



Physical and Infrastructure Framework – Premises for High Altitude Training in the Romanian's Carpathians

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The improvement of performances in a top of competition can be obtained only by increasing the solicitations in the psychophysiological plan and increasing the training efficiently, preparation, the requires to get the high sports performance which are related among them by a good selection of human material, the social medium he lives in and training himself defeating the usual effort concerning the volume, the intensity and complexity of the training for high level performances. This requires don't act isolated, but in strong relation one to another. As harmonious they could combine the more efficient they are, the bigger is the chance of obtaining sport performances in the main international competitions. The analysis of world level touched by sport performance in the main competitions proved that in the training whatever the period of training is: long, medium or short is necessary a real professional work concerning all the components of the training system.

In the actual competitive conditions, powerful and numerous, what can we notice is that in the majority of sports will have advantage among the others the one who will succeed to:

- handle and direct better the complexity of all the components of the training system; directing him currently to the most important competitions;
- to accomplish that all methodological adopted rules to be pointed towards full exploitation of individual possibilities of improvement of the sportsman;
- to succeed in creating a tight relation between the renewal of the plans permanently and efficiently, more and more of global structure in organizational conditions, so the social economical ones;
- to select and to train sportsman capable to handle rough conditions, physiological and physically too, capable of controlling themselves both in training and competitions, to act independently, to orient in an efficient way both in the training and in the competition.

The Altitude – Climate factor increases the efficacy of the sportsman training on a high performance level. It represents a problem of a great importance to be competitive on international scales. That's why we will try to point out some of the aspects which concern the way of implication of geographical medium concerning the process of training, medium from which an adequate utility increases a lot the possibility of a natural increasing of results.

Why is the high altitude training necessary?

High altitude training is a way for preparation for the competitions that take place at medium altitude and also takes to increasing the capacity to have good performance at the flat. By this way of work the intensity of training overcome, complete the possibility that we are offered by usual means of training. From adaptation reactions and some of the reactions of the sportsman body it's improved the capacity of an aerobic effort of the sportsman who are participating at low altitude competitions at sea level. In Romania the majority of sportsman who are participating at the Olympic games have the training at high altitude. These training periods have, in time, various periods, concerning the sport, performance objectives, preparation level etc. Among the Olympic teams that are having practice at high altitude for a short period we can remember the Romanian rowing, canoeing, kayaking, judo, gymnastics, boxing, wrestling, swimming, fencing, shooting teams; we didn't include in this enumeration the athletics national team who are spending a bigger period of time at high altitude than the other teams.

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Among the sportsmen which are adepts of the medium altitude training we can enumerate GABRIELA SZABO, VIOLETA BECLEA SZEKELY, LIDIA SIMON – ATHLETICS, ELISABETA LIPA and the rowing team, DIANA MOCANU and BEATRICE CASLARIU – swimming etc.

Table 1. Quantitative climatic estimation for Carpathian meteorological stations.

Mountain unit	Station, altitude in a.s.l.	Average temperature	Number of days with	
			Snow falls	Snow layer
Maramureă Basin	Ocna Șugatag (490 m)	7.9	54	82.6
Rodna Mountains	Iezer (1785 m)	1.6	120.8	145.9
Moldavian Plateau	Câmpulung Moldovenesc	6.4	55.3	33.9
Ceahlău Mountains	Toaca Peak (1897 m)	0.7	76.0	-
Mureș Valley	Toplița (687 m)	5.4	57.9	111.8
Bistrița Valley	Ceahlău-village (646 m)	7.2	45.0	-
Ciuc Basin	Miercurea Ciuc (665 m)	5.9	49.5	101.0
Vrancea Mountains	Răcăuți (1777 m)	1.2	92.7	165.0
Brașov Basin	Brașov (508 m)	7.7	53.3	80.0
BUCEGI MOUNTAINS	OMU PEAK (2505 m)	-2.5	137.0	216.0
BUCEGI MOUNTAINS	SINAIA (1400 m)	3.7	90.8	146.3
Prahova Basin	Predeal (1093 m)	4.9	81.8	133.1
Bran-Rucăr- Dragoslavele	Fundata (1371 m)	4.4	89.4	135.9
Parâng Mountains	Parâng (1585 m)	3.3	93.7	147.7
Cibin Mountains	Paltiniș-Sibiu (1406 m)	4.5	81.3	189.1
Semenic Mountains	Semenic (1432 m)	3.7	90.4	163.2
Vlădeasa Mountains	Vlădeasa (1836 m)	1.1	119.2	145.0
Țarcu Mountains	Țarcu (2180 m)	-0.2	102.4	186.1

A great deal of their success was possible to this type of training. The relief, the climate with their factors such as a temperature, air humidity, solar radiation in action with the infrastructure framework influence the human physiology being able to influence the determination of a good or less medium to having a high level sports activity. Their action is felt both horizontally and vertically, influencing the birth rate, geographical distribution, the evolution of the society ethnic tradition, physical state of mind, health and last but not least obtaining good results

This paper discusses the physical and infrastructure background of tonic and stimulating mountainous bio-climate typical for the Romanian Carpathians.

