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THE RECORDING AND ANALYSIS OF SPORTS TRAINING USING A SPECIALISED SOFTWARE APPLICATION, WITH MULTI-ENDURANCE SPORTS AS AN EXAMPLE

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SUMMARY

Detailed records are an integral part of managing the training process. A number of theoretical and practical complications are encountered in the selection of appropriate parameters and the flawless processing of training data. The use of information technology to record and analyse training offers a significant simplification of this complicated process. In the text we define key general and special indicators for training multi-endurance sports, which are summarised in a theoretical model. On the basis of that model we developed a specialised software application for the processing, recording and analysis of training for multi-endurance sports, which was then verified in a pilot test. The application allows the user to work with the data entered to structure training for multi-endurance sports.

Key words: sports training, (computerised) training analysis, training planning and supervision, multi-endurance sports, triathlon

INTRODUCTION

Appropriate training records (covering content, intensity, etc.) are regarded as an integral part of supervising the training process (figure 1). They facilitate routine training analysis, the evaluation of its effects, and the implementation of changes in training plans (Blahuš, 1996; Bompa, 1999; Dovalil et al., 2009). The selection of parameters for such records and the error-free processing of training data and its use have not been entirely resolved, and a number of problems have been encountered. Varying degrees of progress have been achieved in certain sports disciplines, but in some cases that progress has been insufficient. The use of information technology (IT) to record and analyse training data can greatly simplify that process, and make better use of a greater range of the data and information available (Perl et al., 1997; Pfützner, 1995).

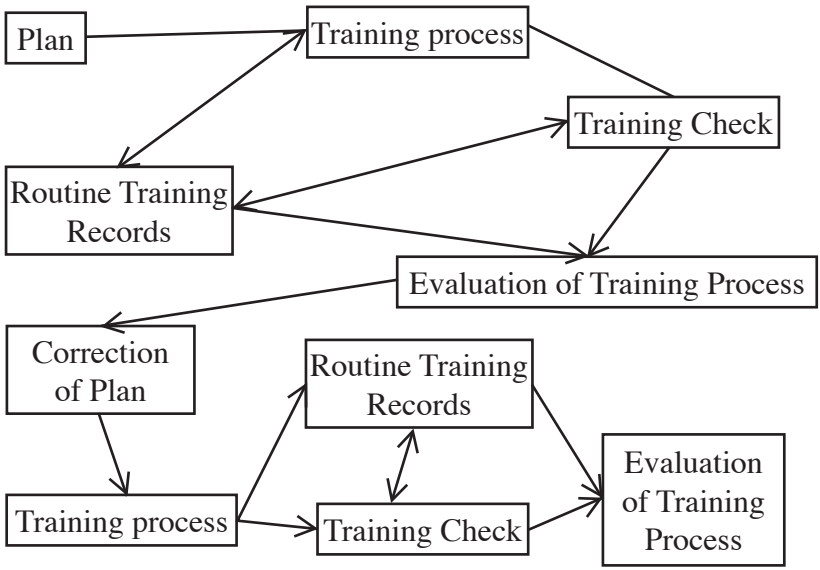

Figure 1. Order of steps of training process control (Dovalil et al., 2009)

The supervision of sports training is today understood as deliberated, rational coaching and adjustments to training. In that sense the concept of training supervision relates to:

– the social and psychological aspects of the process, i.e. guidance, influence on behaviour, etc.,
– training technology, i.e. mainly for setting intensity/stress, its type and amount, scheduling, and the dynamics of the parameters in accordance with the changes achieved in the training condition (Dovalil et al., 2009; Suchý, 2006).

Many authors have worked on a definition of endurance abilities. E.g. Villiger et al. (1991) define it as a person's ability to perform long-term motoric activity at a particular intensity. Costill et al. (1992) and Hollman et al. (1995) look at endurance from a physiological perspective, where those abilities are understood as the organism's resistance to fatigue, and that concept is identical to the concept of functional efficiency. A characteristic feature of multi-endurance sports is long-term, even, submaximal and stereotypical stress of a cyclical nature, in which a variety of sports disciplines are undertaken in a predefined order. From a psychological perspective this is relatively demanding stress, particularly in view of the predominantly monotonous nature of that stress.

