

INTERACTION BETWEEN GENETIC AND NON GENETIC POTENTIALS IN THE FUNCTION OF CREATION AND DEVELOPMENT OF SPORTSMEN INDIVIDUALITY

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Review paper

Abstract

The aim of the paper according to much research done in the field of sport genetics is to analyze interaction between genetic and non genetic potentials of anthropological characteristics of sportsmen. The potentials are in the function of creation and development of sportsmen individuality in order to make the right and on time orientation of selection of young sportsmen and to enable the most optimal modelling of characteristics and abilities of sportsmen for particular sports. Finally, all this has to be carefully planned including sportsmen trainings, methods and burden as well as controlled and analyzed concerning training process as a whole. The sample of variables consists of variables with high impact of genotype ranging from 80-98% (skeleton dimension .98, speed .95, general cognitive factor .92, coordination .87, explosive strength .85 and precision .80), with the possibility to be transformed from 2-20%, then the average impact of genotype ranging from 60-80% (mass and body volume .80, pathological conative characteristics .78, balance .75, functional abilities .70, flexibility .65 and repetitive strength .60), with their possibility to be transformed from 20 - 40% and low impact of genotype ranging from 35-60% (static strength - .60, psychological states - .55, motor knowledge - .55, attitudes and opinions - .50, specific knowledge - .40 and specific habits - 35), with their possibility to be transformed from 40- 65%. General conclusion is that even today and especially in the future management in the process of training technology in top sport will not be possible without knowledge and application of anthropological (humane) genetics in sport. It is non scientific and above all non humane act to violently subject young people to transformational processes of anthropological characteristics in some sports if they do not possess genetic potentials of their individual characteristics and abilities.

Key words: sport genetics, anthropological characteristics, genotype impact, interaction, individuality

Introduction

In modern practice, training technology and sport science it is known that detecting many relevant and dominant factors for achieving top sport results apart from contribution of genetic (limited) potentials of high importance is formation of non genetic (transforming) potentials of sportsmen. This can be explained, from the point of view of anthropological aspect, by the fact that there are no two identical subjects because each sportsman represents an individual for himself. So, in the training process it is necessary to pay attention not only to what is specific for sportsmen state which represents the consequence of transformational training process but also to what is genetically specific in limited state for each person and is impossible to change by training (Malacko & Rađo, 2004). Relation between genetic and non genetic potentials can be defined as an interaction of genetic and non genetic part of variance of each human characteristic and ability. So, the general rule that the impact on a certain anthropological characteristic will be lower if the genotype of the variance of that characteristic is higher is justified.

The same applies vice versa the impact will be higher if the genotype variance is lower. The issue of determination of the relative part of genotype variance in the whole variability of anthropological characteristics so far has not been unified. The reason for this is the different view of in-born coefficients of anthropological characteristics by various authors and countries (Mraković, 1992).

Genetic and non genetic potentials

Genetic potentials are most often represented by inborn coefficient which represents the value of the variance of each anthropological characteristic which is genetically conditioned that is the part of the variance that can not be changed. For this purpose Holtzinger's tables are used most often - inborn coefficient (H₂); however there are many other authors with similar research results (Gaisl, 1981; Wolansky, 1984; Malacko, 2000). Former research done in the field of genetics in sport show that top sport results can not be achieved only by the application of modern training technology.

Moreover they depend on the genetic condition of particular anthropological characteristics and abilities of sportsmen. So, genetics takes more important place in the field of sport anthropology (Wolansky, 1971; Ifrim, 1984; Schwartz, 1984; Nikitjuk, 1986; Wolansky, 1986; Moskatova 1986; Malacko, 1995). Orientational results of former research (Malacko & Doder, 2008):

- morphol. characteristics show that skeleton dimension has the highest genetic condition ($H^2=.98$), mass and body volume have lower genetic condition ($H^2=.80-.90$), and fatty tissue has the lowest ($H^2=.50$). Research of the structure of skeleton muscles shows that motor charact. are under high genetic impact;
- functional abilities are also under genotype impact but they are not the same for each ability ($H^2=.60-.80$) and they show predominance of genetic factor in maximal oxygen consumption which is considered a proof of genetic condition of aerobic system;
- motor abilities are still in the phase of empiric research so it is very hard to accept some conclusions with certainty. However, the following opinions prevail: speed ($H^2=.90-.95$), explosive strength, coordination, balance and precision ($H^2=.80-.85$) are highly influenced by genetics, while repetitive strength, static strength and flexibility ($H^2=.50$) are less influenced which means that bigger changes are possible;
- cognitive abilities are also genetically influenced because their innate coefficient is very high ($H^2=.85-.92$), but it is considered that general cognitive factor can be developed until the age of 7 under the condition various cognitive tasks are solved;
- pathological conative characteristics show that innate coefficient is very high ($H^2=.80-.85$), and research showed that even most modern therapeutically procedures can not decrease pathological factors. Normal conative characteristics show that innate coefficient is very low ($H^2=.50$) which means that it can be developed especially at an early age;
- specific psychological states, motor knowledge, attitudes and opinions as well as specific knowledge and habits are least genetically influenced ($H^2=.35-60$) so there is the possibility of transformation in the desired direction.