The Romanian Carpathians represent a geographically distinct landscape unit; they cover 27.9 % of the country surface. The complex orographic structure of the Carpathian's is characterized by the massive, broken and uneven relief, directly showing the influence of the geological elements and that of a strong erosion. In comparison with the over great mountain system of the earth, the Romanian Carpathians are the mountains of middle and low height. Their maximal altitude amounts to 2544 m/Mt. Moldoveanu, their average one is about 1000 m, and 90 % of their area lie below 1500 m.

The annual course of the climatic elements in the Romanian Carpathias, also due to the influence of the subjacent areas, makes it very differentiated. It should be stressed that the front sides of the Carpathians, Scandinavian – Baltic in North, sub – Mediteranian in South and South - West, oceanic in West and continental in East, diversify the climatic parameters. The principal climatic elements of the Carpathians are in the close connection with the altitude. Those aspects could be regarded in the Table 1.

The numerous landscape types, under the influence of the climatic factors and the men action had developed the tourism and the possibilities to made sport.

The characteristics of the mountainous bio-climate depend on the microclimate of the

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relief, the orientation of the mountain and altitude. Therefore, the neural-vegetative endocrine functions coordinate the acclimatization of the organisms who are intensely and particularly stimulated.

Specialists distinguish two different bio-climatic zones:

- of the high mountains;
- of the small and medium high mountains;

The High Mountains Zone

In our country it corresponds to the altitude extended between 1900-2500 meters. This altitude is considered to be a medium one from the point of view of sport training. Some specialists consider that even at the altitude of 3000 meters, for example 3100 meters in the case of Bogota - the capital of Columbia, we can still talk about medium height.

From the point of view of the training possibilities, the most accessible training zones in Romania are located in the Meridians Carpathians, in the Bucegi mountains at the Babele Chalet at 2206 meters, as well as in the place called Piatra Arsă, situated at the altitude of 1950 meters, near Omu Peak.

In this area there were constructed special centers in order to prepare the sportsmen for the Olympic games. These centers are equipped with the most recent scientifically discoveries in sports. The Bucegi Massif is the most visited by the tourists and by the sportsmen too, because there are very good facilities for winter sports, but also for training at altitude on the plateau. The status the equipment is on Bucegi plateau it's an important factor, which can lead to high performances. It's not unneglectable the fact that there are multiple choices for running platforms in flat field, stadium with synthetic field, body building halls etc.

Finally but not least Piatra Arsă is situated close to Bucharest and the cities of Ploiești and Brașov. It is linked with the adjacent zones by numerous transport lines – modern road goes up to 1400 m altitude, cable transport facilities, realized in Sinaia and Bușteni. In this zone there are so many accommodation capacities.

Besides these zones, other training areas at high altitude can be found at Păltiniș sub-zones, which is the highest altitude tourist center located in Romania (1450), and in Rodna massif, Dracula's territory, with 10 peaks over 2000 m, with so many lakes, alpin meadows and mineral waters, as well as the birthplace of the multiple champions Gabriela Szabo and Anuța Catuna (the winner of the New York Marathon), who started their sportive activity in this places.

So, the specialists say that in this zones are premises in order to achieve good training – and the Romanian sport performances prove it - that one need to know how to take advantage of these natural factors.

Air Temperature

The air temperature in the mountainous regions is lower than that in the plain areas. The temperature diminishes as we go higher and higher, with approximately 0,7 degrees for every 100 meters. The normal medium temperature in all the mountains which have more than 2000 meters in altitude is negative –2,6 degrees measured at the meteorological station from Omu Peak, at 2509 meters.

At altitudes which go over 2000 meters – like in Bucegi Massif - the lowest temperatures are registered in February, while the highest temperature in AUGUST. At altitudes below 2000 meters the lowest temperatures are in January, and the highest in July. This fact is mostly due to the annual regime of cloudiness. The monthly medium figure of the air temperature in February at the altitude of 2509 meters (Omu Peak) is of –11degrees, while the thermal gradient is the lowest during the whole year: 0,3 –0,4 degrees/100 meters.

