Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XV, ISSUE 2 Supplement, 2015, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

Science, Movement and Health, Vol. XV, ISSUE 2 Supplement, 2015
September 2015, 15 (2, Supplement): 455-461
Original article

PARTICULAR ASPECTS OF TRAIL RUNNING AND THE SOMATO - FUNCTIONAL AND MOTRIC PROFILE OF PRACTICANTS

MOCANU PETRONELA[1], LORAND BALINT[1]

Abstract

Aim. The research aims to highlight the biological aspects that define trail running execution from the perspective of relevance indicators required somatically, functionally and motrically so that, based on the obtained data, to outline a practicant profile in order to serve as a methodological benchmark guidance to those who coordinate the process of specific and specialised sports training.

Methods. I used tests focused on somatometric, functional and motric measures in order to obtain the survey data,, which I applied to a number of 10 performance athletes from Romania, of whom 5 females and 5 males. I compared the collected data with those presented in some studies publicated internationally, with the aim of highlighting the differences - regarding investigated plans - between romanian and foreign practicants with a competitional experience recognised in Europe.

Results. The comparative results of the group formed by romanian subjets, practicants of trail running, with the model profile having at base data of an athlet of certain international value, highlight - generally - a superior adaptability level of his body, as well as the specialisation of some of his motricity components in relation to varied conditions required by performing trail running.

Conclusions. Trail running particularities, require from athletes major transformation in the level of motric and somato-functional capacity, aspect that should be taken into consideration by coaches that are involved in specialised athletic training.

Key words: trail running, somato-funtional parameters, specific motric capacity, training model

Introduction

In performance sports, both quantitative and qualitative characteristics, either objective and/ or subjective, reunited in the motric and somato-functional profile of the practicant, representing one of the important operational references for the instruction process.

At a summary analysis, trail running requests a transfer of the athlet who practices middle and long running - meaning that it is capable, while running, to sustain specific andurance effort - from a medium set up after a location such as a stadium or road to a mountain.

In reality, particularities of race itineraries, the medium where trail running is executed, as well as the official rules of different competitions (distances to be covered, difficulty of itinerary, inclination diferrences, the existance of marked and unmarked routes, age categories etc.), are the same number of variables that influence essential ellemets that an athlet, who approaches this type of motric activity, should posses. Therefore, in case of this sport disciplines, the raport between alternating ascending sequences with flat and descending, the diversity of running surfaces consistencies, as well as the variety of climatic conditions, determine the profile on which the athlet should gain progresively, through a guided action, specialised.

Due to the complexity of sustained physical effort, athlets who execute this type of sport disciplines, are strong people, capable to permanently adapt their body, to ease somato-functional parameters, in order to build a flexible and individualised, as well as phisically constant focused on the harmonisation of the sensation of biological pain, with the need indispensably refelt, to go over inerent difficulties, that natural and competitional environment impose (http://www.wmra.ch and http://www.fra.ro/fisiere/1424341060.pdf).

Regarding particularities of running, as a basic motric expression in the given context, we distinguish:

- In descending movement sequences, an increasing force occurs at the contact between foot and the contact surface, fact signaled not only in the breaking phase, but also in the

[1] Transilvania University of Brasov, Faculty of Physical Education and Mountain Sports, ROMANIA
E-mail address: mocanu.petra@yahoo.com
Received 20.03.2015 / Accepted 17.04.2015

impulsion phase. As a consequence, the neuro-mio-artrokinetic request level is very high and necessitates a specific capacity, customised and and individualised of the athlet's, concerning amortisation/ brake of developed shock absorbtion. Corporal position present a permanent change of the mass center and arms have a balancing role when changing the running trajectory. At muscular level, this type of motric action realises an excentric contraction, fact for which, the usage level and muscular pain is high.

- In the descending running phase, at the trunk muscles level, a static force it is present, while muscles from the inferior limbs realise izotonic slow and fast contractions. This type of effort, induces an increased fatigue level (Horvaisa,. Giandoliniab, 2013, pag 26).

Regarding biomecanics, this type of running keeps specific phasis of running on plane surface (contact phase, rolling, propulsion/ impulsion and swing phase), however with the mention of existing a permanently adaption to the permanent route particularities, which in turn correlates, with morpho-functional profile of the individual. So, motric action modifies somehow its structure in case of running on varried surface and the higher is the inclination level, the more the neuro-mio-kinetic usage level increases (in the acceleration and muscular impulsion phasis there are contracted, while in the breaking phase, tendons and muscles combine contraction properties with elasticity ones. (http://en.wikipedia.org/wiki/Level_and_incline_running).

