

**RUN, BUT WHAT IN?  
VALUE ANALYSIS OF RUNNING SHOES USING INSOLES MADE OF  
INNOVATIVE MATERIALS AND INNOVATIVE PROCEDURES**

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## **INTRODUCTION**

Researches indicate that today's hectic world puts more and more emphasis on retaining our health. In order to remain healthy, it is essential to do regular physical exercises, which is the key to mental and physical freshness. More and more people want to move more all over the world, the cheapest way of which is running. If we want running to truly strengthen our health, we need to do it using the right technique and equipment. Medical science has proven that physical exercise made under improper conditions may actually worsen our physical conditions. In our research, we were examining those ergonomic characteristics of sports shoes which are indispensable for running. Based on consumer reports and long-term medical experience, we were focusing on the sole part, more precisely, the insole. Our research indicated that many consumers choose either cheap or aesthetically pleasing shoes for sport, although the product may prove to be inadequate once they start using it. All the experience and research accumulated by experts indicate that most of the pain, symptoms and complaints concerning the feet boil down to sole structure which does not fit the general arch of the foot. Even though forming the right sole structure from quality material is not cheap, it is still worth it in the light of long-term use and possible medical consequences.

## **PRE-RESEARCH STAGE**

The internationally famous Biomechanics Laboratory of the Faculty of Physical Education and Sports Sciences at Semmelweis University, Budapest has been conducting researches and surveys with the help of consumers and sportsmen for years.

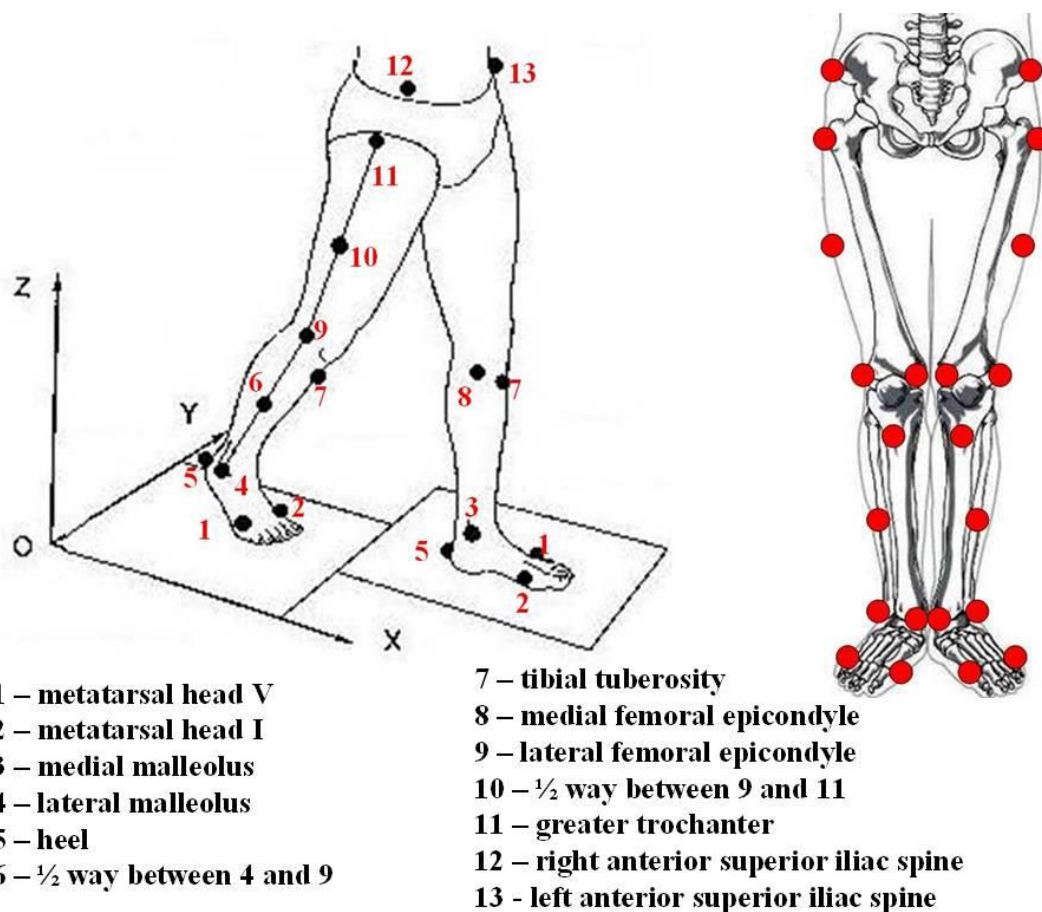
*The researches concerning running shoes include the following areas and goals:*

- Examining the running shoes with a biomechanical approach to find out their effects on the lower limbs
- Revealing the consequences of wearing special sole-structured running shoes
- Verifying the differences between the running shoes included in the research and the inferior quality products of a competitor
- Revealing the direct effect of the special sole-structured running shoes on the muscle groups of the lower limb during regular-speed running.