Above mentioned orientational results of research contribute to the decision to pay greater attention to non genetic potentials of anthropological characteristics when developing sportsmen individuality. Non genetic potentials of anthropological characteristics are in the interaction with genetic potentials so that transformational processes and biological adaptation can be adequately understood and high efficiency and effectiveness achieved during the training process and competing sport activities.

The aim of the paper

The aim of the paper according to much research done in the field of sport genetics is to analyze interaction between genetic and non genetic potentials of anthropological characteristics of sportsmen. The potentials are in the function of creation and development of sportsmen individuality in order to make the right and on time orientation of selection of young sportsmen and to enable the most optimal modelling of characteristics and abilities of sportsmen for particular sports. Finally, all this has to be carefully planned including sportsmen trainings, methods and burden as well as controlled and analyzed concerning training process as a whole.

Methods

The paper altogether includes 18 variables with high genotype impact: ADSK-skeleton dimension, MBRZ - speed, GKOG - general cognitive ability, MKOO - coordination, MEKS - explosive strength, MPRE - precision, lower genotype impact: AMVT - mass and body volume, PKON - pathological conative characteristics, MRAT - balance, MFSP - functional abilities, MFLE - flexibility, MRES - repetitive strength and the lowest genotype impact : MSTS - static strength, PPST - psychological states, MMZN -motor knowledge, PSTM - attitudes and opinions, SSZN - specific knowledge, SSNA - specific habits. The results have been processed and graphically presented.

Results

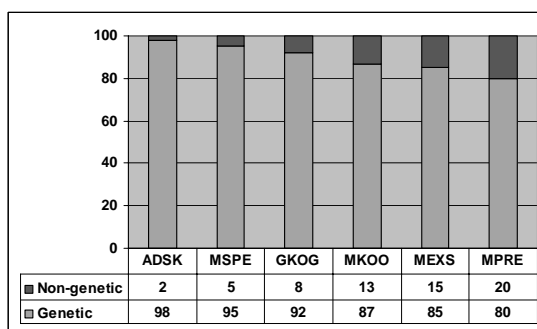


Figure 1. High genotype impact

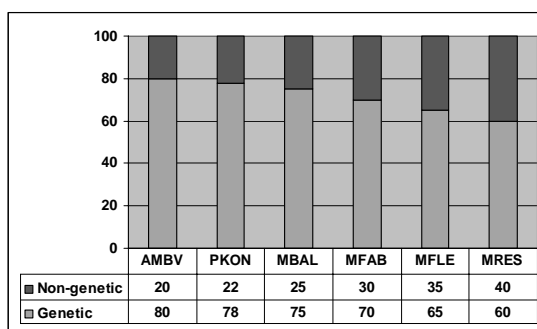


Figure 2. Lower genotype impact

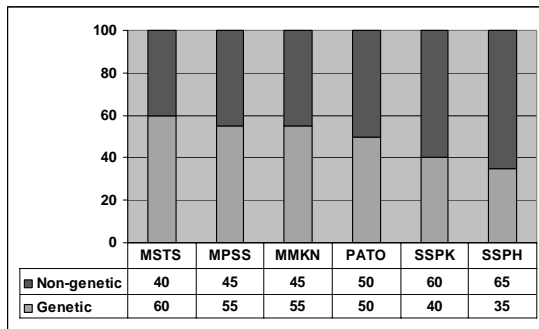


Figure 3. Lowest genotype impact

Graph 1 shows that the high genotype impact of 6 applied variables ranges from 80-98% (skeleton dimension - .98, speed - .95, general cognitive factor - .92, coordination - .87, explosive strength - .85 and precision - .80), with the possibility to be transformed from 2-20%. Lower genotype impact of 6 variables (graph 2) ranges from 60-80% (mass and body volume - .80, pathological conative characteristics - .78, balance - .75, functional abilities - .70, flexibility - .65 and repetitive strength - .60), with the possibility to be transformed from 20 - 40%. The lowest genotype impact (graph 3) ranges from 35-60% (static strength - .60, psychological states - .55, motor knowledge - .55, attitudes and opinions - .50, specific knowledge - .40 and specific habits - 35, with the possibility to be transformed from 40- 65%.

