79 - ANALYSIS FROM THE STATURE RECOVERY OF OBESE INDIVIDUALS AND NON - OBESE AFTER A DAILY TASK.

CLEVER L. G. PROVENSI; LESLIE N. PERSCH
Universidade Federal do Paraná, Curitiba, Paraná, Brasil.
clgpro@sulbbs.com

INTRODUCTION

The mechanical of the intervertebral discs has been object of several studies (REILLY et al, 1984; RODACKI et al, 2003) and it's related with the reduction and increase of stature from the individuals during the day (REILLY et al, 1984). Studies that approach daily tasks have demonstrated that during the execution of the tasks the intervertebral discs tend the lose stature like a strategy of dissipation of overloads and, after the removal of these, recover stature about to be apt to dissipate new overloads (RODACKI et al, 2003). This way, the changes in the mechanical properties of reduction and recovery of height of the intervertebral discs represent a risk factor about to the appearing from pains (ADAMS & DOLAN, 1995).

Some studies have demonstrated that chronic overloads change the capacity of the intervertebral discs to dissipate loads (RODACKI et al, 2003). The non recovery of height of the intervertebral discs after the removal from the overloads is related directly the apparition of pains. As Dunlop et al (1984), the non recovery of stature make the intervertebral discs to transfer the overload to other structures (ex. Facet joints) that aren't specialized on dissipation of loads like the intervertebral discs, so it can lead to pains and chronic problems in a long range (POLLINTINE et al , 2004), including by the compression of the nerves root (WATKINS , 1999).

Epidemiological studies have demonstrating a higher prevalence of back pains on obese individuals in relation to individuals non-obese (FANUELE et al, 2002; WEBB et al, 2003). The excessive overload posture provided by obesity may be one explaining factor about this data. The aim of this study is to compare the recuperation of stature among obese individuals with non-obese to identify if the fat engages this mechanic property of the intervertebral discs.

METHODS

Participants

Participate of the study 20 male individuals from Curitiba city, from this, 10 have been classified as obese (BMI> 30) and 10 as non - obese (BMI< 25). All of the participants in the study appraised no illness (ex: disc herniation) or a momentary muscle-dysfunction (ex.: fractures or muscle-distention) which could interfere on the results. The physical characteristics from the participants are in the Table 01.

TABELA 1 - PHYSICAL CHARACTERISTICS FROM THE PARTICIPANTS

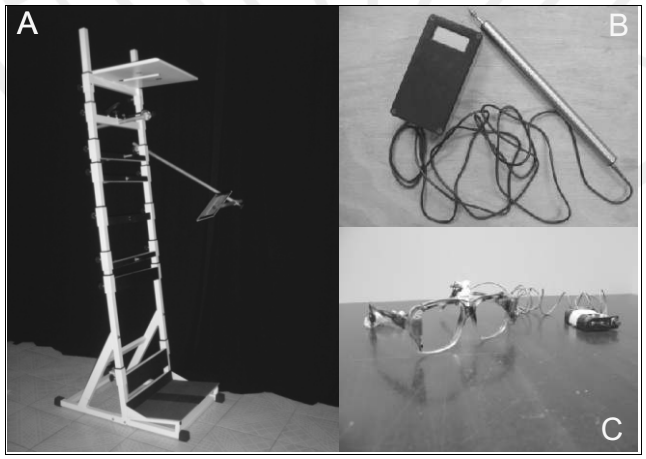
	Age (years)	Stature (cm)	BMI (kg/m^2)
Non-obese	22,4 ± 3,92	176,8 ± 5,8	23,05 ± 2,14
Obese	23 ± 3,71	177,6 ± 5,9	36,56 ± 4,69

Note: values are mean ± standard deviation.

Instruments and Procedures

The analysis of stature variation have been realized by a especial stadiometer, a high-resolution linear vertical digital transducer (LVDT) and a special glass. The Figure 1 presents the equipments used for the data collection.

FIGURA 1 - INSTRUMENTS FOR THE DATA COLLECTION



A = Estadiômetro; B = TDVL; C= Óculo especial.

