Pilates for runner

Key role of the supporting muscle and how Pilates can help performance and prevent injury

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ABSTRACT

There is a reported 2m people running in the UK and an estimated 10m in the US. Running is becoming increasingly popular and fast becoming one of the most popular form of exercise. Running fits easily into modern life when you can just put on your shoes and go without require anything else.

However to put the best chances on your side and prevent injuries you need to have more than just cardiovascular fitness. In this paper we will look at how Pilates can be use as a cross training method and how it can have a positive impact on running performance and injury prevention.

We will first look at the anatomy of a runner and what movement happens when we run. When it is obvious that the main muscles use in running include the gluteal, the quadriceps, the hip flexors, the hamstrings and the calf muscles, in this paper will take a closer look at the role of the supporting muscle, the core. We will look at how providing more stability, mobility, flexibility and balance can have an impact on running abilities.

We will then apply our findings on a female client keen road and trail runner and see how after a 30 weeks program she gain in core strength, stability, mobility, flexibility and balance and the impact on her running.
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1. ANATOMY OF A RUNNER’S BODY

The main running muscles include the quadriceps, hamstrings, gluteal, hip flexors and calf muscles.

**The Quadriceps** – They consist of a group of four muscles (The vastus Medialis, Intermedius, Lateralus, Rectus femoris) and run from the hips and upper femur down to the patella. When you move your leg forward you are primarily using the quadriceps. The four muscles of the quadriceps work together to bend and extend your knee when running (or walking)

*Source: The concise book of muscles, Chris Jarmey, second edition, p. 166*

**The Hamstring** – The action switches from the quadriceps to the hamstrings as your body moves forwards. The hamstrings are made up of four muscles parts (The biceps femoris long head and short head, the semitendinosus and the semimembranosus) and run from behind the knee to the hip.

*Source: The concise book of muscles, Chris Jarmey, second edition, p. 156*
**The Gluteal** – They consist of a group of three muscles, the gluteus maximum, medius and minimus and are located in the buttocks. They are in charge of hip extension and play a vital role in spinal and pelvic stabilisation. They also are an important source of power when running.

*Source: The concise book of muscles, Chris Jarmey, second edition, p. 154*

**The hip flexors** – located on the front of the hip they are made of two muscles (iliacus and the psoas major). They enter into action when lifting the leg. The psoas major is the largest of the muscles stretching from the T12 to the L5 and it attaches to the femur.

*Source: The concise book of muscles, Chris Jarmey, second edition, p. 78*

**The calves** – located on the back of the lower leg below the knees, they provide spring in steps as they help in pushing off the ground to move forward.

*Source: The concise book of muscles, Chris Jarmey, second edition, p. 176*
The assistant muscles are the core muscles and include the abdominals, the back extensors, the pelvic floor and the diaphragm.

**The abdominals** - There are four layers of abdominals, the rectus abdominis, the internal and external obliques and the transversus abdominis, the latter (TVA) being the most important in term of spinal support. This muscle runs from the ribcage to the pubis.

![Abdominals Diagram](image1)

*Source: Pilates for rehabilitation, Samantha Woods, figure 3.1 p.24*

**The back extensors** - The back extensors muscles as the abdominals are arrange in layers and include the erector spinae, semispinalis and deep posterior group with the multifidus being key for spinal stabilisation. All this muscles are involved in providing strength and stability to the core.

![Back Extensors Diagram](image2)

*Source: Pilates for rehabilitation, Samantha Woods, figure 3.2 p.25*
The pelvic floor muscles – The pelvic floor muscles provide a sling of support for the inner viscera and adapt to the changes of internal pressure of the abdominal cavity. When recruited they increase intra-abdominal pressure and thus unloading the spine.

Source: Pilates for rehabilitation, Samantha Woods, figure 3.3 p.25

The diaphragm – This muscle is responsible for drawing air into the lungs. The co-activation of the diaphragm, abdominals muscles and pelvic floor increase the abdominal pressure, thus assisting in the mechanical stabilisation of the spine.

Source: Pilates for rehabilitation, Samantha Woods, figure 3.4 p.25
2. **ROLE OF THE ASSISTANT MUSCLES IN RUNNING**

“Trying to generate force in any direction with a weak core region, is like trying to fire a cannon from a canoe” kinetic-revolution by James Dunne

In order to keep all the right muscles firing in harmony and that the force produced to run goes where we want we need a strong and stable base. This is vital for a runner’s form and efficiency of movement. So even though the muscles of the legs are the source of power, the assistant muscles are the critical foundation from which all movement starts.

