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Individual approach to women's training in speed and power track and field events

By Eugeny Pavlovich Wrublevsky

ABSTRACT

The traditional approach of using training programmes of the same type for both men and women does not take into account the individual variability in gender identification in sportswomen and thus cannot be expected to be the best possible solution in every case. The focus of this project was on the process of selection and training of female track and field athletes specialising in the speed and power events. The aims were to develop and substantiate the criteria for prognostic estimates of speed and power abilities and to determine the main principles for the process of individualisation of preparation for competition (including the construction of training mesocycles), taking into consideration the peculiarities of the female organism. Ninety-five active female athletes, ranging in ability from university level to international standard and specialising in the sprints, hurdles, jumps and hammer throw, took part in the study, which extended a body of work in the field conducted in the Soviet Union and Russia from 1980 to 2003. The author draws a number of interesting conclusions, which serious coaches will need to take into account to optimise the training programmes of their female athletes. One of the strongest is that athletes with a 'high' femininity rating need to adapt their programmes more to the menstrual cycle, while 'low' femininity athletes can follow a more 'male' programme individualised to the particular athlete. This paper was awarded first place in the 2004 European Athletic Association Science Awards.

AUTHOR

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Introduction

Questions connected with the peculiarities of training women appeared together with their first participation in different kinds of sport competitions. Over time, many suggestions of how to improve the process of training and performance results have been made by scientists, coaches and educational specialists from Russia and other countries. However, in recent

monographs almost no attention is paid to the questions of female sport performance and to the specifics of training women.

In what serious observations there are on the unsolved problems of females in sport, the parameters of sportswomen are regularly compared to the 'standard' (feminine) woman. However, it is clear that except in rare cases only a woman who is close to the physiological and psychological indices of male sportsmen can hope to 'survive' in certain disciplines of elite sport. For example, it is doubtful that a feminine woman can put a shot far enough, jump high enough or run fast enough over the 100 metres to be competitive at the top levels of modern athletics. Scientists tell us that among the female population there are women with a high level of hormones in their organism[6,9,20]. This fact leads to their resemblance to men in morphological characteristics and this masculine/athletic somatotype, which is characterised by a lower level of fat and a higher level of muscles, gives them advantages in the development of speed and strength indices.

This leads to the question of developing a system for the selection of females who are comparatively close to male sportsmen in morpho-functional and psycho-physical criteria for the speed and power events in athletics. There is clearly a practical demand for simple, non-invasive methods and criteria to make prognostic estimates of the motor talents of sportswomen.

There is also the issue of a certain discord between authors concerning the dynamics of developing motor abilities and the connection between effectiveness in competition and a certain phase of the ovario-menstrual cycle (OMC). These disagreements may be caused by the fact that the researchers do not take differences between the masculine and the feminine types of sportswomen in to consideration. Moreover, a lack of research on the psychological state of sportswomen and insufficient information of the peculiarities of the OMC prevent ideal co-ordination of the training process for sportswomen, in other words, the arrangement of certain training tasks with the phases of the OMC.

The above-mentioned issues defined the timeliness of the research described below. And the use of high achievement sports as the main pattern of manifestation and confirmation of the identified abilities creates a demand for objectivity in the scientific quests undertaken.

Aims

The focus of this project is on the process of selection and training of female track and field athletes specialising in the speed and power events. The aims are to develop and substantiate the criteria for prognostic estimates of speed and power abilities and to determine the main principles for the process of individualisation of preparation for competition (including the construction of training mesocycles), taking into consideration the peculiarities of the female organism.

Tasks

The tasks set for the project were:

1. To study the peculiarities of the OMC and the dynamics of strength and power abilities in groups of sportswomen with different gender identities.
2. To differentiate the morphological and psychological signs of masculinisation that show up as the markers in the selection of female athletes for the speed and power events of athletics.
3. To develop the main forms of construction of training mesocycles and the distribution of training load for female athletes specialising in the speed and power events of athletics, taking into consideration the biological rhythms of their organisms and some of psychological peculiarities.

Arrangement of the research

The work of this project is based on research by the author at the faculties for track and field sports at Russian State University of Physical Culture (Moscow) and Smolensk

State Institute of Physical Culture in the period1980-2003. The Complex Scientific Group (CSG) of the combined USSR and Russian Federation team responsible for the preparation of top female performers made the collection and inculcation of the research results.

