Research Article

The Effect of Vitamin D3 Supplementation on Increases of Levator Ani Contraction Strength in Women with Uterine Prolapse

Pengaruh Suplementasi Vitamin D3 terhadap Peningkatan Kekuatan Kontraksi Otot Levator Ani pada Perempuan dengan Prolapsus Uteri

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Abstract

Objective: To investigate the differences of levator muscle contraction strength after vitamin D3 supplementation, thus it is expected that the administration of vitamin D3 can reduce the incidence of uterine prolapse recurrence after reconstructive surgery.

Methods: This study is a quasi-experimental study with pre-and-post vitamin D3 supplementation on uterine prolapse patient. Participants in this study were patient with uterine prolapse and fulfilled inclusion criteria (n=19). Serum vitamin D3 levels, levator ani muscle contraction strength (perineometer peritron TM), gastrocnemius soleus muscle contraction strength (hand held dynamometer) were measured prior to and after vitamin D3 1000 IU supplementation. This study was conducted in Gynecology Clinic, Physical Medicine and Rehabilitation Clinic, and The Department of Clinical Pathology Dr. Hasan Sadikin General Hospital/ Faculty of Medicine Universitas Padjadjaran on January-April 2019.

Results: This study showed an increase in levator ani muscle contraction strength with a significant P value of <0.001 and an increase in gastrocnemius soleus muscle contraction strength with a significant P value of <0.001 after vitamin D3 supplementation.

Conclusions: Vitamin D3 supplementation can increase levator ani and gastrocnemius soleus muscle contraction strength in uterine prolapse patient.

Keywords: gastrocnemius soleus muscle contraction strength, handheld dynamometer, vitamin D, levator ani muscle contraction strength, perineometer peritronTM, uterine prolapse.

Abstrak

Tujuan: *Melihat perbedaan kekuatan kontraksi otot levator ani setelah suplementasi vitamin D3, dengan demikian diharapkan pemberian vitamin ini dapat mengurangi insidensi rekurensi prolapsus uteri pasca operasi rekonstruksi.*

Metode: *Penelitian ini merupakan penelitian eksperimental quasi dengan rancangan sebelum dan sesudah pemberian vitamin D3 pada pasien prolapsus uteri. Subjek penelitian adalah pasien prolapsus uteri yang memenuhi kriteria inklusi penelitian (n=19). Dilakukan pemeriksaan kadar vitamin D serum, pengukuran kekuatan otot levator ani (perineometer peritronTM) dan otot lurik gastrocnemius soleus (hand held dynamometer) sebagai otot pembanding sebelum dan sesudah pemberian 3 bulan vitamin D3 1000 IU. Penelitian dilakukan di Poliklinik Ginekologi FKUP/RSHS, Poliklinik Kedokteran Fisik dan Rehabilitasi FKUP/RSHS dan Laboratorium serologi Klinik Patologi Klinik FKUP/RSHS pada bulan Januari – April 2019.*

Hasil: *Penelitian ini memperlihatkan peningkatan kekuatan kontraksi otot levator ani dengan nilai signifikan p<0,001, dan peningkatan kekuatan kontraksi otot gastrocnemius soleus dengan nilai signifikan p<0,001 setelah subjek mendapatkan suplemen vitamin D3.*

Kesimpulan: *Penelitian ini menyimpulkan bahwa suplementasi vitamin D3 dapat meningkatkan kekuatan kontraksi otot levator ani dan otot gastrocnemius soleus pada penderita prolapsus uteri.*

Kata kunci: *inkekuatan kontraksi otot levator ani, kekuatan kontraksi otot gastrocnemius soleus, hand held dynamometer, perineometer peritronTM, prolapsus uteri , vitamin D.*

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INTRODUCTION

Uterine prolapse is a pathological condition due to pelvic floor dysfunction in women whose incidence is increasing. This increasing of the incidence of uterine prolapse is thought to be the effect of the relatively increasing proportion of the elderly population accompanied by improvements in economic level.[1,2] Risk factors for uterine prolapse are multifactorial including parity, vaginal delivery, age, obesity, connective tissue abnormalities, menopausal status, and chronic constipation which causes weakness in the pelvic floor muscles.[1] The primary management that is focused on surgical management turns out to have weaknesses because the recurrence rate after the reconstruction is quite high, so that efforts are needed to prevent progression and recurrence.[3]

Vitamin D has a major role in regulation of the absorption of calcium and phosphor from the intestine. Various studies shows that there is a relationship between growth and musculoskeletal function with serum vitamin D levels.[4,5] Some studies support a relationship between low serum vitamin D concentration and reduced mass and striated muscle strength.[6] Vitamin D deficiency is thought to interfere with the muscle regeneration process, causing a decrease in muscle function. Based on that, it is necessary to perform research on vitamin D_3 supplementation in postmenopausal women with uterine prolapse to know whether there is an increase in pelvic floor muscle strength and whether progression and recurrence after reconstructive surgery can decrease after patients are given vitamin D_3.