For the measurements, all the participants have been positioned stand in the stadiometer, with the body weight divided equally on the two legs , and back supported on adjustable shafts. These shafts have been positioned on the next dots : (1) the apex of the buttocks, approximately at the medial sacral crest height; (2) the middle of the deepest point of the lumbar lordosis curve (approximately L3); (3) the most prominent point of the thoracic kyphosis (approximately T7); (4) the middle of the deepest point of the cervical lordosis curve (approximately C4); (5)) the most posterior protuberance of the head (occiput). The position of the head was controlled by the special glass. The feet contour position was draw to ensure that the participants always put them on the same position. For more detail information about the procedures adopted for the measurements in the stadiometer are describe in Rodacki et al (2001).

The participants have been submitted to one assessment session that was divided in two parts. The first part was used to the familiarization from the participants with the procedures and equipment, so the measure of the variation of stature

might be reproducible. The participants were considerate familiar when the values of the variation of the stature no presented a variation higher then 0,5 mm during 10 consecutives measurements (RODACKI et al, 2001). The second part was just after the first, and it was used to the data colletction.

In the second part of the session, the participants were submitted to a load of approximately 10% of the body weight, distributed of equal forms into two bags carried one in each hand. They went informed to walk in their normal rhythm in a circuit pre-established. This activity was executed to reduce the height of the intervertebral discs. After 30 minutes of activity, the exterior loads have been withdrawals and the participants had their stature measured. After this measurement, the participants were advised to perform little body displacements. They were also advised to remain stand and don't effectuate any kind of sudden movements during 30 minutes, for the recovery of the height of the intervertebral discs. Finished these 30 minutes, the participants had their stature measured again. The Figure 2 shows the design of the study.

FIGURA 2 - DESIGN OF THE STUDY

CARRING	STATURE MEASUREMENT 1	RECOVERY	STATURE MEASUREMENT 2
30' (walking with bags)	2' (estadiômeter)	30' (little body displacements without load)	2' (estadiômeter)

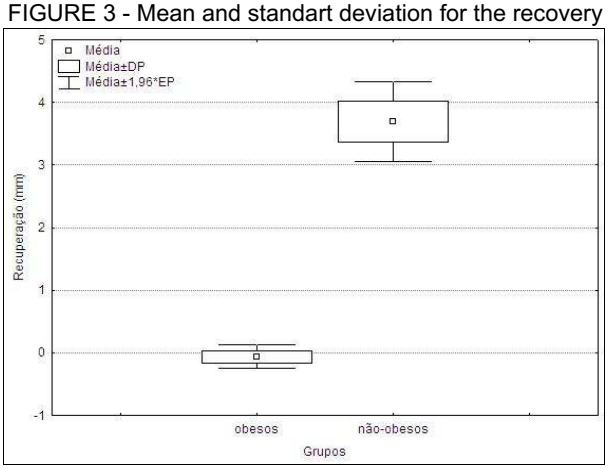
Statistical Analysis

Descriptive statistical analysis (mean _ SD) described the characteristics of each variable. A Shapiro-Wilk test was applied and confirmed data normality. A Student-t test was applied for independent samples for significant changes in the recovery of the stature between the groups. All statistical analyses were performed in the Statistica 7 (*StatSoft Inc.*) The statistical significance level was set at *P* less than .05 for all analyses.

RESULTS

There was a significant difference among the recovery of the stature of individuals obese and non-obese, where the participants obese recover less stature (-0,066 mm) than the individuals no-obese (3,69 mm) (p<0,001, figure 3).

FIGURE 3 - Mean and standart deviation for the recovery of stature.



(p<0,001)

DISCUSSION

The intervertebral discs are situate among the vertebras and they have the objective of dissipate loads and provide mobility to the spinal column (WATKINS, 1999). The intervertebral discs consisting of a gelatin nucleus (nucleus pulposus) that is enclosed for several layers of collagen (annulus fibrosus) fixed from a forms that can support diverse types of loads (axial and torsion) (ADAMS & DOLAN, 1995). One of the principal mechanic properties of the intervertebral discs is the reduction and the recovery of height. These mechanic properties provides to the intervertebral discs the ability to dissipate axial loads, that are used to be imposed during the daily tasks because of the gravity (WATKINS , 1999).