The monthly medium figure of the air temperature in August at the altitude of 2509 meters (Omu Peak) is of 5,7 degrees. In this period of the year, the vertical thermal gradient has the highest value during the whole year: 0,7 –0,8 degrees below 2000 meters and 0,6 degrees between 2000-2500 meters.

The annual medium air amplitude has the lowest value (16,8 degrees). This shows the

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moderate character of the thermal regime of high mountains in Romania. The moderate character results from the geographical position in latitude of the mountainous range – situated between 45-46 degrees north of the Ecuador. The Carpathians are located in a transitional temperate climate. The moderate character exists also because the maximum altitude of these mountains is of 2544 meters (Moldoveanu Peak) represents moderate height in comparison with the other mountain ranges situated at the same latitude.

Knowing the daily regime of the air temperature enables people to organize the activities in the most appropriate moments, avoiding in this way the risks of possible accidents (muscular stretches, muscular breaks and chilblains). Choosing the best moments also enables people to achieve the best results during the training. The lowest moderate hourly figures are registered at sunrise, but this moment differs in time from one month to another.

The highest medium hourly values are registered in July at noon, approximately at 13-14 hours. If at the altitude of 600 meters these figures are of 13,5-22 degrees, than at the altitude of 2500 meters, they are of 4-7 degrees.

During the day, at certain hours, the air temperature can change unexpectedly. This can disturb the training process, as the sportsmen organisms are forced to resort to process of thermal adjustment. The local geographical circulation of the atmosphere causes these thermal fluctuations.

The daily thermal control is maximum in August, as it reaches at the altitudes of 2000 meters values between 6-7 degrees. In this way it demonstrates the dynamics of the existent climate from this altitude.

Also, we have to mention the data regarding the medium number of days, which have a certain temperature values. At an altitude higher than 1800 meters, the number of frosty days when the air temperature is below 0 degrees is of 220-260 days/year, while the summer days with temperatures round 25 degrees are not existent.

Air Humidity

Air humidity is another climatological factor to have a high importance for the sportsman training. Water vapors from the atmosphere are most important for the climate of the mountains. Although they are invisible and it is harder to evidentiate them, water vapors participate in all the biological and physical processes happening in nature, giving the climate features like “humid” or “warm”.

At different altitudes the figures of the relative humidity are rising not directly proportional with air temperatures, but this happens only in the warm season (April-August). During the other months, the figures are rising until they reach altitudes between 1800-2000 meters, point where we can notice the diminishing of their value at the same time the altitude becomes higher. In this way, at the bottom of the mountains, humidity is in proportion of 77 %, at the medium altitudes is in proportion of 87,3-91 percent on Omu Peak. These figures are induced because of the dynamic character of the high peak's climate.

At altitudes over 2000 meters, the highest monthly figures are encountered in May-July, as a great quantity of water vapor is collected through convection.

In the normal condition of life, air humidity is regulating the atmospherically factors, covering the body in an isolating blanket. At a medium altitude where air humidity is between 85-91percent, the organisms obliged to make intense effort have the periferic circulation modified, and the toxic products resulted from the much intense burning during training are eliminated through the skin much harder. Also the abnormal humidity favors the intervention of external factors. The most affected in this case are the respitatoty apparatus like respiratory problems, colds, influenza, colds in the head and the excretory one.

The Atmospheric Pressure

One of the most important factors of the training at high altitudes is the air pressure. In Romania the medium air pressure at the sea level at 0 degrees and the latitude of 45 degrees North of Ecuador is 760 mmHg. But the temperature, by humidity, influences the air pressure by

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the air movement and altitude. For every 100 meters vertically, the air pressure diminishes with 12 Mb until they reach the altitude of 1600 meters and then, at 600 meters high, the annual medium figures are of 948 Mb, at 800 meters, of 925 Mb and at 1200 meters the air pressure is of 747 Mb.

What is really important for the training-taking place at heights is not dropping of the global air pressure but the dropping of the partial pressure of the atmospheric oxygen.

At a medium altitude, the dropping of air pressure determines the oxygen pressure to drop also proportionally. At 2000 meters when we have the air pressure of 600 mmHg, the partial atmospheric oxygen pressure is of 111 mmHg, which is equivalent with 15,8 percent of the air volume.

The climate of the mountains in Romania is influenced in summer by the circulation from the west, while in winter, it is influenced by the dry continental circulation from the east. The slopes orientated to west and north-west, on the main directions of the Atlantic cyclones, are confronted with the intensification of the frontal processes and with orographic convection's. These phenomena determine considerable rising of the precipitation. In the east, the precipitation drop as the descendent adiabatic warming influences them.