Research Methods

The methods used to achieve the set tasks consisted of:

1. Theoretical analysis and generalisation of the statistics given in scientific and methodological literature
2. Questionnaires
3. Somato-typing
4. Psychological and pedagogical tests
5. Statistical development

Finger prints, or finger dermatogliphs (FD), were studied by a standard method with the estimation of the type of pattern (A-arc; L-loop; W-curl; S-pattern)[14].

To fix the characteristics of speed and power abilities of sportswomen, computer thensonometrical equipment was used. Maximum isometric muscle strength (F_{max}) was determined by bending of the leg at the knee joint and pelvis and the time it took to achieve the maximum result (t_{max}). With the data obtained, a differential index (gradient), which characterises explosive force level ($I=F_{max}/t_{max}$), was produced.

Ninety-five (95) female athletes specialising in speed and power events (in this case sprints and hurdles, jumps and hammer throw) took part in the study. Their ages ranged from 17 to 30 and their qualifications ranged from the 1st sporting degree up to master of sport of international class.

The results of the research

The analysis of Russian sport literature shows that for certain reasons study of the problem of psychological aspects of female sports has not been properly pursued. A different situation is observed in foreign sport psychology, which from the middle of the last century has suggested the necessity of paying attention to the masculinisation of the psychology of sportswomen, the differentiation between masculine and feminine types in sport and their influence to the result [7,11]. In recent years, the androgenic theory has developed the most[4,5,6]. The main idea of the theory is that sport promotes the appearance of characteristics common to both men and women and thereby it balances their rights. Haamer[6] underlines that a sports performer has no sex and that sport destroys habitual ideas of masculinity and femininity, allowing sportswomen to be both aggressive and womanly.

To study the manifestation of the masculinisation of the psychology of the sportswomen specialised in the speed and power events in athletics, a 14-factor personality test[10] that is a kind of MMPI and standardisation of Bem's methodology[4] was given. Together with this they filled in questionnaires concerning the characteristics of their OMC's. According to the marks of 'the femininity scale', the participants were divided into three groups (see Table 1) as follows:

- 'Group A - high level of 'femininity'(feminine type), which included 15 of the participant (16%),
- 'Group B - middle level of 'femininity' (androgynous type), which included 28 of the participants (29%)
- 'Group C - low level of 'femininity' (masculine type), which included 52 of the participants (55%).

In Group C (low level of 'femininity') there appears to be more (in percentage) sprinters and horizontal jumpers (long jump and triple jump), and fewer hammer throwers and high jumpers. This can be explained by the relative importance of coordination (in this case lower) in the events strongly represented. An important fact is that Group C contained mostly highly qualified sportswomen, 79% were masters of sport and masters of sport of international class. Among the representatives of this

Group	Points according to the scale of 'femininity'	Conformity to Bem's methodology
A	10-7	Feminine individuals
B	6-5	Androgynous individuals
C	4-1	Masculine individuals

*Table 1: Distribution of sportswomen according to the level of femininity**

group, 85% are of athletic or sub-athletic morthotype. This proves the masculinisation of the build of the sportswomen. The index of masculinity (width of shoulders/pelvis) was from 1.45 to 1.51 conventional units and relative muscular mass exceeded 38%. Different variations of Hyperandrogyny Syndrome (increased amount of hair (hirsutism), poor mammary development, acne vulgaris of the face and back)[9] were also observed.

The analysis of the questionnaires showed the characteristics of the formation and development of the menstrual function among female athletes with different gender identities. The menarche (first menstruation) of the athletes in Group A appears at about 12.8 ±0.21 years; in Group B menarche was at 13 years in 52.3 % of cases and at 14 years in 45.2 % cases. For Group C menarche tended to be later: by 13 years -12.6%; by 14 years - 31.2 %, by 15 years - 47.3%; by 16 years – 8.9 %). Also observed is an acceleration in sexual maturity among hammer throwers, as menarche appears at 11.7 ±0.3 years and a delay of development among the jumpers as menarche appears at 14.3 ±0.5 years.

The research revealed OMC differences between the groups. Group A has the shortest OMC (26.1 ±2.3 days), for Group B it is a bit longer (28.3 ±1.6 days) and for Group C it is longer still (30.8 ±2.8 days). Athletes with 3-day menstruation are more often of the group A than groups B and C ($p<0.05$) while athletes with 6 or 7-day menstruation are prevalent in group C ($p<0.05$).

A more important dependence was revealed between the level of 'femininity' and general physical and mental state in the menstrual and premenstrual phases of the OMC and the athlete's attitude to training during the OMC. Such a connection is more considerable between the alternative results of the 'extreme' groups (A and C).