An optimal core function will also improve our spinal alignment and pelvic stability having a direct impact on movement patterns thus reducing the risks of injuries. Running is such a repetitive movement that imbalance and bad movement pattern can lead to injury.

Furthermore strength and stability in the core will also help avoiding excessive forward lean that can put undue pressure on the lower back. Better posture when running will then protect our lumbar spine from the impact of running.

Thus taking the time to improve strength, stability and mobility of the assistant muscles in running can have a direct impact on efficiency, performance and prevention of injury.

“The stronger your core, the more solid you are as you hit the ground,” explains Jack Daniels, Ph.D., exercise physiologist for the Nike Farm Team. “That reduces your need for unnecessary stabilization, and allows you to be a more economical runner.”
3. **CASE STUDY**

Kim a 35 years old woman has been running for over 10 years, completed several road races and trail races. She is overall healthy, strong and active enjoying swimming, cycling, hiking on top of her running.

Kim has been practicing Pilates on and off for over 5 years. It is only recently that she regularly been joining my Matwork class on a weekly basis. Seeing the benefit of her practice she wanted to take it a step further by coming in the studio and using the apparatus. I designed a program for Kim focusing on the assistant muscles. Kim being a strong woman, she has a lot of power in the legs however she could benefit from a conditioning of her core. Her body is tight and imbalance, she also frequently suffers from lower back pain that often happen following a run. While still working the whole body Kim’s plan will be also focusing on strength, mobility and stability of the core region with the objective of making her stronger and more stable but also with the objective to improve her mobility and range of movement.
## CASE STUDY

