEUTELWOORDE: ELEKTRIESE SPIERSTIMULASIE; TERMOGENETIESE STIMULASIE; KALORIEBEPERKING; OBESE DAMES; ABDOMINALE-; ONDERHUIDSE-; VISERALE-; GEWIGSVERLIES.

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