It is noteworthy that in Group C a high percentage (91.8%) has light menstruations and that the figure for Group A is 14.3% and Group B is 31.6% ($p<0.05$). Painful menstruations are more often observed in Group A (68.3%) than in Groups B and C – 43.2% and 13.6% ($p<0.05$) respectively.

A lower percentage in Group C ($p<0.01$) notes an increase of fatigue during menstruation (10.3%) and the premenstrual phase (13.3%) than in Group B – 62.3% and 73.2% or Group A – 81.1% and 86.6%. Therefore, we can say that the athletes of Group C are characterised by a higher level of working capacity during these phases of OMC (by individual sensations).

It is natural that the general physical and mental state in the menstrual phase of the OMC influences a female athlete's attitude towards training during this period. In Group C, 100% of sportswomen train during this time. But in Group B this percentage is lower (75.2%) and in Group A it is lower still (41.1%). The comparison of a number of sportswomen in each of the groups revealed a reliable ($p<0.05$) difference between the groups. The athletes in Groups A and B prefer to train during the inter-menstrual period. In Group C the percentage who successfully carry out training loading during the menstrual and premenstrual phases of the OMC is 16.8% while 19.9% of respondents say that it doesn't matter to them at what OMC phase training takes place.

Research on the peculiarities of the dynamics of manifestation of certain speed and power abilities during the OMC in these groups was carried out with the help of pedagogical tests (long jump, triple jump, shot put from a standing position and with full motion) and with the help of some instrumental methodologies (determination of explosive power and of latent time-motion reaction index). It is possible to conclude that:

a) For Group C, the OMC doesn't influence the display of motor abilities ($p<0.05$) and the dynamics are comparatively smoothed.
b) For Group A, a lowering of results of test exercises are considerable at the extreme phases of the OMC, which leads to a wave-shaped character to the dynamics of manifestation of certain speed and power abilities. The OMC influences the changes of most indices ($p<0.05$).
c) The athletes in Group B occupy the middle position between the results of the above-mentioned groups according to the character of manifestation of certain speed and power abilities at certain OMC phases: the level of indices during and before menstruation are almost the same as in Group A but the results during of the period of ovulation are almost the same as in Group C.

It is interesting that all the athletes studied who train and show their best results in competitions during the menstrual phase of the OMC have a very short duration of this phase. It is regarded by us as a reaction of the organism to high physical loads and apparently is not a pathology. One should mention that in the middle of OMC (e.g. the phase of ovulation) practically all the athletes studied, while showing a high level of explosive force, showed relatively poor results in competition exercises (by the I-gradient). One should take this into account during competitions because in this OMC phase the level of excitement causes slowing (individually shown) of other nervous centres[13], and any other kind of activity becomes temporarily not so important.

One of the main constituents of work on the selection process for sport is the development of genetic criteria to identify the peculiarities of the motor talents of an individual. One such genetic marker that can be used to solve the problems of prognosis and selection relative to the specifics of sport activities is finger patterns or finger dermatogliphs[1, 17]. They are one of the most important inherited characteristics of a person that can be very easily observed.

It is mentioned in the literature[21] that the peculiarities of dermatogliphs form during the time in the womb, developing under the influence of androgens when the differences between male and female patterns are established. It is shown[1] that among women the 'loop' is frequent, especially the so called 'ulnary loop' (female index). Among men a more complicated pattern is observed – the 'curl' (male index). In comparing the frequency of the 'ulnary loop' among the groups studied it is noticed that in Group C it is met 1.3 times more rarely than in Group A ($p<0.05$). At the same time in this group the frequency of the 'curl' is higher than in Groups A and B. Together with this, the tendency of rapprochement of the indices of FD of the sportswomen of Group C to the analogous ones described in the literature[1] of male sportsmen specialised in speed and power events in athletics (Table 2).

Analysis of the frequency of familiar finger patterns in women runners compared with data for women who have never gone in for sports, as mentioned in the special literature[1] shows peculiarities in the disposition of the 'loops' and 'curls'. The women runners have 'loops' situated on the second finger of the right hand in 32% of cases against 58% in non-sportswomen while they have the 'curl' on the fifth finger more often than the non-sportswomen (62% against 36%). It must

* Under the level of femininity we must understand the level of psychological identify of tested sportswoman with the role of women enforced by the community and the culture[10].