Studies *in vitro* and *in vivo* (with animals models) have been observed that mechanical forces applied too long on the intervertebral discs make morphological cellular modifications (WALSH & LOTZ , 2004), as well as modifications on proportion and quality from the tissues and structures that makes up the intervertebral discs (HUTTON et al, 1999; IATRIDIS et al, 1999), and in some cases the cellular death from the same can occur (WALSH & LOTZ , 2004).

The outcomes of our study demonstrate that obese individuals present an incapacity of recovering the height of the intervertebral discs after the execution of a daily task (non-obese: 3.69mm; obese: -0.066mm). This disability of recovering stature can be associate to a higher overload tax by the body mass from the obese individuals and by a major muscular activation necessary to keep the posture of these subjects (HEALEY et al, 2005). The literature demonstrates that the origin of back pain is related to continuous overloads over non specialized structures on dissipate loads (ex.: facet joints) (DUNLOP et al, 1984; POLLINTINE et al, 2004) and in the compression of the nerves roots (WATKINS, 1999). The overload by the body mass of obese individuals could be acting like a continuous load upon these structures and so lead to back pain.

Studies *in vitro*, that explore the application of overload too long and the disc degeneration, indicates for the problems that can be occasional by the increase of the overload in some structures from column. According to Adams et al (2000), the increase of the overload in posterior annulus fibrosus is a factor which can culminate in a discal prolapse (discal herniation) due to the accumulation of stress, bringing serious problems to the individual and limitations in his life daily. Dunlop et al (1984), demonstrated that, when the intervertebral disc is with it's height reduced, the facet joints support un overload which can lead to pain for inflammatory process and even to the degeneration of the facet joints. These findings have been reinforced by Pollintine et al (2004) who demonstrated that a important calcification of these structures can also occur, taking to the formation of osteofitos. Watkins (1999) cites that beyond the reasons that leave to chronic pains, the reduce in the intervertebral space leads to the compression on the nerves roots, being the cause from most of the pains.

In addition to all these, the non recuperation of height of the intervertebral discs difficult the suit of nutrition of the discs. This process, that occur mostly in the terminal plate is stimulated by the variation in the stature of the intervertebral discs. When

this process doesn't occur perfectly there is un accumulation of metabolic sub products inside the intervertebral which can cause an acceleration into the process of degeneration of the discs (FERGUSON et al, 2004). This phenomenon represent one more risk factor to obese individuals, once they demonstrate an incapacity in recover stature after the execution of a daily task.

CONCLUSION

This study verify that obese individuals present an incapacity of recovering stature. This difficulty may be considerate a risk factor to the development of chronic back pains and also may be considerate as being one of the explaining factors in relation to the higher incidence of back pains in obese individuals.

REFERENCES

ADAMS, M. A.; DOLAN, P. Recent advances in lumbar spinal mechanics and their clinical significance. Clinical Biomechanics. v. 10, n. 1, p. 3-19, 1995.

ADAMS, M. A.; FREEMAN, B. J.; MORRISON, H. P.; NELSON, I. W.; DOLAN, P. Mechanical initiation of intervertebral disc degeneration. Spine. v. 23, n. 13, p. 1625 - 1636, 2000.

DUNLOP, R. B.; ADAMS, M. A.; HUTON, W. C. Disc space narrowing and the lumbar facet joints. The Journal of Bone and Joint Surgery. v. 66, n.5, p. 706-710, 1984.

FANUELE, J. C.; ABDU, W. A.; HANSCOM, B.; WEINSTEIN, J. N. Association between obesity and functional status in patients with spine disease. Spine. v. 27, p. 306-312, 2002.

FERGUSON, S. J.; ITO K.; NOLTE, L-P. Fluid flow and convective transport of solutes within the intervertebral disc. Journal of Biomechanics. v. 37 ,p. 213-221, 2004.