Table 1. A definition of endurance abilities according to Dovalil (1986)

endurance type	predominant activation of the energy system	duration of motion
Speed	ATP-CP	up to 20 seconds
Short term	LA	2–3 minutes
Medium term	LA-O2	c. 8–10 minutes
Long term I–IV	O2	10 minutes or longer

Zintl (1994) examines the training process from a cybernetic perspective, which includes elements of management and regulation. In general the function of management is to predict and subsequently correct the individual factors that influence training. According to Blahuš (1996) the basis for elaborating a concept is to create a model for optimal adaptive management. The aim of guiding training is – using management adjustments that correspond to the current state of training – to produce an optimal output, for instance maximum performance or an increment to performance over a certain period of time. Controlled and uncontrolled factors influence the management of training. A controlled model for guiding training can understandably only influence controlled inputs, covering three basic subsystems: diagnostics, information and decision-making.

In chronological order the first management activity is diagnostics, which is on the boundary between the controlled and the management subsystems. For instance recording the training stress is primarily a matter for the trainer and the athlete, but it should be implemented in close cooperation with a methodologist and other members of the implementation team. The diagnostics subsystem provides the initial, unprocessed information on training directly from the source.

We usually divide the information subsystem into three information blocks:

a) training indicators (the amount and intensity of training and the degree of specificity),
b) the athlete's current overall training condition,
c) the output, i.e. performance and any changes thereto.

With multi-endurance sports there are no great difficulties concerning the complexity of diagnostics. The basis is the scrupulous, systematic and uniform recording of training. However, selecting and defining the correct indicators is a problem. Evaluating the information from block c is somewhat complicated. The inner condition – the current training condition – can only be estimated indirectly using a relatively large number of observable external indicators. Batteries of tests – physiological, psychological and other supplementary indicators ensuring a comprehensive approach to the description of the athlete's condition – play an important role in evaluation.

The primary functions of the decision-making subsystem are the interpretation (evaluation) of information on training and the selection of management adjustments to training. A fundamental precondition for knowledge of the role of decision-making subsystems is the form that decisions on adjustments to the training process will take. The foundations of the methods for processing information are derived from a knowledge of that fact. The other function – the selection of decisions – is exclusively a matter for experts.

For a direct analysis of the relation between training and performance, the following are most often used:

– simple correlation and regression, especially for corrections to training,
– multiple correlations and regressions with a smaller number of variables.

Both methods must be applied to ascertain the link between changes to the training indicators over time and increments to the performance indicators. To improve the diagnostics for optimal sets of information indicators for training, and the diagnostics for the training condition, we use factor analyses with latent variables and statistical theories for tests and batteries of tests (Blahuš, 1996).

One of the main preconditions for the proper recording of the planned and completed training stress is the clear and unambiguous structuring of the training process. Data can only be evaluated if it is appropriately structured, and for that reason categorisation is a crucial precondition for the straightforward evaluation of the training process (e.g., Bompa, 1999; Dovalil et al., 2009; Verchošanskij, 1992; Villinger et al., 1991; Weineck, 1994; Zintl, 1994). If training is not appropriately structured it is essentially impossible to evaluate it in sufficient detail. A standard structure for the training process is required above all to compare training recorded by different trainers (athletes).

Sports training can be evaluated manually using tables or graphs. At present significantly greater efficiency can be achieved when specialised software is used to record, plan and evaluate training (Zintl, 1994; Perl et al., 1997).

The use of information technology greatly facilitates a comprehensive approach to managing the training process. A uniform concept for training is conditional on a systematic approach to processing training inputs and outputs (Blahuš, 1996). Specialised software can only record training using uniform inputs (indicators and supplementary data on training and athletes). Theoretically justified and selected inputs are obligatory for all persons using the application. The use of a specialised software application therefore prevents the recording of training using data that does not allow comparisons to be made. For instance, if the application is not used then triathlon training could be recorded using six intensities of stress, which is impossible (or very difficult) to compare with four intensities, the number we consider sufficient for recording triathlon training.

The second key benefit is the fact that software applications make use of all the potential offered by information technology. Their use greatly simplifies evaluation and the adjusting of stress. The internet allows the majority of training factors to be consulted with experts who are not present at the training venue.

METHODS

The methodology selected was based on the principle of a gradual transition from the general to the specific. We first examined general issues closely associated with the management of the training process, focusing on its recording. We then applied selected parts of that general characterisation to multi-endurance sports. A system of data analysis, computer programming and processing, modelling and verification was used to develop the theme.