Group	% with Ulnary Loop (L_u)	% with Radialy Loop (L_r)	% with Curl (W)
Group A	54.5	4.1	34.8
Group B	47.2	3.8	39.6
Group C	36.2	3.0	52.4
Men (from Abramova[1])	25.8	2.1	67.3

Table 2: Dermatogliph indices for female and male athletes specialised in the speed and power events of athletics

added that it is statistically true ($p<0.01$) that the 'loops' occur less with the specialists in speed and power events than with non-sportswomen[1,14]. Moreover, it is statistically shown ($p<0.05$) that the 'arc' pattern is more often present in the runners than the non-sportswomen. The occurrence of these patterns suggests that, on a statistical level, there are configurations that suggest the ability to perform cyclic work of maximum capacity more effectively and we have concluded that motor talented women, independent of their specialty, have common dermatoglyphic features, which differentiate them from women who are not accomplished in sport.

Thus, FD indices have turned out to be an informational marker by which one can predict genetic predisposition to the capability of effectively doing speed and power work at maximum capacity.

Discussion of the findings

As far back as1903, the Austrian psychiatrist Veininger[22], speaking about human bisexuality, underlined that there's neither an 'ideal' woman nor an 'ideal' man. The human population, he said, is distinguished by great variety and by multiple dimensions of the characteristics determining sex. If one connects the two poles, an 'ideal' woman and an 'ideal' man, with an imaginary line, in the middle will be a real hermaphrodite, possessing signs of both sexes. But, importantly, there will be no empty spaces between the marked points, as every person bears a certain combination of femininity and masculinity.

So how did 'masculine' females suitable for the speed and power events in athletics appear?

Recent research in the fields of neuroendocrinology[3], psychology[8] and sexology[8] has scientifically proven the fact of changes in human sexual behaviour. Under the influence of hormones, sexual differentiation takes place in the mother's womb. The violation of this process can cause a certain masculinisation of the sexual centre of a female embryo. This brain masculinisation of a female embryo may appear under the influence of male hormones, because of certain medicines (including those used to save the pregnancy) or because of stress. This masculinisation in its turn causes changes in female behaviour. Rosenfield's[15] explorations and tests prove that 3-year-old girls who were overloaded with testosterone while in the environment of the mother's womb not only behave like boys but also more willingly play with boys and find toys for girls to be boring.

Thus, there is a suggestion that a strong selection among masculine women, whose inner motivation of their 'masculine' brain leads them to sports, is in process. But further research in genealogies is necessary to prove this. This work is planned for the future.

Another reason for masculinisation in women may be found in the study of the process of changing male sex hormones in the female body[18]. Normally these are secreted in small quantities by the adrenal glands. Physical loading is a stress factor for the organism.

According to Selye[16], the adrenal glands play the main role in the process of adaptation of the organism to a stress situation (cold, hunger, pain or physical loading) and the stress situation in its turn leads to reduction of the synthesis of estrogens and an increase in the synthesis of androgens. This variable means that not only does physical loading stimulate the analogous mechanism for Hyperandrogyngy Syndrome but other stressors do as well[9]. This is exactly what leads to a male build and a male type of hirsutism and causes changes in the menstrual function, voice and character of women (including sportswomen)[9,12,15,20].

Thus, sport, through selection and by the orientation of training influences aimed at high achievement, creates a tough pattern of activity covering all the systems of the organism, including the morpho-genetical complex of FD. This is proven by the one directional system-formed connection of dermatogliph indices with the specifics of sport activities as a model of maximum realisation of inherited potential.

The common research shows the priority of the interconnection of changes of FD with the demands of the specifics of the sport activity that levels the influence of sex dimorphism. It is significant that the fact of reduced sexual distinctions[2] in highly qualified sportsmen in the process of many years of sport selection is proved by the statistics obtained while studying the peculiarities of build, the indexes of heart morphology and the mechanisms of adaptation of the heart, the types of blood circulation, and the proportions and measures of muscle fibres.

