



## Research Article

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# Impact of Hip Conditioning Program with Rotational Movements on the lumbar pain occurrence and foot load parameters

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## Abstract

**Purpose:** The purpose of this study was the analysis of foot load parameters and pain in lumbar region after Hip Conditioning Program with Rotational Movements (HCP) and its influence on these parameters. **Methods:** The study included twenty-three middle-aged volunteers from Bialystok University of Technology (age: 49,43±11,88 years). During the first visit all participants were measured for each of the following components: height, weight and body mass index and all the participants completed written informed consent the PAR-Q+ to identify potentially dangerous health conditions before the HCP. The assessment of foot load parameters and pain levels was conducted with Footwork Pro capacitive pressure measurement plate (Amcube, United Kingdom) and Standardised Nordic questionnaire about the occurrence of pain in lower back area before and after the HCP training regime. The collected data were processed with the Statistica 12 program (StatSoft Inc., United States). Footload parameters were examined with t-test for dependent samples and pain occurrence with Cochran Q test. **Results:** The results shows that HCP was effective and caused reduction in pain occurrence by 21,74% in lumbar spine region and better alignment of the foot load parameters in midfoot, lateral and overall foot region. **Conclusion:** It stands in line with other studies that HCP is effective and efficient way to help people who fights chronic low back pain. Increase in the pressure on the midfoot and lateral side of foot potentially reduce valgus of the ankle joint and lessen pressure on the longitudinal arch of the foot.

**Keywords:** Lumbar pain, Low back pain, Hip Conditioning Program (HCP).

## INTRODUCTION

One of the main problems affecting modern society's health is chronic lumbar pain. The prevalence and incidence of low back pain (LBP) ranged from 1.4 to 20.0% and 0.024-7.0%, respectively. The other studies show that up to 70 % of developed countries' citizens will experience at some point of their life chronic pain localized in lumbar region. LBP is a feeling of pain, raises muscle tension or stiffness localised between the costal margin and the inferior gluteal muscle folds, with or without leg pain (known as sciatica), and is defined as chronic malady when it persists for 12 weeks or even more. Non-specific LBP is pain which is not attributed to a diagnosable pathology (such as inflammation in the process of rheumatoid arthritis or without it, infection process, fractures, pain in the course of osteoporosis) [1]. The source of the LBP problem could vary - from disc degeneration disease, osteoarthritis, increased tonus of low back muscles to psychosomatic symptoms. Nevertheless the reason it is often a problem for medical doctors, physiotherapists and other medical workers to completely solve the problem of the patient [2].

Intervention strategies, which are effective and efficient are essential not only to alleviate pain and improve patient's functioning, but also they need to be effective and cost-efficient for larger segments of population to prevent unnecessary surgical interventions and administering high doses of nonsteroidal anti-inflammatory drug or opioids which always brings a risk of side effects [3]. Researchers concluded that rehabilitation especially exercise therapy like tai-chi, stretching or yoga, manual therapy techniques are strongly recommended in fighting with chronic LBP. Interventions which are known to be effective like fusion surgery or corticosteroid injections may be help for some group of patients, but they are associated with much more side effects and these are expensive procedures and they should be taken into a consideration when other options were not effective in the treatment of patients' complaints.

Feet are basis on which people moves and function. Often when there are problems like pain, stiffness in the lumbar area, the footload and how the foot responds to it, is possible to observe and evaluate.

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The musculoskeletal constitution of feet is very complex, it consists of various articulations, ligaments, tendons and muscles. Harmonious work in this region allows for smooth movement and functioning under continuous load conditions. In the observational study from 2020 results presented by the authors show that pain in the lumbar or cervical region has an effect on how the foot distributes the weight. Participants complaining of some pain problems in the lumbar area had an asymmetry in the load of IV and V of the metatarsal head between the left and right foot and also loading of lateral arch of feet [4].

Hip Conditioning Program – Strengthening and Flexibility Exercises (HCP) – introduces exercises in poor fitness and/or health condition, suffering from movement restrictions caused by immobility, raised muscle tonus, but it is useful also for people that do not have such problems. Program contains exercises which activates large muscle groups, not only superficial muscles, but also muscles laying more deeply in the body. Exercise which activates the muscle in more linear movement or is based just on contraction of them has limited effect. Better activation leads to higher levels of muscular work, body stabilization and in consequence better control over the stabilization and balance during any activity due to better alignment of the body mass center. The twisting force that takes place during rotational exercises allows lengthening of the muscles and tendons, hence decreasing raised muscle tone and stiffness of the muscles [5].