HEALEY, E. L.; FOWLER, N. E.; BURDEN, A. M.; McEWAN, I. M. Raised paraspinal muscle activity reduces rate of stature recovery after loaded exercise in individuals with chronic low back pain. Archives of Physical, Medicine and Reabilitation. v. 86, n. 4, p. 710 - 715, 2005.

HUTTON, W. C.; ELMER, W. A.; BODEN, S. D.; HYON, S.; TORIBATAKE, Y.; TOMITA, K.; HAIR, G. A. The effect of hidrostatic pressure on intervertebral disc metabolism. Spine. v. 24, n. 15, p. 1507 - 1515, 1999.

IATRIDIS, L. C.; MENTE, P. L.; STOKES, I. A. F.; ARONSSON, D. D.; ALINI, M. Compression-induced changes in intervertebral disc properties in a rat tail model. Spine. v. 24, p. 996 - 1002, 1999.

POLLINTINE P, DOLAN P, TOBIAS JH, ADAMS MA. Intervertebral disc degeneration can lead to "stress-shielding" of the anterior vertebral body. A cause of osteoporotic vertebral fracture? Spine. v. 29, p. 774-782, 2004.

REILLY, T.; TYRRELL, A.; TROUP, J. Circadian variation in human stature. Chronobiology International. v.1, p. 121-126, 1984.

RODACKI, C.; FOWLER, N.; RODACKI, A.; BIRCH, K. Repeatability of measurement in determining stature in sitting and standing postures. Ergonomics. 2001.

RODACKI, C.; FOWLER, N.; RODACKI, A.; BIRCH, K. Stature loss and recovery in pregnant women with and without low back pain. Arch Phys Med Rehabil. v. 84, p. 507-5512, 2003.

WALSH, A. J. L; LOTZ, J. C. Biological response of the intervertebral disc to dynamic loading. Journal of Biomechanics. v. 37, p. 329-337, 2004.

WATKINS, J. Estrutura e Função do Sistema Musculoesquelético. São Paulo: Manole, 1999.

WEBB, R.; BRAMMAH, T.; LUNT, M.; URWIN, M.; ALLISON, T.; SYMMONS, D. Prevalence and predictors of intense, chronic, and disabling neck and back pain in UK general population. Spine, v. 28, n. 11, p. 1195-1202, 2003.

CLEVER LUIZ GREGOLIN PROVENSI
Departamento e Educação Física - Universidade Federal do Paraná.
Rua Coração de Maria, nº 92, Jardim Botânico, Curitiba, Paraná, Brasil.
CEP 80.215-370. Telefone: 3360-4333

ANALYSIS FROM THE STATURE RECOVERY OF OBESE INDIVIDUALS AND NON - OBESE AFTER A DAILY TASK.

ABSTRACT

The mechanical of the intervertebral discs have for objective dissipate loads and is related with the reduction and increase of stature from the individuals during the day. Some studies have demonstrated that overloads change the capacity of the intervertebral discs to dissipate loads. This study aim to compare the recuperation of stature among individuals obese and non-obese to identify if the fat engages this mechanic property of the intervertebral discs. For this, 20 male individuals, 10 obese (BMI>30) and 10 non-obese (BMI<25) had their stature variation verify after a daily task. There was a significant difference among the recuperation of stature of obese and non-obese individuals (obese: -0,066 mm /non-obese: 3,69 mm, p<0,001), where the obese participants recover less stature than the non-obese participants. The difficulty of recovering stature from the obese participants may be considerate a risk factor about the development of back pains and also may be considerate one of the explaining factors related to the higher incidence back pains in this individuals.

KEY WORDS: Obesity, Intervertebral Disc, Back Pain.

ANALYSE DU RECUVERY DE LA STATURE DES INDIVIDUS OBÈSES ET NON - OBÈSE APRÈS JOURNAL D'A CHARGER.