The above researches were focused on a group of 32 healthy average-sized men and women who made average physical activities. The researches concentrated on the functionality of the examined

running shoes during running, taking into consideration both medical recommendations and consumer demand (Age: 28.8+/- 8; height: 172.2+/- 6 cm; weight: 66.15+/- 11.1 kg.)

The researches were conducted with the APAS (Ariel Performance Analysis System) program, and they were recorded with four JVC GR-DVR 9800 digital cameras. The applied statistical method was the student's test which compared the original recorded and the projected relative values and variables of the examined running shoes.



Picture 1. Reflective Marker of a Modified Body Model

Source: [enquist.hu/files/imov.ppt](http://enquist.hu/files/imov.ppt) (11.15.2015)

*The results of the laboratory examinations were the following:*

- During the same amount of support phase, the application of the running shoes resulted in greater movement range in the knee and smaller range in the ankle.
- At the moment of heel contact, the lower quality running shoes with their more rigid sole structure showed greater temporary angle speed, which was explained by the passive "impact" of the foot.
- The torque of the shank was significantly lower while wearing the examined running shoes in its average, as well as its maximum, value.
- The movement range of the ankle joint is smaller, while the movement range of the knee joint is higher when wearing the examined running shoes as opposed to the inferior quality shoes.
- The torque of the shin during running in the examined running shoes is lower than in traditional shoes, which reduces the tension in the ankle and the knee.

The above results of the research and the consumer reports served as the basis of the Value Analysis research of our running shoes. The results of the Value Analysis also indicated to us that the next phases of the research should focus on the sole section of the running shoes, while we should also consider the possibilities of product development, innovative technologies and the inclusion of modern medical materials.

## PROJECT AIMS

The aim of our research is to improve the sole section of the currently examined running shoes as well as to find innovative solutions using the current results of Value Analysis.  
Our goal is to find the price/value proportion which is optimal for the consumer and provides the right quality level while properly satisfying their demands.

## CONSUMER DEMANDS CONCERNING THE SOLE SECTION BASED ON PRELIMINARY RESEARCH

- It should fit the foot
- It should suit the type of sport
- It should be light, thin and functional
- It should meet current standards
- It should be functionally durable
- It should protect the foot
- It should enhance performance
- It should correspond to the bio-mechanics of running shoes
- It should be skin-friendly and easy to wash
- It should provide a solution to foot problems even while doing sport

## PARTS OF EXAMINED SHOES

RUNNING SHOE STRUCTURE	PRICE (HUF/P)
SOLE	7 000
AIR CUSHION	4 500
INSOLE	10 000
UPPER PART	5 000
TONGUE	3 000
SHOELACE	500
	30 000

