НАЦИОНАЛНА СПОРТНА АКАДЕМИЯ
"ВАСИЛ ЛЕВСКИ"

КАТЕДРА "ФУТБОЛ, ТЕНИС"

ЧЕТВЪРТА МЕЖДУНАРОДНА НАУЧНА КОНФЕРЕНЦИЯ

Авангард Прима
София, 2007

ESTABLISHMENT OF OPTIMAL PROGRAM MODELS FOR PRACTICE OF ELEMENTS OF FOOTBALL ACCORDING TO BIOMECHANICAL RESEMBLANCE

Aleksandar Aceski
Aleksandar Tufekcievski
Ilija Klincarov
Faculty of physical culture – Skopje, Republic of Macedonia

INTRODUCTION

The purpose of a qualitative biomechanical analysis is to improve technique while purpose of qualitative anatomical analysis is to determine the predominant muscular activity during specific phase of a performance[1].

Knowing the biomechanical characteristics of the elements from the football game it may be established the degree of appropriate muscular groups in the performing of the movement partly for each element.

In order to form new motor skills having this in mind pedagogical principles more often is enforced need for more rational approach at their forming. Because of that, the order of the elements which are training should be of such kind to permit more efficient transfer in the learning process.

From the former knowledge it can be see that certain mechanisms on the central nervous system, are responsible for the control of the motor manifestations with the same biomechanical structure, while for motor manifestations with other biomechanical structure are responsible other mechanisms.

From that reason it is need more rational approach at training of elements of basketball to provide the most efficient transfer in the learning process and to have in mind the pedagogical principles. This is equally important for the class of physical education as well as during the training process in sports clubs.

The subject of this research is studying of the biomechanical and motor structure of the dynamics stereotypes of elements from sports game football, which are most learned on the class of physical education and during the training process in the sports clubs, and the optimal learning order on the same.

Primary aim of this research is to establish the biomechanical optimality at certain elements of football.

Concrete aims of the research are:

- to establish biomechanical similarity between the elements,
- to establish the degree of the biomechanical homogeneity of the elements,
- to establish the next biomechanical similarity,
- to establish similarity of one element with all the other,
- to establish the central roll and the meaning of the elements in the learning process.

[1] McGinnis, P., M., Biomechanics of sport ...2005.

METHODS

During the planning of this research we started from the object and the aims which is from the start conditioned the variables should cover the researching area.

There were analyzed 21 elements from sport game football represented in learning process in Macedonian basic schools as well as in the training process in the sport clubs. The analyzed elements are: 1. passing with the internal part of the foot (PIF), 2. passing with the external part of the foot (PEF), 3. kicking with the upper-internal part of the foot (KUIF), 4. kicking with the upper part of the foot (KUF), 5. kicking with the upper-external part of the foot (KUEF), 6. volley kick in sagittal plane (VKSP), 7. volley kick in horizontal plane (VKHP), 8. kicking with the top of the foot (KTF), 9. kicking with the heel (KH), 10. kicking with the forhead of the head (KFH), 11. kicking with crown of the head (KCH), 12. kicking with the head in jump (KHJ), 13. leading with the upper part of the foot (LUF), 14. receiving with the internal part of the foot (RIF), 15. receiving with the upper part of the foot (RUF), 16. receiving with the thigh (RT), 17. receiving with the chest (RC), 18. caching low balls with banding of the body (CLBBB), 19. catching high balls (CHB), 20. boxing ball with the one hand (BBOH), 21. boxing ball with two hands (BBTH).

Total were defined 82 biomechanical variables and as a starting point for further analyses it was established initially binary matrix. The biomechanical variables are classified in several groups. The first group of variables is intent to describing the aim of realization on the entity it is own. The second group of variables defines the starting and the finishing positions of all sports elements. The third group variables are intent to describe the functional-anatomic structure and the forth group the mechanical structure of analyzed sport elements.

The sample of the football elements is analyzed with the methods of qualitative biomechanical analysis and the results are given in binary matrix with symbols 1 and 0, where in horizontal are placed the elements from football and in vertical the variables[2].