The increase of performance and mastery by sportswomen is mainly connected to how properly the training process is combined with the biological rhythms of their organisms. The most important of these is the OMC with all its complex physiological manifestations. To our mind, the fact of the later appearance of menarche in Group C can be explained by the specifics of selection of masculine girls (who are consequently late developers) as well as by huge physical loadings in periods of big hormonal changes in the organism. Moreover, the delay of menarche happens mostly if girls take up sport at 12-13 years, which is the 'critical' period in the development of the sexual system and when there is not yet a connection between the central mechanisms controlling the functions of the sexual system. As already mentioned, the sportswomen of Group C are less influenced by the cyclical functions of the reproductive system. It is interesting that as the number of biological cycles differs between groups, it is possible to state that the amount of days of good working ability varies as well. Thus, the sportswoman with a 21-day OMC will have about 17 cycles a year, one with a 28-day OMC will have 13 cycles and one with a 35-day OMC will have 10. And the number of the days of good and high results is correspondingly about 178, 222, 255. Moreover, if in the first half of 35- and 32-day OMCs (including menstrual and postmenstrual phases) 2 or 2.5 week microcycles are suitable, for 24- and 21-day cycles only 0.5 of a microcycle is suitable. It is possible to conclude that the longer the OMC of a sportswoman the more possibility for realising a wider training programme during the first half of the cycle (because of greater time). At the same time, almost all the training programmes for sportswomen with a short OMC are done during the second half of the OMC, which leads to difficulties in developing some qualities - flexibility, strength, endurance, speed abilities etc.

Sportswomen with 35-day cycles present a more effective 'biological model' for training programme realisation than sportswomen with a 21-day OMC, as they have about 77 days of good and high quality working ability available. Therefore, it is necessary that the planning of the training process should be different not only for men and women but also it should be different for every sportswoman. At the same time, interrogation of sportswomen shows that in 82% of cases coaches are not interested in a female athlete's general physical and mental state or in the timing and character of menstruations. Almost all coaches lower the training loading only after a specific request by the athlete.

It is significant that OMC influences sprinters less, and high jumpers and hammer throwers most of all. This fact can be explained by a huge difference in coordination complexity between these event groups. This fact evidently leaves its mark on the neuro-psychological sphere connected to the phases of the OMC. It was also noticed that special capacity to work substantially changes during different OMC phases in the preparatory period. During the competition phase sportswomen's training may take place with less attention paid to the phases of the OMC. This tendency is independent of the event analysed.

The author realises that he did not manage to throw light upon the questions of individual examples of psycho-physiological peculiarities of a woman's organism. In particular, some aspects should be confirmed in endocrine studies using more participants. However, it was felt that it was necessary at first to draw the attention of coaches to the fact that the traditional approach of using the same type of training programmes for both men and women does not always present the best situation, as these programmes do not take into account the individual variability in gender identification of female athletes in particular and sportswomen in general. And even if male coaches cannot 'live' the strange and alien 'female world' they are obliged at least to understand it if they want to help their athletes reveal the unique possibilities given to them by nature.

Conclusions

1. The OMC formation, its character and the peculiarities of the dynamics of manifestation of certain speed and power abilities over its period are essentially different between groups female athletes with different gender identification. Among the athletes of high qualification (masters of sport and masters of sport of international class) a group with the longest period of OMC was distinguished. These sportswomen go through all training loadings during all the phases of the OMC and in their case the manifestation of speed and power abilities does not depend on the OMC.
2. In the process of selection for speed and power events it is necessary to give preferences to women of an athletic somatotype. This is characterised by increased muscles, shoulder width, chest circumference and leg length and decreased pelvis width. Supplementary criteria of this morphotype that can be taken under consideration are peculiarities of sexual development: the delay of menarche until 14-16 years and a long OMC establishment; underdeveloped mammaries at an age of more than 14; and a masculine type of hirsutism in places non-specific for women.
3. Taking into account the fact that FD is a genetically determined marker that is programmed during the embryonic period of development and never changes it will in future be possible to state that dermatogliphy peculiarities of fingers can be used as a sign of motor talent. It will be necessary to use a male pattern of FD as one of the components of an athletic somatotype together with information from certain psychological tests as the criteria for prognostication of certain speed-and-power abilities in sportswomen.
4. While constructing a training mesocycle it is very important for sportswomen with a high level of 'femininity' to coordinate the volumes of loading with their OMC phases. In a group with a low level of femininity, a more variable planning of huge loadings is possible. This is connected to some psychological peculiarities of OMC treatment as well as to the distinctions in the dynamics of the manifestation of certain speed and power abilities of the sportswomen in these groups. For sportswomen of high qualification who have a gender identification similar to men and a masculine somatotype, the use of adapted male training methods is possible. However, all the methods should be strictly individualised and take into account sportswoman's current condition and state.