As anatomico-functional aspects, Castillo Montes, (2013, pp. 5 - 10), points out that trail running engages in effort muscular chains through isotonic contractions, concentric, excentric and isometric (in descending sequences), negociating optimal functional relationships between agonist and antagonist muscles (stabilisers, fixers and synergists). At the level of lower limbs, the involved muscles on flat running segments are hip flexors and knee extensors (psoas iliaque, quadriceps); hip extensors and dorsal flexors (large glutes, harmstrings); adductor and abductor muscles (medium glutes); ankle extensors and dorsal flexors (sural triceps, posterior tibial, peronier); dorsal ankle flexors (anterior tibial, quadratus lumborum). The muscles involved in ascending phase, are hip flexors and knee extensors (psoas iliaque, quadriceps); hip extensors and knee flexors (large glutes, harmstrings); adductor and abductor muscles (medium glutes); ankle extensors and plantar flexors (sural triceps, posterior tibial, peronier); ankle flexors and dorsal flexors (anterior tibial). In the descending phase, the following muscles are involved: hip flexors and knee extensors (psoas iliaque, quadriceps); hip extensors and knee flexors (large glutes, harmstrings); adductor and abductor muscles (medium glutes); ankle extensors and plantar flexors (sural triceps, posterior tibial, peronier); ankle flexors and dorsal flexors (anterior tibial).

Lower limb joints are subject to permanent adaption to environment variation, through an absortbtion action of the shocks specific to this type of effort, while ligaments have an adjusting role for mio-articular activities.

Trunk muscles that act in the trail running effort is represented by: anterior serratus that participates in the inspiration phase, lifts the ribs and assures an increase in elasticity to the thoracic cage; latissimus dorsi muscle, that realises arm actions (intern rotation, adduction and extension) and extension of the dorsi-lumbar area; pelvis and lumbar muscles, which intervene in the exhaling phase, lift the pelvis and produces lateral inclination; abdominal muscles (rectus abdominis which realise trunk flexion and descends the anterior pelvis, transverse abdominus and obliques); lumbar extensors, that assure the sustainment of trunk posture (Castillo Montes, 2013, p. 63).

The somato-functional profile complexity of the trail running athlet, is highlighted through a specialised panel, which includes optimal weight, height and perimeter muscular indexes. The tonicity and trophicity muscular level is increased and due to specialised offorts, red muscular fibers are developing, but with a powerful capacity of contraction, on the background of motric specific force quality requested.

As functional aspects, there are highlighted decreased values of the pulse in clinostatism - at wake up - and afterwards, in orthostatism, while in the effort it manifests a powerfull capacity of cardiovascular recovery and optimal pulse, with value betweem 160-180 p/min. Blood presure changes once with altitude increase and respiratory frequency is influenced directly by the cardiac frequency, fully exploating elasticity of the thoracic cage.

As a particular aspect of trail running, Saunders, Philo et al., (2012 pp. 465-485) mention that an economic rolling in the excentric contraction phase

(stretching), produces an optimal relationship of balance between O_2 consumption as a reaction of respiratory changes and body mass index. Not only biomechanic factors, but also phisiologica ones, influence economic behaviour in performance sport, as weel as muscular metabolic adaptations. A superior level of energy and elasticity, positively increases the adaptation level, while muscular rigidity, reduces oscillatory movements, and the breaking force, negatively influences the running action. (Easthope, 2013, p. 47) Moreover, methodic and sistematic exposure of the body at altitude, improves metabolic parameters, having as effect the efficient use of O_2.

At respiratory level, fatigue is manifested through modifications of functional parameters and the lack of oxygenation and the charging level of trunk and inferior limbs muscles in isometric efforts, decrease the oxygenation level of tissues.(Wüthrich et al, 2015, pp. 519-527)

Motric profile is the influence and also influences somato-functional factors. Therefore, trophic and hypertrophic muscles indicate an increased level of force indexes - in relationshipwith the indexes of physical and functional development; in the impulsion phase, it registers the manifestation of some increased speed capacities; the process of motric adjustment, imposes a good joint mobility and an increased level of neuromuscular supleness.

Also, it is finded a capacity in effort net superior, to the athlets that practice clasic fond disciplines. Efficiency and motor control in executing running, reduce injury risk, determinant factors for these atributes being determined by muscular flexibility, muscular power and capacity of neuro motor activation. (https://uncexss.wordpress.com/2014/02/ and http://www.scielo.br/scielo.php?pid=S1413-35552014000200137&script=sci_arttext). According to Bonacci, et al., (2009, p. 903-921), the activity specific performed with endurance, imposes a gestural economy and a permanent adjustment of the execution technique.