Chart 1. Parts of the Examined Shoes  
Source: own material

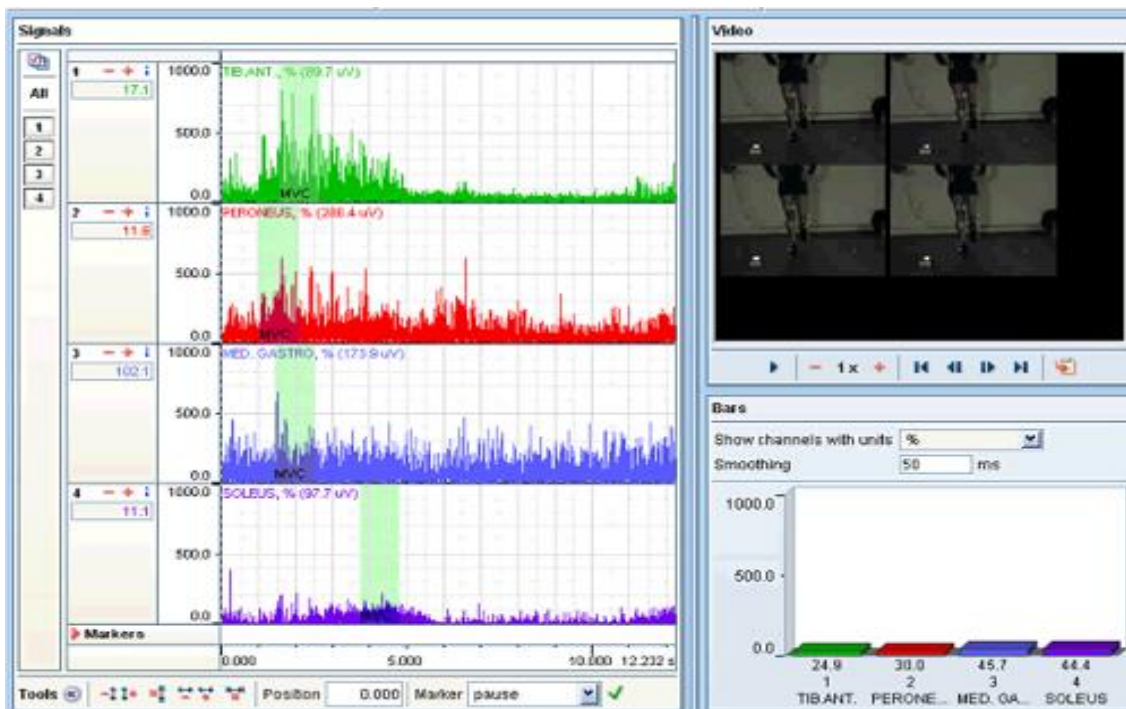
Following the examination of the product component and the consumer reports, we started a well-grounded research of the area in question. Based on various consumer demands and their ranking, it became clear that the users of running shoes primarily concentrated on the function supporting the arch of the foot, and this was the main demand to be satisfied on a proper level. Based on the experience and report of orthopedic surgeons and rheumatological head physicians, improperly made

sole sections of running shoes do lead to severe traumas on the spine, waist as well as the areas around the ankle and the knee. While evoking these negative effects during running, we also risk serious health problems in the short and long term alike. Regarding the insole, it could be said that on the one hand, it is the most expensive part of the examined running shoes, while on the other hand, this is functionally the most important part of the product in terms of comfort, long-term effects and wearability.

DEMANDS		FUNCTIONS
Comfortable	→	Fits Shoes
Durable	→	Resists Tension
Vents Properly	→	Ensures Ventilation
Water-Resistant	→	Protects Joints
Supports Foot Arch	→	Holds Foot Arch
Easy to Clean	→	Protects from Injury
Ensures Adhesion	→	Sticks to the Ground