HCP introduces rotational movements, which are not directly opposed to gravitational force as linear type of exercises do, causing less stress on the cartilage surface of the joints. HCP training regimen due to twisting forces occurring in rotatory movement results in more flexibility of muscles, tendons and ligaments, causing better blood supply – more oxygen and nutrition. Continuous training in HCP regime will result in improved mobility and coordination during movement, more efficient proprioception and overall efficiency in functioning. It contributes to better general fitness and psychosomatic health, reducing risk of falls, injuries and as a form of musculoskeletal pain prophylaxis.

Hip conditioning program with rotational movements is a training program designed not only to fight hip joint problems, but also to increase level of fitness, muscle strength and flexibility which results in better performance of musculoskeletal system.

## METHODS

The study included a total of twenty three middle-aged participants (age: 49,43±11,88 [y]; height: 1,69±0,08 [m]; weight: 73,08±15,93 [kg]; Body Mass Index (BMI): 25,55±4,1 [kg/m<sup>2</sup>]; examined and supervised

during the training regime in Bialystok University of Technology sports hall, reporting that they would exercise at least two times per week for this study. Before HCP, all subjects were informed about the training protocol and gave their informed consent regarding study procedures. The Physical Activity Readiness Questionnaire (PAR-Q+) was used to provide information relevant to the safety of beginning HCP and to identify known diseases and risk factors for cardiovascular diseases or orthopedic injury [6].

Hip Conditioning Program with rotational movements' duration was 12 weeks and two times a week. The training took place in air-conditioned training room at Bialystok University of Technology sports hall.

HCP training consisted of 3 parts - warm-up, main exercises part and stretching and breathing exercises. Training intensity was set at 60-70 % of maximal heart rate which was calculated with Whaley formula based on the participants' resting heart rate value measured the same day as the exercises were done.

All participants were measured for each of the following components: weight, Body Mass Index (BMI) and height. Participants' weight and BMI index was measured by using Body Composition Analyzer JAWON MEDICAL IOI-353 (Accuniq, South Korea). The subject's body height was measured by using professional scale and stadiometer WPT 100/200 OW (RADWAG Wagi Elektroniczne, Poland).

The assessment of foot load parameters and pain levels was conducted with Footwork Pro capacitive pressure measurement plate (Amcube, United Kingdom) and Standardised Nordic questionnaire about the occurrence of pain in lower back area before and after the HCP training regime.

The collected data was processed with the Statistica 12 program (StatSoft Inc., United States). Foot load parameters were examined with t-test for dependent samples and pain occurrence with Cochran Q test.

## RESULTS

The table 1 shows data for footload parameters of left foot before and after the training regimen. From these data we concluded that footload value after 12-week HCP is statistically significant ( $p < 0,05$ ) between midfoot, lateral and overall footload value after the treatment. The footload in left midfoot load before treatment was 1,64N/cm<sup>2</sup>\*s±0,84 vs 2,12 N/cm<sup>2</sup>\*s±1,21 after treatment, lateral region result was 3,91N/cm<sup>2</sup>\*s±1,4 vs 4,41 N/cm<sup>2</sup>\*s±2,18 and in the overall footload was 3,62N/cm<sup>2</sup>\*s±1,14 vs 3,93 N/cm<sup>2</sup>\*s±1,57.

**Table 1:** T-test for dependent samples - left foot load parameters before and after treatment

Area of interest Left foot	Before exercise		After exercise		N	Diff.	SD (Diff.)	t(23)	df	p	Confidence (-95%)	Confidence (+95%)
	Mean	SD	Mean	SD								
Forefoot	4,31	1,13	4,35	1,21	23	-0,040	0,858	-0,226	22	0,82	-0,411	0,331
Midfoot	1,64	0,84	2,12	1,21	23	-0,473	1,026	-2,214	22	0,038*	-0,917	-0,029
Lateral	3,91	1,40	4,41	2,18	23	-0,503	1,155	-2,088	22	0,049*	-1,003	-0,004
Medial	3,32	1,04	3,44	1,22	23	-0,127	0,450	-1,357	22	0,188	-0,322	0,067
Heel	4,58	1,86	5,09	2,70	23	-0,503	1,165	-2,069	22	0,050	-1,006	0,001
Overall	3,62	1,14	3,94	1,57	23	-0,318	0,674	-2,261	22	0,034*	-0,609	-0,026

N—number of subjects; SD—standard deviation; Diff—difference;

