PRACTICAL EXPERIENCES OF ALTITUDE TRAINING WITH FEMALE MIDDLE DISTANCE RUNNERS

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On the basis of his experience in altitude training acquired during the preparation of West German female middle-distance runners at St. Moritz in 1982, 1983 and 1984, the Author gives a detailed description of the methods of training he used. He also lists a number of precautions that should be observed before and after altitude training in order to ensure an improvement in the performance of the athletes.

1. Preliminary Remarks

The worldwide interest in using altitude conditions for improving athletic performances began with the specific, long term preparation for the 1968 Olympics, held under the difficult climatic conditions of the altitude of Mexico City.

As early as in Rome 1960, the sensational marathon winner Abebe Bikila (Eth) has drawn attention to the possibilities of altitude-adapted athletes competing at sea-level; but thereafter the first problem to solve was the preparation for a successful participation in the competitions at the altitude of Mexico City. The persons involved know how difficult a task this was. For example, the male running disciplines were dominated by highland-Africans; in six running events they won five gold-, four silver- and two bronze medals.

After four years of preparation for the 1972 Munich Olympics, the marathon winner Frank Shorter (USA) and the Finns Lasse Viren and Pekka Vasala once again drew attention to the positive effects of altitude
training on competitions at sea-level. Other countries, e.g. FRG and GDR, had to learn that the combination of an unchanged competition-preparation at sea-level and a preparation at moderate altitudes was very unreliable. It is known, however, that since 1972 altitude research for the improvement of performance has been done with athletes from the USSR, Bulgaria, GDR, Rumania as well as with Mexican race walkers.

I would like to describe in this paper my practical experiences and the methods of training used in the altitude preparation of West German female middle distance runners at St. Moritz/Switzerland (1800 metres above sea-level) in 1982, 1983 and 1984. In these years I repeatedly met there the successful Swiss runners Markus Ryffel and Pierre Deleze as well as the Austrian runners Millonig and Nemeth. In 1985 the Norwegian female runner Kristiansen prepared herself for her 10,000m-world record (30:59,42) at St. Moritz.

I will first present the most important results of these three years (table 1). From my own experiences I can say that especially for younger athletes and "altitude beginners" even a training camp at altitudes between 600 and 1200m can be effective. But in the context of my ideas of training methods I must favour altitudes from 1800 to 2400 m. It is convenient if the training area is sheltered from the wind. I have no experiences of training at altitudes higher than 3000 m.

The psychic effect is not insignificant for the effectiveness of altitude training. As far as this is concerned, the following factors should be considered:

— Selection of a convenient environment (infrastructure/hotel);
— Change in training conditions (courses/road surfaces);
— Change in the climate;
— Relaxation – concentration on training for a long period (eating - sleeping - training);
— Regeneration following a competition period – length of time to the next competitions;
— Being convinced of the effectiveness of the altitude;
— Group training of elite athletes – exchange of experiences in theory and practice. Nevertheless, altitude training also holds many dangers. Existing injuries and diseases are intensified under altitude conditions. This is particularly true for the following diseases and parts of the body:
— appendicitis;
— teeth;
— colds/infections;
— sciatica.

In some cases in spite of preventive measures states of iron deficiency could be observed in the post-altitude phase. For these reasons it should be an important principle only to train at high altitudes when in a good state of health.

In addition to this I think that the following precautionary measures are necessary: the sportswear should be very carefully selected. Even in summer the athletes should take winter clothing with them (gloves, rainwear, several pairs of shoes, headgear, sufficient training clothes) because at high altitudes there are frequent and sudden (hourly) changes in the weather as well as cool or even cold winds (especially dangerous when training on the track - knee- and achilles tendon protection). There can also be snow and heavy rainfalls even in July and August. At high altitudes it is also necessary to drink
more (electrolyte drinks), to sleep more and to protect oneself from the sun – especially during training sessions which last for several hours.

2. Placement of the Altitude Training Within the Yearly Training Cycle

All experiences show that the duration of the stay at altitude should be 20 to 22 days in order to achieve the desired effect. Our limited possibilities for holding training camps of several weeks' duration have led to the consideration to use the stay at altitude mainly to improve the aerobic performance capacity in the immediate preparation for the international yearly peak events, such as the European Championships, the World Championships and the Olympics.

If the altitude training in these phases is optimally done, it will be as effective as a considerably longer training phase (4 to 5 weeks) at sea-level.

Fortunately, in the period under review the phases of preparation for the various peak events were equally long. The preparation for the World Championships 1983 shall serve as an example of the procedure.

Aims of the preparation under moderate altitude conditions:

1) to increase the effectivity of a basic preparation period. The main task is the improvement of general fitness, particularly of aerobic endurance;

2) to increase the effectivity of the following training phase. The main task is the development of the necessary competition-specific performance capacity.

So, the aim of altitude training is not a direct preparation for competition. The aim is rather to develop the prerequisites of a higher effectivity as well as of higher training loads in the last phase of the competition-preparation.

This results from the experience that after altitude-stays of three weeks there is an increase in performance capacity of up to six weeks' length or even longer when such a procedure is used (see fig. 1). During altitude training camps the following training methods are used:

- endurance runs (the volume is dependent on the realized volume in the second preparation period);
- athletic and strength exercises (main point during the first half of the stay);
- sprint training;
- repetition runs.

3. The Three Phases of Altitude Training

First phase: acclimatization (4 to 6 days)

That phase is extremely important for every athlete – it can only be shortened if several stays at altitude are possible during one year. In these days the training consists of “plenty open-air activity”, which can last for several hours (not too exhausting!). Examples of these kinds of activities are slow endurance runs of about 30 minutes two or three times a day, flexibility exercises, swimming, light games and walks.