Our work included the following steps:

1. A summary of the current level of knowledge in the recording and evaluation of the training process in the selected sports discipline, focusing mainly on computer processing.
2. The processing of a detailed analysis and a critical evaluation of the current level of knowledge in training process supervision in a multi-endurance discipline (the triathlon).
3. The selection and detailed justification of selected training indicators suitable for recording the training intensity for the triathlon.
4. Based on the above, we produced a recording system facilitating the planning and devising of training, with a brief theoretical justification.

5. In cooperation with specialists we have designed and developed a software application to produce training records, which facilitates work with the data in accordance with training needs (according to a cycle).
6. The appropriateness of the procedures used in the application was verified by means of a pilot trial. The ten triathletes who worked with the pilot version of the application were not selected at random from the group of approximately eighty athletes in the Czech Triathlon Association's Youth Sports Centres. That selection was guided by the long-term diligence they had displayed in maintaining their training diaries in written form, which is obligatory for all the athletes taking part.

RESULTS

The development of a specialised software application that satisfies the intended purposes required the classification of training exercises as adaptive drift. The classification system required a way of expressing intensity and specificity, using appropriate indicators.

Intensity was qualified in four ranges (e.g., Aschwer, 1999; Dovalil et al., 2009; Evans, 1994):

I. aerobic – lactate (CP),
II. anaerobic – lactate (LA),
III. aerobic threshold intensity (ANP),
IV. aerobic (O_2).

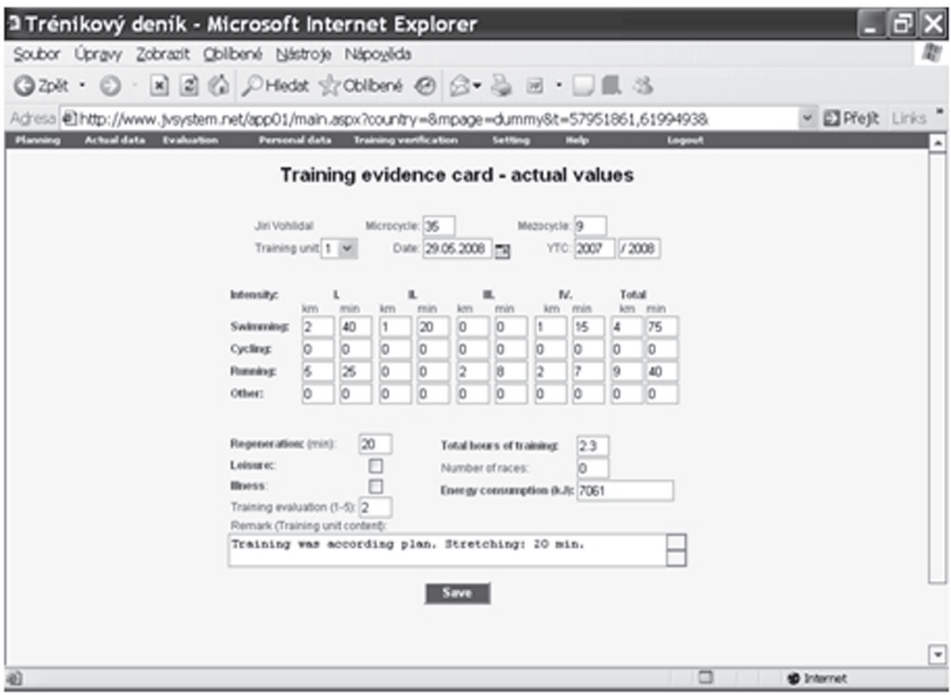

Figure 2. The input form for training records

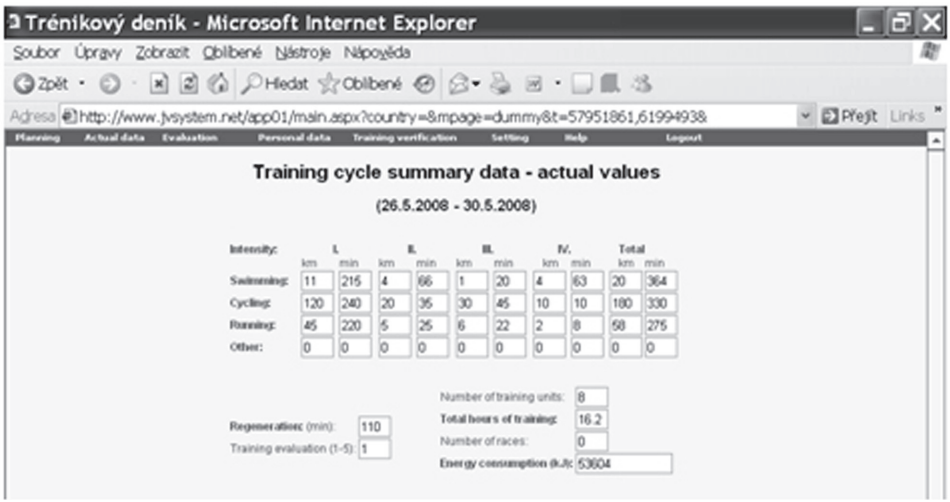

Figure 3. The basic introductory form for triathlon training records

The degree of specificity refers to the similarity/diversity of a given exercise in relation to competing. The specificity of the intensity of training for the triathlon is recorded separately for swimming, cycling, running and other complementary disciplines

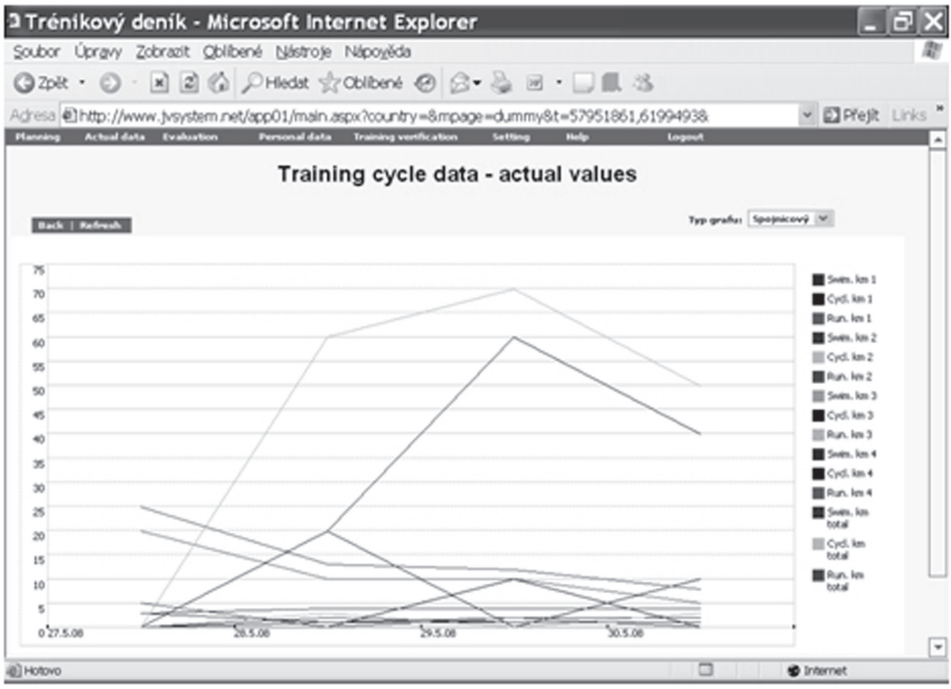

Figure 4. The software offers many options for adding the data entered in an arbitrary time sequence