Chart 2. Demand-Function Relationship

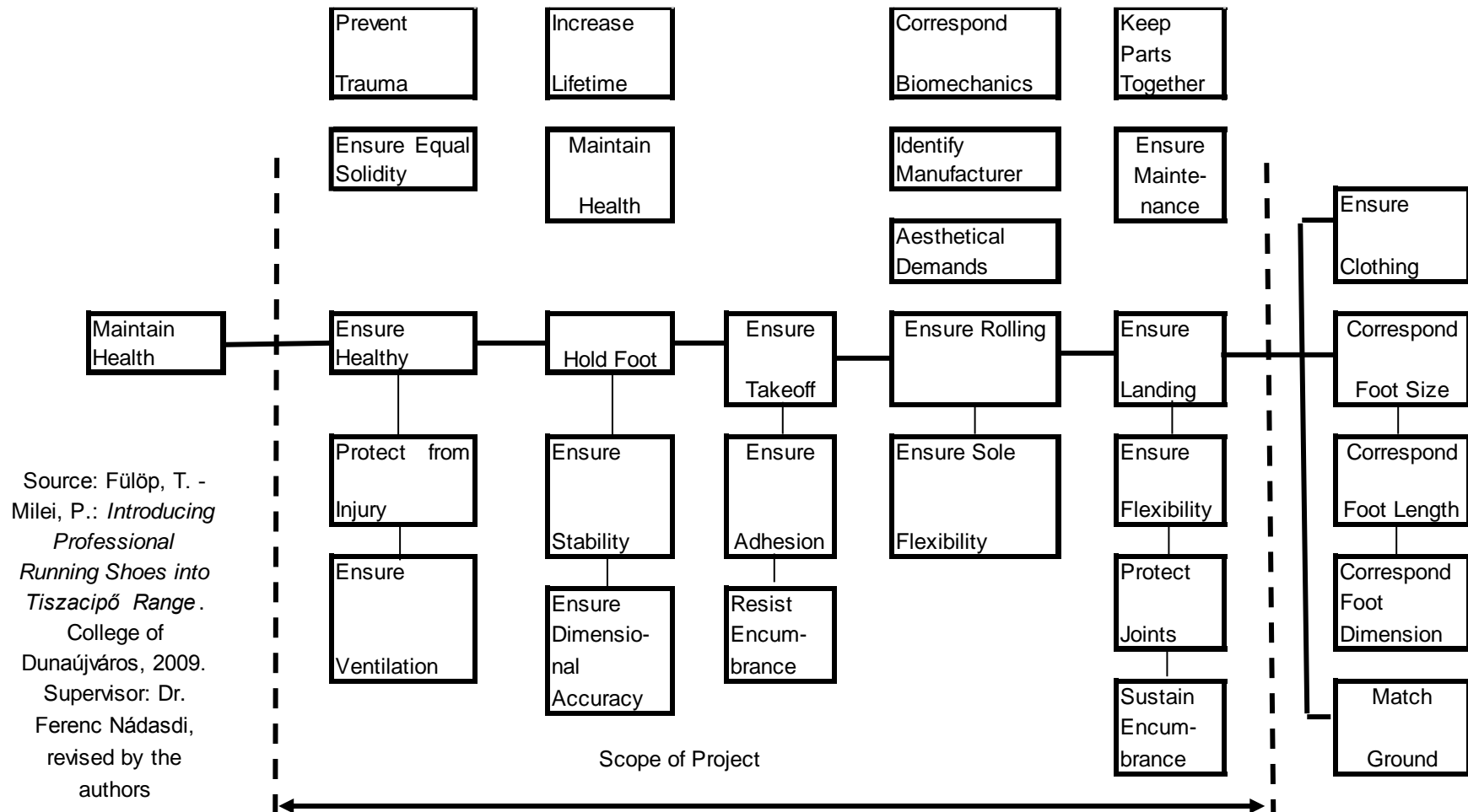
Source: own material



Picture 2. Examined Movement at Normal Running Speed

Source: [enquist.hu/files/izomaktivitas\\_vizsgalata.ppt](http://enquist.hu/files/izomaktivitas_vizsgalata.ppt) (15-11-2015)

The FAST Diagram of the running shoes is shown in Chart 3. We considered it important to model the footwear because the role of the sole section within the whole footwear itself can be presented better.



Picture 3. FAST Diagram

## SUGGESTIONS

Based on the results of the analysis, we can say that the examined running shoes, especially their sole section, must undergo technological improvement in terms of the current procedures as well as the materials used. To create the proper sole component, we recommend insoles produced by CAD technology. This way, the analyzed running shoes would meet the medical conditions set by doctors while also completely satisfying consumer demands. Milled Sport is a sports insole brand created by innovative CAD-technology. They are easy to carve and are adaptable, with three or four separate layers built in. These unique sports insoles reduce sport-specific tension and the burden on special pressure points. They divide body weight optimally, and take burden off the entire muscle and bone system. Three-dimensional CAD is a new-generation, digital, virtual and intelligent planning platform. It is an important tool to use new innovative procedures during the production of insoles. 3D CAD is used not only to design proper, user-friendly, insoles, but also in the fields of aviation, space exploration, car industry and ship production. Regarding the material used in insoles, we recommend the TRlactive RUN sports insole brand. This insole was specifically designed with repeated encumbrance and running movement in mind, taking into consideration the demands of the heel encumbrance, standing and leaning forward phases. The joints in the leg receive multiplied tension during running. When we change to running from walking, the forces affecting the leg increase significantly, as it was proven by the researches conducted by Semmelweis University. Every single step made in running means that the ligaments have to bear twice or three times the weight of the runner. All this tremendous force has to be borne by the leg. The TRlactive RUN sports insole was designed to reduce the incoming force during landing, rolling and leaping ([www.lbt.hu/sportbetetek](http://www.lbt.hu/sportbetetek)).

## EXPECTED RESULTS

Regarding physiological effects, the following results are predicted after the development of the examined product:

- retaining health and the prevention of static problems, therapies and pain connected to flatfoot and muscle weakness
- after introducing the recommended insole and its technological procedures, the encumbrance on the ankle and its connecting joints is smaller than in running shoes with traditional insole, owing to the smaller angle turns of the ankle joint
- the application of the innovative 3D CAD technology in producing insoles in the examined running shoes reduces tension in the ankle and the knee
- the passive movement system (lower limb, spine) is relieved.

As part of the analysis and the results, it must be mentioned that the development of the examined product involves increased costs on the part of the manufacturer. However, after taking into consideration the increase in the quality of the product and the consequent increase in the fulfillment of consumer demands, we can be sure that the consumers will attach a bigger price/value proportion to the product. This also means that within the context of function/cost=value, the value of the product is expected to increase with the enhanced function performance. Market researches indicate that a significant portion of the users are ready to pay higher prices for a better quality product. We also see possibilities of marketing the new insoles in several other countries as well.

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