\* $p < 0,05$ , footload unit of measurement - N/cm<sup>2</sup>\*s

**Table 2:** T-test for dependent samples - right foot load parameters before and after treatment

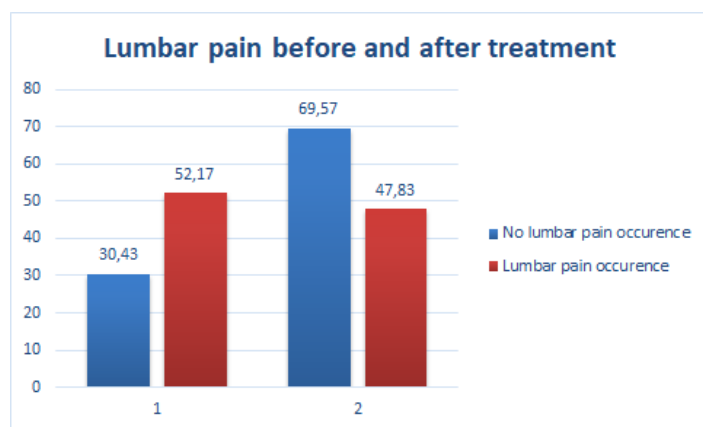
Area of interest Right foot	Before exercise		After exercise		N	Diff.	SD (Diff.)	t(23)	df	p	Confidence (-95%)	Confidence (+95%)
	Mean	SD	Mean	SD								
Forefoot	3,93	0,97	3,90	0,92	23	0,043	0,804	0,259	22	0,798	-0,304	0,391
Midfoot	1,73	0,74	2,15	0,88	23	-0,423	0,579	-3,498	22	0,002*	-0,673	-0,172
Lateral	3,70	1,01	4,03	1,19	23	-0,321	0,506	-3,042	22	0,006*	-0,540	-0,102
Medial	2,95	0,72	2,99	0,81	23	-0,039	0,536	-0,350	22	0,730	-0,271	0,193
Heel	4,08	1,34	4,31	1,46	23	-0,229	0,979	-1,123	22	0,274	-0,652	0,194
Overall	3,34	0,81	3,52	0,94	23	-0,186	0,387	-2,298	22	0,031*	-0,353	-0,018

N=number of subjects; SD=standard deviation; Diff-difference;

\* $p < 0,05$ , footload unit of measurement - N/cm<sup>2</sup>\*s

Table 2 presents data from right foot baropodographic evaluation, results are similar as in the left foot - results were observed at baseline in midfoot, lateral side of foot and overall footload. The footload in right midfoot load before treatment was 1,73N/cm<sup>2</sup>\*s±0,74 vs. 2,15 N/cm<sup>2</sup>\*s±0,88 after treatment, lateral region result was 3,7N/cm<sup>2</sup>\*s±1,01 vs. 4,03 N/cm<sup>2</sup>\*s±1,19 and in the overall footload was 3,34N/cm<sup>2</sup>\*s±0,81 vs. 3,52 N/cm<sup>2</sup>\*s±0,94.

Figure 1 presents difference in percentage of pain occurrence before and after HCP in the lumbar region evaluated with Cochran Q test. After 12-week program there was decrease by 21,74% in pain occurrence in the lumbar region.



**Figure 1:** Lumbar pain occurrence before and after HCP program with hip traction

## DISCUSSION

Most previous studies regarding the management of chronic LBP recommend multidimensional approach consisting of many forms of physical therapy like exercises, manual therapy, but also education and prophylaxis. In the article from 2018, the researchers were analyzed how exercise therapy could prevent the incidence of LBP, the results shows that exercises on its own was able to decrease the risk of LBP incidents by 33% [7]. Strengthening with stretching or aerobic exercises when performed two to three times weekly could be used for the prevention of LBP in the general population. It stands in line with our findings – pain occurrence was reduced by 21,74% after 12 weeks and participants reported better fitness and mobility.

Meta-analysis from 2012 concerning exercise therapy protocol for chronic LBP provide information that exercise therapy appears to be effective in slightly decreasing pain and improving function in adults

with pain problems in low back region [8]. HCP program consists exercises which are crucial for stabilization of body. After the training regime participants has more even foot load than before intervention, especially in the midfoot, lateral and overall feet region in both of feet (e.g. midfoot region in the left foot before and after therapy - 1,64N/cm<sup>2</sup>\*s±0,84 vs 2,12 N/cm<sup>2</sup>\*s±1,21, right foot - 1,73N/cm<sup>2</sup>\*s±0,74 vs. 2,15 N/cm<sup>2</sup>\*s±0,88 were  $p < 0,05$ ). In the 2005 article it was noted that stabilization exercise could be used in LBP management with benefit [9]. In the article from 2018, researchers find that spinal traction caused slight decrease in pain levels from 7 to 5.44 points in patients with lumbar pain problem, however there are number of articles which do not recommend spinal traction due to insufficient data about its efficiency [10]. In this research data shows slightly decreased pain levels in the lumbar region after 12-week course of regimen. However, there is need evaluating long term efficacy in this matter.