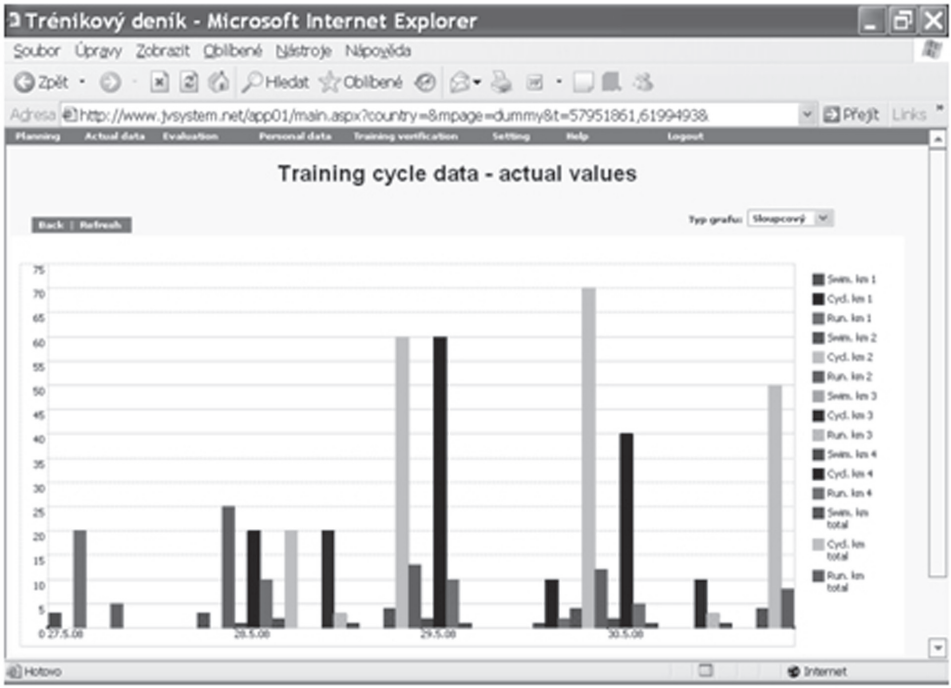

Figure 5. Examples of training intensity in microcycles (numerical and graphic presentations)

(e.g., cross-country skiing, kayaking, skating). The kilometres and time elapsed are always recorded (Suchý, 2006).

The application also offers the recording of complementary data, which serves to specify the indicators recorded, e.g. a verbal description of the training intensity, the duration of regeneration, the number of days for rest, training and illness, batteries of tests, personal bests and the energy intensity in the triathlon, personal and contact data, basic anthropometric parameters, subjective training evaluation, etc.

The introductory form, overview tables and a number of different kinds of charts can be used for the purposes of evaluation.

The application also facilitates the planning of training: the entering of new data and the replacement or modification of data already recorded. Both variants can be modified in the planning form (overall capacity, individual intensities, degree of specificity). It is also possible to compare the plan with the training intensity actually achieved.

DISCUSSION

In developing the software we had to answer criticism concerning practical difficulties in entering training data into the application. The recording of all the data required, using the advantages offered by IT, does not require any extra time. The proposed recording system

offers more options for the user to supervise the training process. Compared with traditional written records, a computer record can greatly facilitate the evaluation of the selected training approaches.

The question remains of whether four stress intensity ranges are sufficient for quality triathlon training records. The other indicators included in the application comprehensively document triathlon training.

It has been demonstrated that the computer application satisfies the objectives set when work commenced. In our opinion it greatly facilitates the process of recording, processing, analysing and planning the training process for the triathlon.

CONCLUSION

Our analysis of the current level of knowledge concerning the supervision of the training process for the triathlon revealed that little has been published on the use of IT to record the training process. In contrast a large number of training diaries have been produced in written form, but with various capacities for more precise training records. On the basis of an analysis of the specific requirements for the triathlon, we developed a selection of training indicators and data that can be adequately recorded.

Following that theoretical justification, the training indicators were incorporated into a system of records that permits computerised data processing. That system was used to design and develop a software application for recording triathlon training. The application allows the user to work with the data entered, and it greatly facilitates the modification of the data entered for the purpose of structuring training (in cycles) for the triathlon.

A working demo version of the application described above can be studied on the website www.jvsystem.net/app01/main.aspx.

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EVIDENCE A ANALÝZA TRÉNINKU ZA VYUŽITÍ SPECIALIZOVANÉHO SOFTWARE NA PŘÍKLADU MULTIDISCIPLINNÍCH SPORTŮ

JIŘÍ SUCHÝ, JOSEF DOVALIL

SOUHRN

Nedílnou součástí řízení tréninkového procesu je jeho detailní evidence. Volba vhodných parametrů a dokonalé zpracování dat o tréninku se setkává s řadou teoretických i praktických komplikací. Využití výpočetní techniky k evidenci a analýze tréninku nabízí významné usnadnění tohoto komplikovaného procesu. Vybrané klíčové obecné a speciální ukazatele dostatečně charakterizující trénink vytrvalostních vícebojů jsme zpracovali do teoretického modelu. Na základě tohoto modelu jsme zpracovali a následně na základě pilotního praktického ověření verifikovali specializovaný software určený ke zpracování, evidenci a následné analýze tréninku. Prezentovaný software umožňuje s vloženými údaji operativně pracovat pro potřeby stavby tréninku vytrvalostních vícebojů.

Klíčová slova: sportovní trénink, vytrvalostní víceboje, triatlon, (počítačová) analýza tréninku, plánování a kontrola tréninku

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