Discussion and conclusion

In recent years in top sport sportsmen selection has been intensified concerning the interaction of their anthropological characteristics, abilities and individuality. This appears as the reaction to traditional training process which was criticised and denied for many years. In traditional training process the trainer has almost the same approach to all sportsmen applying firstly programmed training which is planned in advance on the basis of trainer’s personal experience, intuition and tradition, suggestions of some ‘authorities’ as well as some other suggested and not enough checked information and not on the basis of concrete programmed training in situational conditions.

Sportsmen individual preparation is inevitable and obligatory during all training processes throughout the year because it is creative, can be corrected, interactive and can be compared. Every trainer should practise it disregarding the kind of preparation in focus. Focus of each particular preparation during all training and competing periods depends on the type of sport, age, preparation level, competition levels and sport form achievement and it is on the trainer’s creativity.

Accordingly, it is the trainer's duty to constantly 'listen' to each sportsmen organism, to notice and control the application of used training techniques, methods and burden and to take prompt and right measures so that he can create future work on the basis of feedback paying attention to the planned (expected, desired) sportsmen state in the target time.

Graph 1 shows variables of anthropological characteristics which are in the majority of sports dominant or relevant and have high genotype impact, ranging from 80-98% (skeleton dimension .98, speed .95, general cognitive factor .92, coordination .87, explosive strength .85 and precision .80), with the possibility to be transformed from 2-20%. At first sight such information might cause appropriate doubt and discourage trainers regarding any change under the impact of trainings and burden. However, due to the existence of important interactions (relations, correlations) with other characteristics and abilities in integral anthropological area partial change in concrete training activities is possible.

It practically means that trainings include creation of conditions (specific or situational motion structures improvement or development of abilities with lower or the lowest genotype impact) in order to optimally express naturally and genetically conditioned characteristics and abilities through effective motion structure of specialized sport activities. It really means that specific and/or situational motion structures (technical elements) must be adapted to innate individual speed, coordination, sportsman explosive strength developing all other dominant and relevant motor abilities which are in interaction and present in the structure of particular sport activity (specification equation) unless they are isolated redundant (deranging) motions.

Cognitive abilities represent the basis of thoughtful, conscious activity and it would be impossible to practice methodological procedures of education without them. It would be impossible to analyze sport success and failure, control and manage all other thoughtful operations in the process of training. It is supposed that there is no sport, no matter how much simple, where intelligence does not participate in specification equation. If the general device (general cognitive processor) for reception, information analysis and decision making does not function properly, it is impossible to achieve good results in such a complex situation as top sport. On the basis of former practice, experience, tradition and scientific research it has been discovered that the more complex the structure of sport activity the higher cognitive abilities and vice versa.

Reviewing graph 2 it can be seen that lower genotype impact of 6 variables ranges from 60-80% (mass and body volume .80, pathological conative characteristic .78, balance .75, functional abilities .70, flexibility .65 and repetitive strength .60), with the possibility to be transformed from 20 - 40%. In the majority of sports mass and body volume, functional abilities and conative characteristics represent anthropological segments which are important for achievement of top sport results because there is the possibility of their change. In contrast to some sports with hard tissues dominant manifested by sum of longitudinal and transversal dimension in unique skeleton dimension in the majority of other sports sportsmen have increased values in soft tissues defined by the quantity of muscular mass and subdermal fatty tissue. Concerning scientific literature it is known that muscles' volume has direct impact on the ability of muscular strength development. So, it defines the possibility of high or low efficiency of motion, mastering resistance or hurdles. In training procedures of transformation of soft tissues (muscular mass increase) it is highly necessary to pay attention to balance in order to develop active muscular mass by constant use of muscular stations and by adequate nutrition regarding the fact that big muscular mass has high energy consumption which increases total motor efficiency and effectiveness. For pathological conative characteristics (personality characteristics) it is important to emphasize that their increased intensity decreases adaptation level, in other words, if some pathological conative factor is higher, the adaptation level is lower. It is supposed that pathological conative characteristics have physiological basis and cause disturbance of personality integration which causes violation of balance between the process of irritation and inhibition. The influence of conative regulative mechanisms on success in sport activity has different intensity and it depends on the type of mechanism and kind of sport as well as on some other expected or non expected situations and conditions aiming at the most optimal sport result regarding ability, sport knowledge and sportsman form. The intensity which is lower than the expected value of conative mechanism and especially higher one decreases the potential sport success of sportsmen. Sportsmen functional abilities are mostly identified with their motor capacity which is characteristic for its longer motion and is based on the efficiency of function of regulative mechanisms which are manifested in energetic reserves (adenozin-triphosphate, creatin-phosphate, glycogen and oxygen) and functional quality of energetic potential. Some groups of muscle fibres (slow-contracting, oxidizing or red) are suitable for slow aerobic workout while the others are more suitable for non aerobic workout