<table>
<thead>
<tr>
<th>BASI Block system</th>
<th>Session 1-10</th>
<th>Reason and Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warm up</strong></td>
<td>Fundamental BASI warm up: - Pelvic curl - Spine twist supine - chest lift - Chest lift with rotation</td>
<td>Pelvic curl and spine twist to start moving the spine in flexion and rotation and allowing the hips to open.</td>
</tr>
<tr>
<td><strong>Footwork</strong></td>
<td>Reformer</td>
<td>Working on pelvic-lumbar stabilisation as well as the alignment of the feet, ankles and knees</td>
</tr>
<tr>
<td><strong>Abdominals</strong></td>
<td>100s &amp; short box</td>
<td>Strengthening the abdominals and back extensor (flat back and climb a tree). Climb a tree also stretches the hamstring.</td>
</tr>
<tr>
<td><strong>Hips</strong></td>
<td>Basic leg spring series</td>
<td>Working on strength and flexibility of the hip joint while developing pelvic-lumbar stability. Dissociation of the legs moving while the pelvis stay in neutral.</td>
</tr>
<tr>
<td><strong>Spinal Articulation</strong></td>
<td>Bottom lift - with extension</td>
<td>Working on spinal mobility and pelvis stability while strengthening gluteal and hamstring</td>
</tr>
<tr>
<td><strong>Stretches</strong></td>
<td>Kneeling lunge</td>
<td>Improving hip flexor and hamstring flexibility</td>
</tr>
<tr>
<td><strong>Full Body Integration</strong></td>
<td>Knee stretches - Round back - Flat back</td>
<td>Working on disassociation between the trunk and the legs. It also strengthen the hip extensors and abdominals</td>
</tr>
<tr>
<td><strong>Arms</strong></td>
<td>Kneeling arm series</td>
<td>Developing trunk stabilisation while working on the arms</td>
</tr>
<tr>
<td><strong>Full Body Integration</strong></td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Legs</strong></td>
<td>Side split / single leg skating</td>
<td>Strengthening the glutes medius and hip abductors and adductors. Both exercises also focus on pelvic-lumbar stability</td>
</tr>
<tr>
<td><strong>Lateral flexion/rotation</strong></td>
<td>Mermaid</td>
<td>Working on spinal mobility (lateral flexion and rotation) as well as abdominals strength with oblique emphasis</td>
</tr>
<tr>
<td><strong>Extension</strong></td>
<td>Breaststroke prep</td>
<td>Working the back extensor and develop abdominal control in a prone position</td>
</tr>
<tr>
<td>BASI Block system</td>
<td>Session 1-10</td>
<td>Reason and Observation</td>
</tr>
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<td>------------------------</td>
</tr>
</tbody>
</table>
| Warm up           | Intermediate BASI warm up: - Roll up  
|                   | - Spine twist supine  
|                   | - Double leg stretch  
|                   | - Single leg stretch  
|                   | - Criss cross  
|                   | Warming up and awaking the deep abdominals muscles |
| Footwork          | Cadillac  
|                   | Tracking the knee and ankle and working on hamstring strength and stretch |
| Abdominals        | Roll up with RUB & Breathing  
|                   | Working the abdominals and spinal articulation. Breathing also works on balance and breathing. |
| Hips              | Basic leg springs - Frog  
|                   | - Circle down, up  
|                   | - Walking  
|                   | - Bicycles  
|                   | Improves hip disassociation and strengthen hip and hamstring. Great to address any imbalance between legs (two separate spring) |
| Spinal Articulation | Monkey  
|                   | Working on abdominals control and spinal mobility. It is also a great dynamic stretch for hamstring and calf. |
| Stretches         | Ladder Barrel stretches - Hamstring stretch  
|                   | - Gluteal stretch  
|                   | - Adductor stretch  
|                   | - Hip flexor  
|                   | Working on increasing flexibility |
| Full Body Integration | Sitting forward  
|                   | Kneeling cat stretch  
|                   | Working on abdominal control and strength as well as spinal mobility. With sitting forward we also stretch the hamstrings while kneeling cat stretches the shoulder |
| Arms              | Arm standing series  
|                   | Developing trunk stabilisation while working on the arms |
| Full Body Integration | NA  
|                   | N/A |
| Legs              | Leg press standing  
|                   | Teaching functional movement of the leg, improving balance and correct muscles recruitment patterns. We also work on disassociation of the leg from the rest of the body. |
| Lateral flexion/rotation | side stretch  
|                   | Working on abdominal with oblique emphasis with a lateral flexor stretch |
| Extension         | Swan Basic  
<p>|                   | Strengthening the back extensor while controlling the abdominal and keeping the scapular stable |</p>
<table>
<thead>
<tr>
<th>BASI Block system</th>
<th>Session 20+</th>
<th>Reason and Observation</th>
</tr>
</thead>
</table>
| Warm up           | Intermediate BASI warm up:  
- Roll up  
- Spine twist supine  
- Double leg stretch  
- Single leg stretch  
- Criss cross | Warming up and awaking the deep abdominals muscles |
| Footwork          | Wunda Chair | Keeping the trunk stable and neutral while working on hip, feet, ankle and knee strength and control. Calf raise works on strengthening the calves while stretching them. |
| Abdominals        | Standing pike  
Cat stretch kneeling  
Torso press sit | Working on the abdominals and back extensor control and strength. Standing pike and cat stretch also increase lumbar flexibility by stretching the lower back. |
| Hips              | Single leg supine series  
- Frog  
- circle down, up  
- Hip extension  
- Bicycles | Improve hip disassociation and strengthen hip and hamstring. Working one leg at a time also outline any imbalance between legs and hip extensor. |
| Spinal Articulation | Tower prep | Working on spinal articulation and abdominals while stretching and controlling hamstring. |
| Stretches         | Full lunge | Hip flexor stretch and hamstring stretch while keeping pelvis stable. |
| Full Body Integration | Up stretch I & II | Working on abdominals and back extensors strength while improving hamstring and shoulder flexibility. |
| Arms              | Rowing back I & II | Working on abdominals and back extensor control as well as shoulder mobility. |
| Full Body Integration | Balance control front | Working on trunk and scapular stabilisation while strengthening the abdominals. |
| Lateral flexion/rotation | Side over on box | Working the abdominals with oblique emphasis. |
| Extension         | Pulling strap I & II | Working the back extensor while working on shoulder strength and movement mechanics. |
5. **CONCLUSION**

Within 4 months with an average of 2 Pilates sessions a week, Kim has noticed a difference in her running as well as in her daily life.

She is more aware of her core and posture in her daily life and when she runs. This had a positive impact on her lower back pain. She also noticed less tightness in her hips and hamstring. She is feeling more stable as she run especially in term of pelvis stability making her feel stronger and more efficient when she runs.

The results are encouraging and Kim will carry on with regular sessions at the studio giving us the opportunity to continue working further and addressing other part of the body that can benefit her running.
6. **BIBLIOGRAPHY**

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