METHODS

This study is a quasi-experimental study with pre-and-post vitamin D3 supplementation on uterine prolapse patient. Participants in this study were patient with uterine prolapse and fulfilled inclusion criteria (n=19). Serum vitamin D3 level, levator ani muscle contraction strength (perineometer peritron TM), and gastrocnemius soleus muscle contraction strength (hand held dynamometer) were measured prior to and after vitamin D3 1000 IU supplementation. This study was conducted in Gynecology Clinic, Physical Medicine and Rehabilitation Clinic, and The Department of Clinical Pathology Dr. Hasan Sadikin General Hospital/ Faculty of Medicine Universitas Padjadjaran on January-April 2019. Analysis and data processing carried out by the researcher and statistic supervisor. The data collection will be carried out by the researcher. This is done manually and computerized by using the software program Statistical Product and Service Solution (SPSS) for Windows version 22.0.

RESULTS

This research was conducted and evaluated from January until April 2019 in the Department of Obstetrics and Gynecology Faculty of Medicine Universitas Padjadjaran / RSUP dr. Hasan Sadikin Hospital in Bandung. The subjects consisted of 19 samples of uterine prolapse women.

Table 1. Characteristics of Research Subjects

Characteristics	n	%
Age (y.o)		
50 – 59	8	42.1
60 – 69	5	26.3
≥ 70	6	31.6
Mean (SD) : 63,0 (8,1)		
Range : 50 – 76		
BMI (kg/m2)		
18.5 – 24.9	12	63.1
≥ 25	7	36.9
Mean (SD) : 24.2 (3.7)		
Range :19.3 – 32.9		
Parity		
< 3	3	15.8
≥ 3	16	84.2
Range: 1 – 6		

Table 2. Comparison of Vitamin D3 Levels, Levator Ani and Gastrocnemius Soleus Muscle Contraction Strength before and after Vitamin D3 Supplementation

Variable	Measurement		*P-value**)
	before supplementation	after supplementation	
Vitamin D3 (ng/mL)			
Mean (SD)	10.66 (2.31)	25.84 (7.11)	<0.001
Levator ani muscle contraction strength (cmH2O)			
Mean (SD)	24.57 (3.75)	33.90 (7.88)	
Gastrocnemius soleus muscle contraction strength (kg)	6.67 (1.18)	11.08 (0.94)	<0.001
Mean (SD)			
Median	6.5	10.7	<0.001
Range	5.0 – 8.3	10.0 – 13.3	

Table 3. Comparison of Increases Strength of Levator Ani and Gastrocnemius Soleus Muscle Contraction after Vitamin D3 Supplementation

Statistic Measurement	Increases the Strength of Levator Ani Muscle Contraction	Increases the Strength of Gastrocnemius Soleus Muscle Contraction	*P-value**)
Mean (SD)	9.34 (6.57)	4.40 (0.73)	0.005
Range	-2.7-22.7	3.3-5.5	

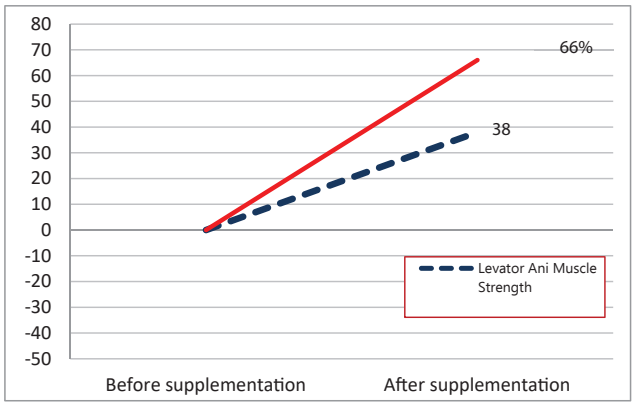

Figure 1. Percentage of Increases the Levator Ani and Gastrocnemius Soleus Muscle Contraction Strength