In the Bucegi Mountains, which are the eastern part of Meridional Carpathians, the annual quantity of precipitation on Omu Peak is of 1346 mm.

In general, over 2500 meters, the annual quantity of precipitation drops below 1200, because the air masses which climb the slopes drop in temperature adiabatically and the water vapor condense and fall. This condensation level exists until 1900 meters. The dropping of the precipitation is also caused by the air cooling when it reaches the top where is the little water vapors.

The highest quantities of precipitation are measured in June, when the activity of cyclones is more intense and the thermal convection inside unstable masses of air is high. During this period, on Omu Peak was measured a quantity of 173 mm. The days with precipitation are more than 170 yearly, at more than 2000 meters altitude. The appearance of precipitation like rain, drizzle, snowfall, sleet or hail in a minimal quantity of 0,1 mm is due to the action of such factors as the presence of clouds, the surface during the day and the modification of the radiative –caloric balance as well as the soil humidity.

Choosing the Altitude

Choosing the altitude for the training depends on various factors: climate, region, sport centers, organizations, the purpose and the objective of the movement at altitude.

If we take in consideration the medium altitude between 1800-3000 meters than in Romania the only possibility for preparation is at Piatra Arsa where it had opened a modern center for Olympic training situated in Bucegi Plateau from Meridians Carpathians.

For winter sports taking in consideration that all means of transport correspond with all requires it's welcomed the training in this place where the snow lasts over 7 months.

For sports prevalent in aerobe such as: rowing, kayak-canoe unspecified preparation can be done in winter (cross – country skiing), on the other hand the climatic factors have an important influence, the preparation can be done only during summer May-August.

The factors that influence the training: the air temperature, intensity of winds, duration of precipitation, convective rain may stop the training for a short period of time, the other hand frontal precipitation may interrupt the training for 1-2 days, the presence of cloudiness, fog, air humidity, solar radiation..

A great deal of attention must be given to picking the training place depending on the season and climate conditions. It became a usual thing from couple years ago that the training could be for a long period an high altitude. However, this thing, in our country is less probable because of moderate continental conditions of climate. That's why during winter valuable sportsmen have the advantage of having training stages in places where the climate is gentle and the bio climate extremes have a small value.

Training at low altitude has no effects compared with the one at medium altitude. Neighbored with this zone at a distance of 30 km from Sinaia (the departure point for Piatra Arsa) and 12 km from Braşov is situated Poiana Braşov with all the equipment necessary for

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sport at high level of performance: stadiums, hotel, gym rooms, sport clinic and rehab centers.

Low altitude climate is not an appropriate one. As a result the intention of stimulating the effort capacity at sportsman can only be accomplished only in a small part.

Beside sportive factors the altitude and the climate has an essential importance in training, in gaining high sport performances. It's very important picking the place and the period of training to correspond with the training purpose, individual way of life and some necessary facilities having good performances is influenced by altitude, latitude and season.

The training effects can be evaluated concerning:

- health status;
- psihological status;
- the capacity of adjustment to hard working conditions;
- level of preparation;
- competitional value;
- the period of training;
- experience in high altitude training;
- last but not least the way you can approach training steps.