The received facts with the biomechanical analyses on the elements are estimated with more mathematical operation defined with the algorithm ALPROBI. First of all is formed starting binary matrix with basic biomechanical characteristics on the movements. From this matrix we got symmetrical matrix on standardized measures on the biomechanical similarity and are determined all the rest parameters for biomechanical structure on the model.

The first parameter gives information about the coefficient on the biomechanical similarity on the whole system. This coefficient which is standardized from 0-1 points the degree of homogeneity of the elements.

The second parameter is intent for establishing the neighbor biomechanical similarity on the elements. This coefficient is significant for establishing on the degree on the optimality for the learning process.

The third parameter points on the connection of the element with all the others. With this coefficient is established the primary meaning on certain elements in the whole system, the central part on certain elements in the learning process.

For the purpose of the research three different theoretical models of learning were established, presented at table 1.

[2] The example of the biomechanical variables and the binary matrix are not shown and they are at the authors.

Table 1. Theoretical models of football sport elements learning order

MODEL I	MODEL II	MODEL III
1. passing with the internal part of the foot (PIF)	2. passing with the external part of the foot (PEF)	5. kicking with the upper-external part of the foot (KUEF)
2. passing with the external part of the foot (PEF)	1. passing with the internal part of the foot (PIF)	9. kicking with the heel (KH)
3. kicking with the upper-internal part of the foot (KUIF)	5. kicking with the upper-external part of the foot (KUEF)	13. leading with the upper part of the foot (LUF)
4. kicking with the upper part of the foot (KUF)	4. kicking with the upper part of the foot (KUF)	20. boxing ball with the one hand (BBOH)
5. kicking with the upper-external part of the foot (KUEF)	3. kicking with the upper-internal part of the foot (KUIF)	16. receiving with the thigh (RT)
6. volley kick in sagittal plane (VKSP)	7. volley kick in horizontal plane (VKHP)	12. kicking with the head in jump (KHJ)
7. volley kick in horizontal plane (VKHP)	6. volley kick in sagittal plane (VKSP)	8. kicking with the top of the foot (KTF)
8. kicking with the top of the foot (KTF)	9. kicking with the heel (KH)	4. kicking with the upper part of the foot (KUF)
9. kicking with the heel (KH)	8. kicking with the top of the foot (KTF)	18. caching low balls with banding of the body (CLBBB)
10. kicking with the forehead (KFH)	12. kicking with the head in jump (KHJ)	11. kicking with crown of the head (KCH)
11. kicking with crown of the head (KCH)	11. kicking with crown of the head (KCH)	21. boxing ball with two hands (BBTH)
12. kicking with the head in jump (KHJ)	10. kicking with the forehead (KFH)	1. passing with the internal part of the foot (PIF)
13. leading with the upper part of the foot (LUF)	13. leading with the upper part of the foot (LUF)	3. kicking with the upper-internal part of the foot (KUIF)
14. receiving with the internal part of the foot (RIF)	16. receiving with the thigh (RT)	15. receiving with the upper part of the foot (RUF)
15. receiving with the upper part of the foot (RUF)	15. receiving with the upper part of the foot (RUF)	6. volley kick in sagittal plane (VKSP)
16. receiving with the thigh (RT)	14. receiving with the internal part of the foot (RIF)	14. receiving with the internal part of the foot (RIF)
17. receiving with the chest (RC)	17. receiving with the chest (RC)	2. passing with the external part of the foot (PEF)
18. caching low balls with banding of the body (CLBBB)	19. catching high balls (CHB)	7. volley kick in horizontal plane (VKHP)
19. catching high balls (CHB)	18. caching low balls with banding of the body (CLBBB)	19. catching high balls (CHB)
20. boxing ball with the one hand (BBOH)	21. boxing ball with two hands (BBTH)	11. kicking with crown of the head (KCH)
21. boxing ball with two hands (BBTH)	20. boxing ball with the one hand (BBOH)	3. kicking with the upper-internal part of the foot (KUIF)