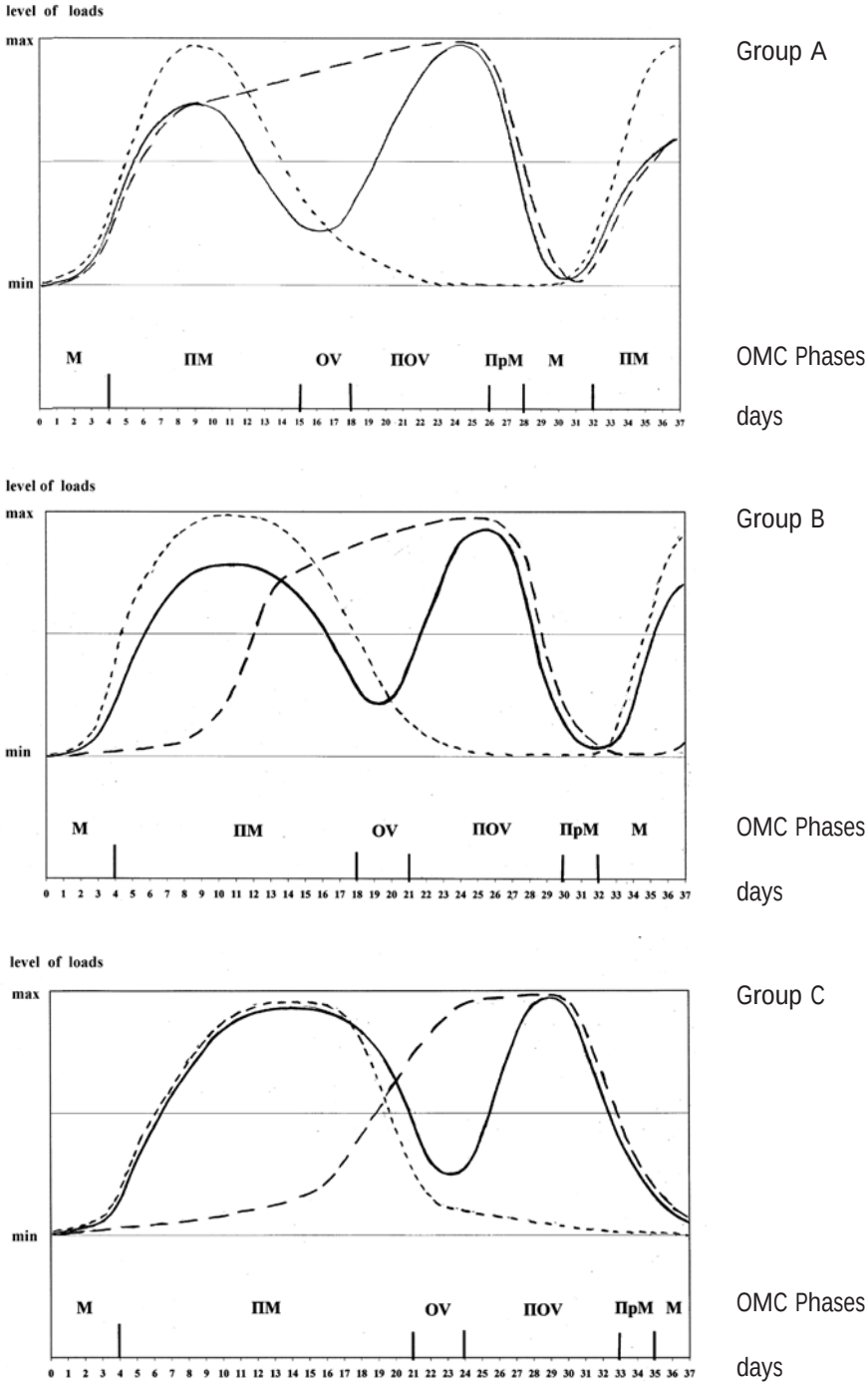

Figure 1: Common scheme of training load organisation in special-preparation level with female athletes (example of sprint and hurdle events)

------- *speed and strength loads*

- - - *alactic-anaerobic loads*

_____ *glicolitic loads*

Recommendations

1. During the planning of special preparation for female sprinters and hurdlers, it is necessary to place loads of alactic-anaerobic and glicolitic types in different periods of time and to sequence the application of maximum volumes of different loads with favourable OMC phases. These must be achieved to lower the chance of undesirable influence of physical exercises on the reproductive function of the athletes[19,23].
2. During the construction of the training process of female jumpers and throwers it is recommended coordinating the means of preparation with rising training potential of favourable OMC phases (Figure 1) to achieve the best increases in conditioning and competition results.

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