References

- Astrand, I.** (1960), *Aerobic work capacity in men and women with special reference to age*. Acta. fisiol.scand.supl.1 – 92.
- Baciu, Clement, C.** (1977), *Anatomia funcțională și biomecanica aparatului locomotor*, Ed. Sport – Turism, București.
- Baumann, Isabelle,** (1996), *Antrenamentul la altitudine mare*, în Sportul de performanță, Nr. 380, Bucuresti.
- Behnke, A., Wilmor, J.** (1974), *Evaluation and Regulation of Body Build and Composition*, Englewood Cliffs: Prentice-Hall,Inc., în Selecția talentului în sport Nr. 1(98), București.
- Bert, P.** (1943), *Barometric pressure*, în Antrenamentul la altitudine, în CCPS, SDP, București, Nr. 380.
- Brătucu, L.** (1996), *Fiziologia efortului sportiv – curs*, FEFS, Cluj–Napoca.
- Brohm, J. M.** (1991), *Pour une antropologie critique du sport*, Revue EPS, Nr. 23.
- Cohnheim, O.** (1903), *Physiologie des Alpinismus*, Bergman, Wiesbaden.
- Cristescu, Maria,** (1969), *Aspecte ale creșterii și dezvoltării adolescenților din R.S.R.*, Ed. Academiei R.S.R., București.
- Daniels, J.** (1996), *Antrenamentul la altitudine mare*, în Sportul de performanță, Nr.380, București.
- Demeter, A.** (1972), *Fiziologia Sporturilor*, Ed. Stadion, București.
- Dorofteiu, M.** (1992), *Fiziologie – coordonarea organismului uman*, Ed. Argonaut, Cluj–Napoca.
- Drăgan, I.** (1977), *Cura de altitudine*, Ed. Sport–Turism, București.
- Drăgan, I.** (1993), *Practica medicinei sportive*, Ed. Medicală, București.
- Drăgan, I. et all.** (1970), *Elemente de investigație în medicina sportivă*, Ed. Stadion, București.
- Drăgan, I.** (1979), *Selecția medico-biologică în sport*, Ed. Sport - Turism, București.
- Dragnea, A., Bota, Aura,** (1999), *Teoria activităților motrice*. Ed. Didactică și Pedagogică.
- Dragnea, A.,** (1985), *Antrenamentul sportiv*. Ed. Didactică și Pedagogică, R. A. București.
- Fărcas, I.** (1983), *Probleme speciale privind climatologia României*, U.B.B., Cluj–Napoca.
- Fesci, C. Simona,** (1984), *Influența condițiilor climatice asupra organismelor*, Ed. Enciclopedică, București.
- Georgescu, M.** (1977), *Controlul medical și primul ajutor medical*, București, IEFS, Curs.
- Gigliotti, L.** (1993), *Experiențe ale antrenamentului la altitudine*, în Specialiștii italieni despre atletism, C.C.P.S., București.
- Hăulică, I.** (1997), *Fiziologia umană – elemente de fiziologie ambientală*, Ed. Medicală.
- Hebbelink, M.** (1970), *Performanță și talent*, Ed. Fizică în școală, București, CNEFS sect. Documentare, vol.VIII.
- Hebbelink, M.** (1988), *Talent identification and development in sport: Kinanthropometric Issues*, in New Horizons of Human Movement, Interdisciplinary seminars, 1988 Seoul Olympic Scientific Congress: 22-26, în Selecția talentului în sport Nr. 1(98), București.

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- Hellemans, J.** (1996), *Intermittent Hypoxic Training*, Noua Zeelandă.
- Hollmann, W.** (1996), *Antrenamentul la altitudine*, în Sportul de performanță, Nr.380 Bucuresti.
- Holz, P., Eduard F.** (1989), *Un concept de promovare a talentelor în sportul de performanță vest-german*, Leistungsport 19, 5, p. 5.
- Iliev, I.** (1996), *Intensitatea antrenamentului la altitudine*, *Antrenamentul la altitudine*, în CCPS, SDP, București, Nr. 380.
- Lange, G.** (1996), *Antrenamentul la altitudine mare*, Sportul de performanță, Nr. 380, București.
- Lenzi, G.,** (1993), *Antrenamentul la altitudine*, Specialiștii italieni despre atletism, C.C.P.S., Bucuresti.
- Martin, E. D.** (1996), *Utilizarea altitudinii în scopul îmbunătățirii performanței*, în Antrenamentul la altitudine, CCPS, SDP, București, Nr. 380.
- Polizzi, Gr.** (1993), *Experiențe ale antrenamentului la altitudine*. Specialistii italieni despre atletism, C.C.P.S., Bucuresti.
- Popov, I.** (1996), *Antrenamentul la altitudine, argumente pro si contra*, în Sportul de performanță, Nr.380, Bucuresti.
- Pugh, C. G.** (1964), *Man above 5000m – mountain exploration*, in Handbook of physiology, American Physiological Society, Washington.
- Saltin, B.** (1966), *Aerobic and anaerobic work capacity at an altitude of 2250 m*, Schweitz, Z. Sportmed., 14, 27.
- Surd, V., coord** (1998), *Rural space and regional development*, Ed. Studia, Cluj-Napoca.
- West, J. B., et al.** (1962), *Arterial oxygen saturation during exercises at high altitude*, J. Appl. Physiol, 17, 617.
- Wilmore, J. H., Costill, D. L.** (1994), *Physiology of sport and exercise*, Human kinetics.
- Zamora, Elena, Crăciun D.** (1999), *Igiena educației fizice și sportului*, Ed. Risoprint, Cluj-Napoca.
- *** **Atlasul R.S.R.**, (1979) Ed. Academiei, București.
- *** **Conținutul și metodica antrenamentului sportiv**, (1971), Consiliul Național Pentru Educație Fizică și Sport, Ed. Dacia, București.
- *** **Geografia României**, (1983), Ed. Academiei, București. vol I – IV.