RESULTS AND DISCUSSION

According to results from the research at the sports game football it could be concluded that the biggest biomechanical similarity it is found between the elements kick with the upper part of the foot and kick with upper-external part of the foot. Some smaller similarity is appearing between kick with upper-internal part of the foot and kick with upper-external part of the foot which is 91%, volley kick in sagittal plane and kick with the top of the foot which is 88%, as well as between the elements kick with the upper part of the foot and kick with the top of the foot with 88%. Smaller biomechanical similarity it is noticed between the elements volley kick in horizontal plain and receiving high balls which is 10% as between volley kick in sagittal plane and receiving high balls with 10%.

Coefficient on the biomechanical similarity of all elements in all three models is 0.44. That means the elements from football have more expressive heterogeneous biomechanical structure. From didactical aspect this fact points that in the learning process it can not be expected effective transfer between some elements. Coefficient on the next biomechanical similarity at the all elements given in determinate order in the first model is 0.65 in the second 0.62 while in the third 0.43. This fact says that the order of learning on the sports elements from football according to the first model is most optimal. An upon the strength values on the biomechanical connection of one element with all the rest in the model, it may be concluded that central place in the learning process in sports techniques in football have elements: kick with the top of the foot (.56), passing with the external part of the foot (.52), kick with the upper part of the foot (.52), leading with the upper part of the foot (.53) and volley kick in sagittal plane (.52).

Table 2. Standardized measured of the biomechanical similarity between football elements, coefficient of strength relationship on one element with all the rest (in the main diagonal), coefficient on biomechanical similarity on the whole system on elements (KBSWS) and the coefficient on next biomechanical similarity of all elements (KNBSWS).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	(.50)																				
2	.826	**(.52)**																			
3	.711	.667	(.48)																		
4	.546	.592	.774	**(.52)**																	
5	.667	.756	**.909**	.791	(.41)								KBSWS = .44								
6	.546	.592	.774	**1.00**	.791	(.51)															
7	.455	.410	.651	.714	.651	.714	(.41)								KNBSWS = .65 (first model)						
8	.667	.711	.682	**.884**	.727	**.884**	.651	**(.56)**							KNBSWS = .62 (second model)						
9	.606	.606	.477	.537	.477	.537	.342	.667	(.50)						KNBSWS = .43 (third model)						
10	.202	.202	.310	.423	.310	.423	.318	.362	.434	(.35)											
11	.253	.303	.207	.318	.259	.318	.212	.362	.434	.647	(.35)										
12	.319	.319	.419	.429	.419	.429	.476	.372	.342	.582	.370	(.36)									
13	.718	.765	.538	.651	.587	.651	.551	.783	.564	.223	.334	.350	**(.53)**								
14	.728	.592	.512	.381	.419	.381	.238	.512	.683	.212	.265	.238	.551	(.46)							
15	.578	.622	.409	.512	.455	.512	.326	.636	.620	.207	.310	.233	.685	.744	(.49)						
16	.590	.639	.402	.514	.452	.514	.257	.653	.738	.286	.400	.206	.595	.772	.854	(.50)					
17	.287	.287	.147	.200	.147	.200	.150	.293	.462	.501	.556	.250	.316	.451	.440	.541	(.34)				
18	.239	.239	.196	.200	.196	.200	.150	.147	.257	.501	.445	.350	.263	.350	.342	.324	.632	(.31)			
19	.335	.335	.147	**.100**	.147	**.100**	.100	.245	.410	.390	.390	.250	.368	.451	.440	.433	.632	.790	(.34)		
20	.431	.478	.391	.401	.440	.401	.401	.489	.359	.278	.278	.401	.526	.350	.391	.379	.158	.211	.316	(.40)	
21	.420	.466	.381	.390	.429	.390	.439	.477	.350	.271	.271	.488	.513	.342	.381	.369	.154	.257	.359	.872	(.40)

CONCLUSION

On upon the results form the biomechanical analysis of elements from the sports game football and the coefficient received with data estimated it could be concluded that:

- Knowing the biomechanical characteristics of the elements form the football game it may be established the degree of the involved muscles groups in the performing of the movements partly for each element.
- The first model on the order of the training of the elements from football is the most optimal according to the criterion on the next similarity on the group analyzed elements. This kind of model is expected to give the most effective transfer in the training process in sports clubs and in the classes of physical education.