RÉSUMÉ

Le comportement mécanique des disques intervertébraux, qu'ont comme objectif absorbé des charges, est lié à réduction et l'augmentation de la stature des individus pendant le jour. Quelques études ont démontré que les surcharges changent la capacité des disques intervertébraux d'absorber des charges. Ce but d'étude pour comparer la récupération de la stature parmi des individus obèses et non-obèses pour identifier si la graisse engage cette propriété mécanique des disques intervertébraux. Pour assurer ceci, 20 individus masculins, 10 obèses (BMI>30) et 10 non-obèses (BMI<25) ont fait vérifier leur variation de stature après qu'un jour des activités. Il y avait une différence significative parmi la récupération de la stature des individus obèses et non-obèses (obèses: -0.066 millimètres /non-obèse: 3.69 millimètres, p<0,001), où les participants obèses récupèrent moins de stature que les participants non-obèses. La difficulté de récupérer la stature des participants obèses peut être prévenante un facteur de risque au sujet du développement des douleurs dorsales et peut également être la prévenante des facteurs explicatifs liés aux douleurs dorsales d'incidence plus élevée en cela des individus.

MOTS CLÉS: obèse, disques intervertébraux, douleurs dorsales

ANÁLISIS DE LA RECUPERACIÓN DE LA ESTATURA DE INDIVIDUOS OBESOS Y NO - OBESO DESPUÉS DE TAREA DIARIA.

EXTRACTO

El mecánicos de los discos intervertebrales tienen para el objetivo disipan cargas y se relacionan con la reducción y el aumento de la estatura de los individuos durante el día. Algunos estudios han demostrado que las sobrecargas cambian la capacidad de los discos intervertebrales de disipar cargas. La puntería de este estudio es comparar la recuperación de la estatura entre los individuos obesos y no-obesos para identificar si la grasa contrata esta característica del mecánico de los discos intervertebrales. Para esto, 20 individuos masculinos, 10 obesos y 10 no-obesos hicieron su variación de la estatura verificar después de una tarea diaria. Había una diferencia significativa entre la recuperación de la estatura de los individuos obesos y no-obesos (obesos: -0.066 milímetros /no-obesos: 3.69 milímetros, $p<0,001$), donde los participantes obesos recuperan menos estatura que los participantes no-obesos. La dificultad de recuperación de la estatura de los participantes obesos puede ser considerada un factor de riesgo sobre el desarrollo de los dolores de espalda y también puede ser la considerada de los factores que explican la incidencia con los dolores de espalda más altos en este individuos.

Palabras-Claves: Obesidad, Disco Intervertebral, Dolor de Espalda.

ANÁLISE DA RECUPERAÇÃO DE ESTATURA DE INDIVÍDUOS OBESOS E NÃO-OBESOS APÓS UMA TAREFA COTIDIANA.

RESUMO

O comportamento mecânico dos discos intervertebrais, que tem por objetivo dissipar cargas, está relacionado com a redução e aumento de estatura dos indivíduos durante o dia. Alguns estudos têm demonstrado que sobrecargas crônicas alteram a capacidade dos discos intervertebrais em dissipar cargas. este estudo objetivou comparar a recuperação de estatura entre indivíduos obesos e não-obesos para identificar se a obesidade compromete esta propriedade mecânica dos discos intervertebrais. Participaram do estudo 20 indivíduos do sexo masculino dos quais 10 foram classificados como obesos e 10 como magros não-obesos. As análises de variação de estatura foram realizadas utilizando-se um estadiômetro especial, um transdutor digital de variação linear e um óculo especial. Foi aplicado um teste t de *student* para amostras independentes para observar se houveram diferenças significativas na recuperação de estatura entre os grupos. Foi observada uma diferença significativa entre a recuperação de estatura de indivíduos obesos e não-obesos, onde os indivíduos obesos recuperaram menos estatura (-0.066 mm) do que os indivíduos não-obesos (3.69 mm). A dificuldade de recuperar estatura dos indivíduos obesos pode ser considerada um fator de risco para o desenvolvimento de lombalgias crônicas e pode ser considerada um dos fatores explicativos em relação à maior incidência de dores nas costas nestes indivíduos.

PALAVRAS-CHAVE: Obesidade, disco intervertebral, lombalgias.