Observational study published in 2020 were active nurses were evaluated for pain problems and how feet responded in baropodometric examination when the complaint of pain either in lumbar or cervical spine was reported. Results show that there is an asymmetry in the load of the metatarsal heads (IV and V head) between the left and right foot ( $p = 0.000$ ) and there was also an asymmetry in the lateral part of the left and right heel ( $p = 0.028$ ). They found also correlation between complaints occurring in the cervical spine area and loading of the lateral arch of the right foot ( $p = 0.032$ ) and also in the lumbar spine area ( $p = 0.045$ ) [4]. In our study we found that HCP is helpful in aligning the footload parameters and improving feet functioning and thus better mobility.

However, in the article from 2013, researchers presented results where asymmetry in the foot posture or feet function was not significantly associated with LBP. Foot posture showed no association with pain in the lumbar region. However, pronated foot function was significantly associated with LBP in women (odds ratio [OR] = 1.51, 95% confidence interval [CI] 1.1 to 2.07,  $p = 0.011$ ) and this remained significant after adjusting for factors comprising of age, weight, smoking and depressive symptoms (OR = 1.48, 95% CI 1.07 to 2.05,  $p = 0.018$ ) [11]. Pronation of the foot is causing more load in medial region and less load in lateral area so we can make an assumption that HCP regimen due to improving load of lateral side of foot could lessen pain in lumbar region of the spine.

## CONCLUSION

HCP could be beneficial in people with chronic low back pains. Moreover, HCP causes increase of the pressure on the lateral side and on the midfoot area. In consequence it will abolish the increased

pressure on the longitudinal arch of the foot, which will reduce the potential valgus of the ankle joint. That may project on the entire lower limb and its joints, among others reducing increased tension of the extensor muscles of the fingers and toe and overloading posterior tibial muscle. However, it needs further research to carefully assess the degree of changes.

HCP resulted in alleviating pain and due to better stabilization of core muscles it resulted in better functioning and mobility.

Due to accessible exercises HCP can be also used in' home as form of regular exercise regime to maintain outcomes of program and as a form of prevention.

### Conflicts of interest

None.

### REFERENCES

1. Chou R. Low back pain (chronic). *BMJ Clin Evid*. 2010, 8:2010-1116.
2. Fatoye F, Gebrye T, Odeyemi I. Real-world incidence and prevalence of low back pain using routinely collected data. *Rheumatol Int*. 2019, 39(4):619-626. doi:10.1007/s00296-019-04273-0
3. Qaseem A, Wilt TJ, McLean RM, et al, for the Clinical Guidelines Committee of the American College of Physicians. Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline from the American College of Physicians. *Ann Intern Med*. 2017, 166:514-530. doi: <https://doi.org/10.7326/M16-2367>
4. Kołcz A, Główska N, Kowal M, Paprocka-Borowicz M. Baropodometric evaluation of foot load distribution during gait in the group of professionally active nurses. *J Occup Health*. 2019, 62(1). doi: 10.1002/1348-9585.12102.
5. Zuzda GJ, Latosiewicz R, O'Hara K, Esteves D, Bras R. Effects of Rotational Exercise on Fitness Training. *Med Sci Sport Exerc*. 2013, 45(5S): 2798, 661.
6. Bredin Shannon SD. PAR-Q+ and ePARmed-X+ New risk stratification and physical activity clearance strategy for physicians and patients alike. *Can Fam Physician*. 2013, 59(3): 273-277.
7. Shiri R, Coggon D, Falah-Hassani K. Exercise for the prevention of low back pain: systematic review and meta-analysis of controlled trials. *Am J Epidemiol*. 2018, 187(5):1093–1101. doi: 10.1093/aje/kwx337.
8. Hayden JA, Cartwright JL, Riley RD, Vantulder MW, Chronic Low Back Pain IPD Meta-Analysis Group. Exercise therapy for chronic low back pain: protocol for an individual participant data meta-analysis. *Syst Rev*. 2012, 1:64. Published 2012. doi:10.1186/2046-4053-1-64
9. Hicks GE, Fritz JM, Delitto A, McGill SM. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Arch Phys Med Rehabil*. 2005; 86:1753-1762. doi: 10.1016/j.
10. Shalaby AS, El-Sharaki DR, Salem GM. Anxiety, depression, and quality of life in backache patients before and after spinal traction. *Egypt J Neurol Psychiatr Neurosurg*. 2018, 54(1):44. doi:10.1186/s41983-018-0048-5
11. Menz HB, Dufour AB, Riskowski JL, Hillstrom HJ, Hannan MT. Foot posture, foot function and low back pain: the Framingham Foot Study. *Rheumatology*. 2013;52(12):2275-82.

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