The athletes went through this phase in a very disciplined manner, because shortly before the arrival at St. Moritz, the first competition period had ended with the German Championships, and the athletes really enjoyed this week of regeneration in the beautiful environment of St. Moritz.
Figure 1: Selected factors of altitude training as well as of the following 3 weeks at sea-level

**The effectivity factors of moderate altitude conditions**

- Reduced atmospheric and partial pressure of oxygen
- Reduced air density (air resistance)
- Reduced air humidity
- Changes in temperature
- Intensified UV-radiation
- Higher ozone content of the air
- Permanent wind and changes in wind direction
Second phase: training phase
(12 to 14 days)

This phase is characterized by high training volumes, and the training in the first part is exclusively aerobic. There is a systematic increase in intensity. Speed plays an important role in preserving the high level of motor abilities achieved in the first competition period. In the second part of this phase there are two or three anaerobic training sessions (the number depends on the individual state of development). Mistakes in this training phase are almost exclusively results of an inadequate training intensity.

Compared to training at sea-level we kept to the following training contents:
— endurance runs: The speed was about 0.3 to 0.4 m/sec (= 2 to 3 min/10 km) slower than at sea-level;
— repetition runs:
  2000m-runs: 10 to 15 sec slower than at sea-level
  1000m-runs: 4 to 8 sec slower
  400m-runs: same speed as at sea-level
  200m-runs: 0.5 to 1 sec faster than at sea-level.

If the intensities are high, the pauses are longer than at sea-level.

Third phase: recovery before the return to sea-level (2 to 4 days)

The intensity of training is reduced in the last phase, depending on the amount of the training loads in the main phase. This makes it easier for the athlete to go back to her normal training at sea-level. The athlete should not have to readapt herself to sea-level conditions in a state of fatigue. That is why in this phase the training volume is low and the training is aerobic in nature; light speed training is also possible.

4. How to Proceed After the "Descent"

The first five days at sea-level are as important as the phase of adaptation at the beginning of altitude training. Contrary to our experiences of successful competition preparation, on the first or second day after the return to sea-level we consciously do not use these positive experiences; the first 4 or 5 days after a demanding training camp of three weeks are rather for recovery!

The first hard training session is recommended only on the fifth or sixth day; the first competition should take place after 6 or 8 days. After this time the further procedure does not differ from a "normal" preparation for a competitive peak, if you disregard the fact that we strive for a systematic intensification and higher loads in some important training sessions.

As can be seen in table 1, the German middle distance runners M. Klinger and B. Kraus achieved excellent results (4th/2nd place) over different distances (800 m/3000 m) in the World Championships respectively on the 24th and 25th day after the return to sea-level. In 1984, R. Gerdes was fourth in the 1500m-event of the Los Angeles Olympics with a personal best on the 28th day after her return to sea-level. As an "additional task" there was also the problem of the time-lag between Germany and Los Angeles to solve. In 1982, M. Klinger won the bronze medal in the European Championships (1 : 57.22/German record) on the 25th day after altitude training.
Table 1: Results in the Years from 1982 to 1984

<table>
<thead>
<tr>
<th>Year</th>
<th>Athlete</th>
<th>Achievement before altitude training</th>
<th>Achievement after altitude training</th>
<th>Placement in peak event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>M. Klinger</td>
<td>1:59.78 (16.7)</td>
<td>1:57.22 (Germ. Rec.)</td>
<td>Bronze medal (Eur. Champ.)</td>
</tr>
<tr>
<td>1983</td>
<td>M. Klinger</td>
<td>1:59.28 (14.6)</td>
<td>1:58.11</td>
<td>4th in the World Champ.</td>
</tr>
<tr>
<td></td>
<td>B. Kraus</td>
<td>8:46.18</td>
<td>8:35.11 (Germ. Rec.)</td>
<td>Silver medal (World Champ.)</td>
</tr>
<tr>
<td>1984</td>
<td>R. Gerdes</td>
<td>4:06.49</td>
<td>4:04.41 (Pers. Best)</td>
<td>4th in the Olympics</td>
</tr>
<tr>
<td></td>
<td>G. Bußmann</td>
<td>50.87</td>
<td>49.75 (Germ. Rec.)</td>
<td></td>
</tr>
</tbody>
</table>

Additionally from the sprint section:

1983 G. Bußmann 50.87

5. Summary

1) For the female middle distance events an altitude training (ca. 2000 m above sea-level) of three weeks' length can be considered an effective preparation for the main competition.

2) It is necessary to be in a good state of health and fitness when training at altitude. If possible, the stay at altitude should come immediately after a competition period.

3) After a phase of acclimatization (up to 5 days) there follows a mainly aerobic training phase (14 days). In this phase the volume and intensity of the training should gradually approach sea-level conditions. In the last phase there should be 2 to 4 days of preparation for the "descent".

4) As compared to training at sea-level, the intensity is reduced. This is true for endurance runs and longer repetition runs. If there are intensive, anaerobic training loads, the pauses should be extended.

5) The stay at altitude should be followed by a 3- to 4-week-phase of systematic intensification according to the principles of preparation for a competitive peak.

6) This phase is also divided into three parts:
   — 3 to 4 days of reacclimatization/regeneration;
   — 10 to 12 days of high training loads;
   — 8 to 10 days of developing a high level of performance.

7) Up to the 28th day after the return to sea-level very good performances in peak-competitions could be observed. The high performance-level could be maintained for several weeks.

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