Alternative manifestation of resistence with isometric and pliometric efforts, determine that, the more trained are these, the better are the economico-functional indexes of the body, to increase the neuromuscular capacity characterised through power and elastic energy, producing in the end, as effect of learning - at specific effort requests, sistematically repeated - at an increased level of biologic adjustment.

Running technique on varied surface, demands a permanent adjustment to the environment. In ascending sequences, the athlet sustains the corporal segment of the trunk, leaned forward, through an isometric contraction, arms flexed from the elbow joint, shoulders relaxed and inferior limbs realise short stepts through quick concentric contractions. There are present oscilatory movements, given by the dissociation of the scapulo-humeral belt from the pelvic and arm movement - opposite foot, it is coordinated with the respiratory rhythm. In the descending phase there are used almost all the body muscles, permanently changing the mass center, being dependent on the itinerary particularities and arms permanently balance the movements. In this phase, the request level is much higher, descending periods being also the segments where experimented athlets detach from the others.

Age is another factor that influences performance, especially concerning the quality of recovery process, knowing the fact that muscular fatigue has accentuated effects, in relationship with the athlet's age. (Easthopea et al., 2014, p. 207–211)

Methods

In any sport branch, seting up a model profile of the athlet (from the temporal perspective, dynamic), creates premises through which it develops, in the training process, potential in the increase of the current state of performance.

In order to set up this model, in case of subjects who practice trail running, the methods that I used were: specialty bibligraphic documentation, at which I appealed in order to realise a relatively integral profile of the top performance runner. In this context, we highlight that, both at national and international levels, at this moment trail running is slightly approached by the specialists in field, as a theretico-methodical direction.

In order to realise the research, I selected 10 romanian athlets (5 female gender – F; 5 male gender - M), practicants of trail running. Investigated subjects, participate to competitions organised nationaly and internationally, not only in clasic sport disciplines of middle and long distance running , but also in trail running and are legitimated to the following clubs: CSU Craiova, CSU Brașov, CSU Panduri Târgu Jiu, CSM Dorna, CSM Reșița.

Collecting data, concerning some somato-functional and motric parameters, was done as follows: for the somatic indicators - consisting of body weight and height - there were realised measures with the help of the weighing scale and taliometer, for the functional data (cardiac frequency), it was appealed to the pulsometer; for the

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XV, ISSUE 2 Supplement, 2015, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST,
DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

investigation of the specific motric capacity, in case of investigating the explosive force manifested at the lower limbs level, standing long jump was used, while for the endurance level using strenght, a new standardised sport discipline was conceived, consisting of the following itinerary: climbing 50 steps, followed by 50m flat running, 50m descending running - on stairs running - and in the end, 50m of running on flat contact surface (location: Sala sporturilor from Braşov) – with repeating the itinerary 5 times (in total: running 1km - time allocated for this itinerary: 4 min/subject with maintaining the pulse at 160p/min). Also, through a specialised electronic computer, taken from the following website http://www.calculatorpro.com/calculator/vo2-max-calculator/, I calculated VO_2max. (maximal oxygen quantity that an individual can assimilate in effort/ time unit), formula based on the following indicators: gender, body mass, pulse value after the running test, on varied profile (1000m).

In order to be able to analyze trail running technique at the subjects, I realised individualized observation forms, while their were participating to the national competitions and for the model subjects, the analysis was based on the videos taken from the website https://www.youtube.com/watch?v=F93jGSLsZzU, https://www.youtube.com/watch?v=smPmNDgaXvs, https://www.youtube.com/watch?v=FcBlGb0qgS8 and https://www.youtube.com/watch?v=YzSUs-MZcVA.

Analyses had the purpose of realizing some evaluations of the segmentary and globally corporal motric executions and in the end model indexes were compared with those of subjects from the group that was directly studied.

Results

In table 1, there are presented the data collected from the subjects of the research, from the female gender (F). At these, it can be observed a physical development with a height level (height) reduced and an underweight or a normal weight.

Functional parameters are reciprocally conditioned, after the premise that an oxygenated heart and a big pulmonar capacity, fact that is owed to the thoracic cage elasticity; there is an increased effort capacity, exprimated through the level of VO_2max. and through the obtained values of standing long jump, it is demonstrated a high level of muscular properties, having at base optimal indexes of muscular supleness, adequated for efforts developed on varried contact surface.