In order to confirm this optimal model is necessary to conduct experimental research in practice.

REFERENCES

1. Aceski, A., Naumovski, M., Petrov, L. (2005). Utvdavane na optimalen model za obucavane na tehniceskite elementi ot sportnata igra basketbol. Sport&nauka. Izvanredni broj 4. Veliko Trnovo.
2. Aceski, A. (2005). Utvrduvanje na optimalni programski modeli za ucenje na elementite od sportskite igri kosarka, odbojka, fudbal i rakomet), Neobjaven trud, Skopje: Fakultet za fizicka kultura.
3. Anastasovski, I.(1999). Utvrduvanje na optimalen model za obucuvanje na elementite od kosarka kaj ucenicite od pettite oddelenija. Magisterski trud, Skopje: Fakultet za fizicka kultura.

4. Anastasovski, I. (2001). Utvrduvanje na optimalni modeli za obucuvanje na elementite od sportskite igri kosarka, rakomet, odbojka i fudbal opfateni vo nastavnite planovi za osnovnoto obrazovanie. Doktorska disertacija, Skopje: Fakultet za fizicka kultura.
5. Anastasovski, I., Popovski, A. (2004). Utvrduvanje na optimalen model za ucenje na elementite od kosarka spored biomehanickata struktura opfateni vo nastavniot plan i program za osnovno obrazovanie. Fizicka kultura, Skopje, br. 1, 107-110.
6. Behnke S. R. (2006) Kinetic anatomy. Human kinetics.
7. Klincarov, I. (1997). Utvrduvawe na optimalna metodska postavenost na predvidenite sodrzini od sportskite igri vo nastavnite planovi za osnovnoto obrazovanie. Magisterski trud, Skopje: Fakultet za fizicka kultura.
8. Klincarov, I. (2001). Optimalna metodska postavenost i realizacija na nastavata po predmetot fizicko i zdravstveno obrazovanie vo osnovnoto obrazovanie vo Republika Makedonija. Doktorska disertacija, Skopje: Faukultet za fizicka kultura.
9. Knudson V. D., Morrison S. C.: Qualitative analysis of human movement, second edition, Human kinetics, 2002.
10. McGinnis, P., M. (2005). Biomechanics of sport and exercise 2nd edition. Human Kinetics, USA.
11. Opavski, P. (1982). Osnovi biomehanike. Naucna knjiga, Beograd.
12. Tufekcievski, A. (2000). Biomehanika na covekoviot lokomotoren sistem. De Gama - Skopje, Skopje.
13. Tufekcievski, A.: (1991). Praktikum po biomehanika, Skopje.
14. Tufekcievski, A. (2003). Biomehanika. Skopje: Fakultet za fizi~ka kultura.
15. Tufekcievski, A., Dukovski, S., Angelovski, D., Naumovski, M. (1990). Biomehanicka optimalnost na ucenje na elementi od kosarka. Neobjaven trud, Skopje.
16. Tufekcievski, A. (1988). Biomehanicka struktura na dinamickite stereotipi vo fizickata kultura. Doktorska disertacija, Skopje: Fakultet za fizicka kultura.
17. Tufekcievski, A., Jankovski, Q., Trninic, S., Ristovski, D. (1988). ALPROBI - algoritam i program za utvrduvanje na optimalnosta na mrezesti biomehanicki modeli za ucenje na motornite stereotipi. Godisen zbornik na Fakultetot za fizicka kultura, Skopje.
18. Thomas R. J., Nelson K. J., Silverman J. S.: Research methods in physical activity. Fifth edition, Human kinetics, 2005.