DISCUSSION

In Table 1. shown the characteristic of the study were 8 subjects (42.1%) aged 50-59 years. Several studies support the hypothesis that age is one of the risk factors that affect the weakness of levator muscle and affect the regeneration of striated muscles. Various studies show that increasing age is one of the main risk factors that cause weakening of the pelvic floor muscles.[7-9] Based on Body Mass Index found 12 subjects (63,1%) 18,5-24,9 kg/m^2 and 36,9% with BMI ≥25 kg/m2. Obesity is thought to increase the risk of weakness in levator ani muscles. It was found that obesity was significantly associated with pelvic floor muscle strength.[9] Obese women (BMI> 30) have a doubled risk of developing POP compared to women with normal BMI.[10] Based on parity 16 subjects (84.2%) was found with parity ≥ 3. A multiparity had a risk of 2.92x greater than nulliparity women. Also obtained the risk of increasing as much as 1.2x in each subsequent delivery. This increase was associated with repeated trauma to the supporting structures of the pelvic organs at each addition to 1 vaginal delivery. [11]

In Table 2 statistical analysis finds that the average value of vitamin D_3 levels increases significantly with p-value <0.001 after 3 months vitamin D_3 supplementation on uterine prolapse women. The levator ani and gastrocnemius soleus muscle contraction strength also significantly increase after supplementation (P-value <0.001). There is a relationship between vitamin D levels and the strength of levator ani muscles. In that study showed a significant positive correlation between vitamin D levels and the strength of levator ani muscle contractions with a value of p <0.05.[12] In this study an examination of the strength of the gastrocnemius soleus muscle was intended as a comparative striated muscle. The selection of the soleus gastrocnemius muscle is based on previous research, which shows that there is a relationship with levator ani muscle strength with correlation coefficient (r) of 0.519 and p-value of 0.001, which means that there is a

moderate and significant correlation between the gastrocnemius soleus muscle strength and levator muscle in patients with uterine prolapse.[13] On 40 subjects with vitamin D deficiency who showed significant results with p <0.04. Vitamin D affects the strength and function of striated muscles through various mechanisms. The mechanism of action of vitamin D affects the striated muscle in two ways, genomic and nongenomic. The genomic effect of vitamin D on striated muscles is regulating gene transcription through vitamin D receptors found in the core membrane of muscle cells causing the process of muscle cell differentiation and proliferation through the effects of insulin growth factor (IGF) which induces muscle hypertrophy. Whereas the nongenomic effect of vitamin D is 1.25 (OH) D appears and binds to membrane receptors that activate signal transduction triggering the pathway of MAP Kinase (MAPK) and Phospholipase C (PLC), which converts fast calcium influx into cells. [14-16]

In Table 3. Statistical analysis shows comparison of increases the strength of levator ani and gastrocnemius soleus muscle contraction after vitamin D_3 supplementation with result significant P-value <0.001. Several studies have shown significant differences between the strength of various striated and vitamin D muscles. There was a difference in upper extremity and lower extremity muscle strength with increased vitamin D levels in 65 male soldiers who carried out long-term missions. The study showed a positive relationship between increasing vitamin D levels and upper extremity muscles, whereas there was a negative relationship with lower extremity muscle strength. The difference in results between the upper and lower extremities in the study is suspected because the upper extremity muscles experience more severe training, namely maintaining the balance of the body against gravity when lifting weapons equipment weighing about 50 kg every day.[17] In Figure 1 shows that percentage of levator ani muscle contraction increased by 38%, while in the gastrocnemius soleus muscle as much as 66%. So that it can be concluded that in this study the gastrocnemius soleus muscle experienced a greater increase in contraction strength than the levator ani muscle. This result may be due to several things, namely that the gastrocnemius soleus muscle is a plantar flexor muscle group that has basic functions to walk (at most), run, and jump. That muscles that had more increased strength were muscles that were used more for physical training.[17] Furthermore, in this study no imaging examination of levator ani muscle anatomic imaging was conducted on the subjects of the study to see damage to the levator ani muscle. It is known that one of the risk factors for uterine prolapse is avulsion in the levator ani muscle, so it may be a confounding factor for the results of this study.[18]

CONCLUSION

Vitamin D3 supplementation can increase the levator ani and gastrocnemius soleus muscle contraction strength in uterine prolapse patient.

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