(fast-contracting, glycolytic or white). It is considered that some white muscle fibres can perform as red muscle fibres as the time passes and accordingly to circumstances (for example in stamina training) but when the training process stops they return to the former state but muscle fibres have high genetic limitation.

Reviewing graph 3 it can be seen that the lowest genotype impact ranges from 35-60% (static strength - .60, psychological states - .55, motor knowledge - .55, attitudes and opinions - .50, specific knowledge - .40 and specific habits - 35, with the possibility to be transformed from 40-65%. From this group of listed variables with low genotype impact the most important is motor knowledge (learnt motion structures) based on the most modern learning theories. On the basis of such knowledge it is certain that new theories, concepts, approach and learning methods should be based on activation of, so far neglected, right cerebral hemisphere where the center for automatic-reflexive creation and task operationalization is based, as well as intuition, creativity and logical thinking with their base in individual genetic potentials. Accordingly, turning learning methods towards right cerebral hemisphere in modern conditions represents an important challenge in sport with the aim to activate unused potential of right cerebral hemisphere and in the interaction of both hemispheres enable motion structures (situational mobility, technique, tactics) to be realized in a simpler way and more appropriately and that way make learning process faster and more efficient and effective. Presented and analyzed research results contribute to the orientation that special attention should be paid to genetic and non genetic potentials of anthropological characteristics when developing sportsmen individuality in order to adequately understand transformational processes and biological adaptation and that way achieve well-timed and valid orientation in sports selection. Then, regarding training technology characteristics and abilities' modelling of sportsmen should be done concerning particular sports and sport disciplines. Further, the diagnosis should be done and finally planning and programming of trainings, methods and burden as well as control and analysis of the effects of total training process. All above stated and analyzed results in the fact that even today and especially in the future the management of training technology in top sport will be impossible without the knowledge of anthropological (humane) genetics in sport and its application. It is non scientific and above all non humane act to violently subject young people to transformational processes of anthropological characteristics in some sports if they do not possess genetic potentials of their individual characteristics and abilities.

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INTERAKCIJA GENETSKIH I NEGENETSKIH POTENCIJALA U FUNKCIJI KREIRANJA I RAZVOJA INDIVIDUALNOSTI SPORTAŠA

Sažetak

Cilj rada je da se na osnovu većeg broja istraživanja u prostoru sportske genetike izvrši analiza interakcije genetskih i negenetskih potencijala antropoloških karakteristika, koji su u funkciji kreiranja individualnosti sportista, radi pravovremene i pravovaljane orijentacija prilikom selekcije, a s druge strane, optimalno modeliranje značajki za pojedine sportove, sprovedo njihovo dijagnosticiranje, planiranje i programiranje, kao i analiza efekata trenažnog procesa. Razmatrane su varijable s visokim utjecajem genotipa, u rasponu 80-98% i mogućnosti transformacije 2-20%, zatim srednji uticaj genotipa u rasponu od 60-80% i mogućnosti transformacije u rasponu 20-40% i mali utjecaj genotipa u rasponu od 35-60% i mogućnosti transformacije u rasponu 40-65%. Generalni zaključak je, da već danas, a pogotovu u budućnosti, upravljanje u procesu trenažne tehnologije u vrhunskom sportu neće biti moguće bez poznavanja i primjene antropološke (humane) genetike u sportu. Neznanstveno je i nestručno (i nehumano), nad mladim ljudima sprovoditi transformacione procese u pojedinim sportovima i sportskim disciplinama, ako oni za njihove individualne osobine, sposobnosti i karakteristike ne posjeduju odgovarajuće genetske potencijale.

Key words: genetika u sportu, antropološke karakteristike, utjecaj genotipa, interakcija, individualnost

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