Table 1. Somato-functional and motric data – Female (F)

Athlet	F 1	F 2	F 3	F 4	F 5
Age	22	25	23	24	26
Weight (Kg)	42	39	46	45	52
Height (cm)	158	156	157	156	162
Elasticity CT	+8	+5	+7	+8	+7
IMC (BMI)	16,8	16	18,7	18,5	19,8
FC-rest (p/min)	40	42	48	47	52
VO_2max. (mL/kg/min)	79,60	75,9	75,76	75,45	74,14
Standing long jump (m)	1,86	1,73	1,78	1,75	1,70

IMC - body mass index; Cardiac frequency; CT - thoracic cage elasticity; VO_2 max. - maximum oxygen quantity in effort.

In case of male subjects, because we had data from 2 athlets practicants of trail running, the remarcable results internationally (occupying first 3 places at the International Trail Running Championship), one of these being romanian, I realised a comparison between their parameters, with those registered in the investigation of the 5 subjects of the target group, that activates at clubs/ sport associations in Romania. The data are presented in table 2.

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XV, ISSUE 2 Supplement, 2015, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

Table 2. Somato-functional and motric data – Male (M)

Athlet	M1	M2	M3	M4	M 5	M – Model 1	M –Model 2
Age	22	20	23	26	21	27	31
Weight (Kg)	59	60	55	60	59	58	58
Height(cm)	175	170	168	170	166	171	176
IMC (BMI)	19.3	20,8	19,5	20,8	21,4	19.8	18,7
FC-rest (p/min)	44	43	48	58	58	34	36
VO_2max (mL/kg/min)	78,03	79,6	81,4	79,84	81,86	81,17	79,62
Standing long jump(m)							
Elasticity CT	2,20	2,18	2,03	2,22	2,14	-	-
	+7	+7	+7	+6	+8	-	-

IMC - body mass index; FC – cardiac frequency; CT - thoracic cage elasticity; VO_2 max. - maximum oxigen quantity in effort; M - Model 1- model athlet 1; M - Model 2 – model athlet 2

It can be observed that, all the subjects are relatively small and thin, with IMC classified in the underweight categories (IMC < 18.5), respectively normal weight (IMC 18.5 - 24.9). Cardiac frequency of resting is correlated with VO_2max values, this relationship indicating avery good cardiovascular adjustment to specific efforts. Values of the explosive force at the lower body level, highlights that, height doesn't represent a decisive factor in the manifestation of this combined motric quality, when this is situated in optimal relationship with body weight.

Model subjects, related to morfo-functional and motric panel at romanian athlets from the group studied, present a superior level of investigated parameters; obviously reffering to indicators that we could investigate for this research; there are observed significant differences concerning the relationship between height and weight; standing cardiac frequency; IMC-ul and VO_2 max.

From the point of view of manifestation aspects in trail running techniques, the collected data through effectuated observations toward the subjects, allowed us to realise a centralisor, that we present in a tabelar way. (table3).

Table 3. Data centralised for technical aquisitions manifested in trail running

Running sequence up hill/down hill Segment/ globally		Romanian athlets	*Models*
UP HILL	Head	- Leaning, over the knee line	- Easily leaning forward, perpendicular to the knee plan, doesn't go over their line
	Arms	- Arms movement forward -bak - without rhythm	- Arms movement foreward - backward - oblique, with rhythm
	Back	- Back oscillates with left-right movements	- Back is firmly stabilised, in isometric contraction
	Inferior Limbs	- Contact is done ona large surface on the sole, medium steps	- Contact is made on the toes, permanently controlling work at the ankle joints; short steps, quick and rhythmic
	Globally	- Arms and feet movement doesn't represent a good belt dissociation, without rhythm, mass center falls before toes.	- Belt dissociation is realised, with optimal rhythm of intensity and control of movement. Mass center is descending, falls on the slope line.
DOWN HILL	Head	- Head oriented backwards	- Head axis, perpendicular to the ground
	Arms	- Arm movement forward - backward, without rhythm	- Arms oscillate in the sideways, balancing the body

	Back	- Back is slightly left after the legs, oscillates with left-right movements, slowes down running	- Back perpendicular to the slope line, doesn't oscillate
	Inferior limbs	- Long steps are made, slowing down running	- Normal steps are maid, quick, with contact heel-toes, without an extensive oscillation backwards
	Globally	- Presents twitching, lifted shoulders, lack of rhythm and deficitary alternation of limbs	- Increased balance, mass center down, dissociation movements of human pectoral girdle and pelvic gridle

Discussions

Specialists bring into discussion the importance of adapting somatomotric components to the trail running specifity through the permanent balancing posture (Jeff Galloway, Trail Running: The Complete Guide, Mayer, Mayer Sport, 2014 UK pag 72-73). Training through specific efforts assures the increase in endurance capacity, efficiency in movements, increase in the movement speed, power, dynamic flexibility, elasticity, joint stability, muscular balance, motivation and recovery (Matt Fitzgerald, Runner's world guide to cross - training, Rodale, USA 2004 pag.3).

Conclusions

In order to increase the specialisation level in trail running, there should existe an adaptation process for somato-functional and motric particularities for athlets, in specific trail running environment. This fact, can be realised only through a convergent pedagogical approach, conducted at the level of sport training and based on the realities of the specific competitional environment.

Starting from the assumption of the permanent and individualised necessity of a trail running athlet to adapt to variable environmental factors it is imposed that through the instruction process to use those methodologies that assure the onset and development of those transformations at the motric capacitiy and somato-functional levels, that answer efficiently to the complex problematic caused by the execution of trail running.

Romanian coaches should understand that from a certain level of obtained performances by the athlets he coordinates, the way to follow in instruction is that of specialisation on the sport discipline, completely eliminating participation to traditional competitions of clasic athletics, respectively in the middle and long distance running.

The complexity of requests from trail running, determine the profile of a practicant with specialised motric capacity, not only concerning combined motric qualities, activated, but also of technical knowledge characterised through practical flexibilit, concrete. This motric profile, is amplified after the somato-functional modifications that are determined by the systematic and continous execution of trail running, as well as the echilibrated psychic, achieved by the athlete.

Acknowledgments

This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), ID 134378 financed from the European Social Fund and by the Romanian Government.

References

Easthopea CS, Nosakab K, Caillaudc C, Vercruyssend F, Louisa J, Brisswaltera J, 2014, Reproducibility of performance and fatigue in trail running; Journal of Science and Medicine in Sport - Volume 17, Issue 2, March 2014, pages 207–211;

Easthope CS, 2013, Reducing muscular fatigue in trail running : mechanisms and strategies; Thèse, Education. Université Nice Sophia Antipolis; University of Sydney, 2013.

Darin A, Padua, February 21, 2014, https://uncexss.wordpress.com/2014/02/ (accesat. 21.03.2015)

Castillo Montes FJ, 2013, El corredor de montaña : fortalecimiento, prevención y recuperación funcional, Formacion Alcalá S.L. 2013, pag. 63

Bonacci J, Chapman A, Blanch P, Vicenzino B, 2009, Neuromuscular Adaptations to Training, Injury and Passive Interventions, Sports Medicine November 2009, Volume 39, Issue 11, pag. 903-921

Fitzgerald M, 2004, Runner's world guide to cross - training, Rodale, USA 2004 pag.3

Galloway J, 2014, Trail Running: The Complete Guide, Mayer & Mayer Sport, 2014 UK pag 72-73

Horvaisa N, Giandoliniab M, 2013, Foot strike pattern during downhill trail running, Footwear Science Volume 5, Supplement 1, 2013, pages S26-S27, Special Issue: Proceedings of the Eleventh Footwear Biomechanics Symposium Brazil, http://www.tandfonline.com/doi/full/10.1080/19424280.2013.799535 (accesat. 20.03.2015) ;

Philo U, Saunders DB, Pyne RD, 2004, Telford, John A. Hawley, Factors Affecting Running Economy in Trained Distance Runners, Sports Medicine June 2004, Volume 34, Issue 7, pp 465-485

http://link.springer.com/article/10.2165/00007256-200434070-00005 (accesat. 11.03.2015);

Saragiotto T, Di Pierro C, Lopes AD, 2014, Risk factors and injury prevention in elite athletes: a descriptive study of the opinions of physical therapists, doctors and trainers, Brazilian Journal of Physical Therapy vol.18 no.2 São Carlos Mar, Apr. 2014, http://www.scielo.br/scielo.php?pid=S1413-35552014000200137&script=sci_arttext (accesat. 11.03.2015)

Wüthrich TU, Marty J, Kerherve H, Millet GY, Verges S, Spengler CM, 2015, Aspects of respiratory muscle fatigue in a mountain ultramarathon race, Medicine and Science in Sports and Exercise [2015, 47(3):519-527];

http://en.wikipedia.org/wiki/Trail_running (accesat. 13.03.2015);

http://www.fra.ro/fisiere/1424341060.pdf (accesat. 16.03.2015);

http://www.wmra.ch/index.php?option=com_content&task=view&id=543&Itemid=8&nav=special (accesat. 18.03.2015);

http://en.wikipedia.org/wiki/Level_and_incline_running (accesat. 19.03.2015);

http://www.timeanddate.fasterreader.eu/pages/ro/bmi-calc-ro.html (accesat. 10.03.2015);