WARMED UP BODIES AND SPORTING CAPACITY

Arnold PAVLOV

Donetsk legal institute

Abstract. Research is conducted from the change of the special capacity in a few groups of sportsmen at the increase of temperature of body during training. It appears that the middle increase of indexes of the special capacity of sportsmen at the increase of the T body during training makes: 1. Athletes – 8,3% (only from data of those indexes which were registered to loading), 2. Boxers – 2[illegible],1%, 3. Karate-men – 37,8%.

Key words: sporting capacity, warmed up bodies, training.

DIFFERENTIATION OF MOVEMENT PATTERNS IN THE LOWER EXTREMITIES JOINTS DURING GAIT WITH NATURAL VELOCITY

W. FORCZEK, W.CHWAŁA

Academy of Physical Education in Krakow, Poland

Introduction. Locomotion is a general definition encompassing all movement transferring the body. However walking is the most common form of locomotion. It forms a basic part of our daily activity being highly complex at the same time. The literature review shows that scientists' considerations (especially in the last decades) are particularly focused on controversial issues concerning gait symmetry or asymmetry. It results from questions regarding limb coordination in producing smooth rhythmical motion of the able-bodied. Up till now (to simplify data collection)it has been assumed, that symmetry was a natural phenomenon, whereas asymmetry was seen as a sign of pathology.

Currently, however, it is said that asymmetrical behavior of the lower limbs reflects functional differences between the lower extremities (Vanden-Abeele 1980). This difference is related to the contribution of each limb in carrying out the tasks of propulsion and control during able-bodied gait. According to Hirasawa (1981) one lower limb is responsible for support and body weight transfer during walking, while the contralateral limb contributes more to propulsion.

Hence there is a need for the research, that would support this hypothesis. It may help in the future to use the results in practical evaluation of gait pathology.

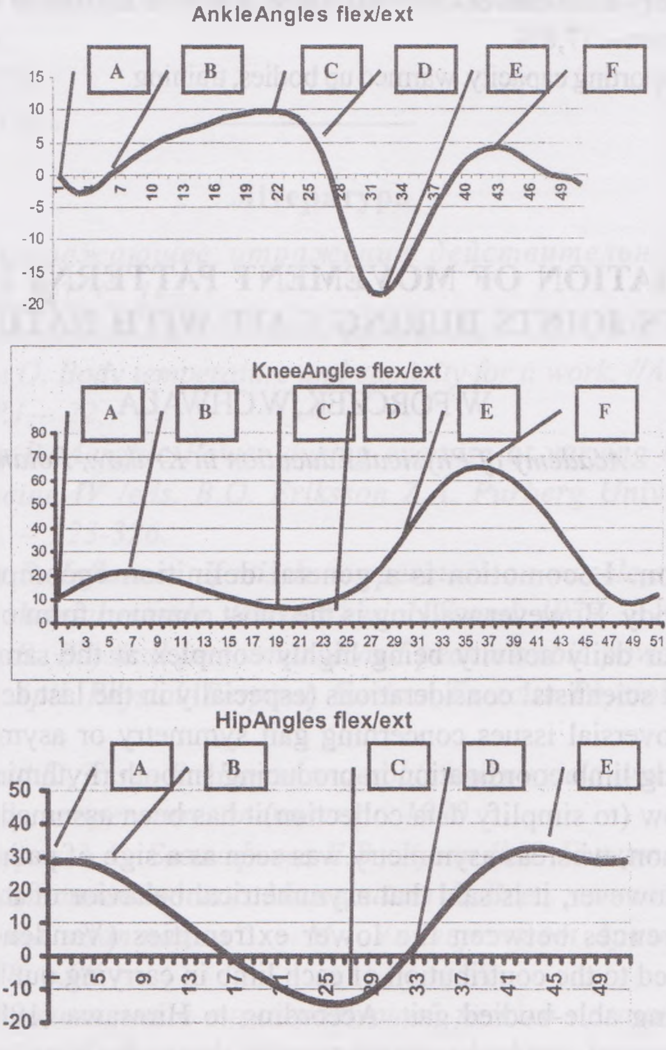
The purpose of this study is to show the range of asymmetrical behavior of the lower limbs in locomotion with natural velocity in able-bodied aged 18-25 as far as mean angle ranges are concerned.

Material and method. The study was made in 2004 in Biokinetics Workshop in Department of Human Movement at the Academy of Physical Education in Krakow. The study was based on a sample of 15 volunteers aged 18-25 using the optoelectronic system Vicon with five cameras. Using this system it was possible to establish the tri-dimensional trajectories of markers fixed on the subjects' skin.

Inclusion criteria aimed at selecting only subjects without any locomotor's disorders no history of orthopedic or neurosensory disorders that would affect the results of the study.

12 gait cycles with normal stabilized velocity for each subject were recorded. Mea values of biomechanical parameters that characterize locomotion trajectories based on 480 normalized walking cycles (Hof 1996). The study was based on the mean values of angle ranges in sagittal plane in the following joints: ankle joint, knee joint and hip joint.

The angular values are marked on the graph in the following characteristic points:



Graph 1. The angular changes in sagittal plane of: ankle joint, knee joint, hip joint

Results. The joints of the lower extremities have, at the initial contact (IC) the following mean angular values: ankle joint 3° dorsal flexion, knee joint 17° flexion and hip joint 35° flexion. The differences between mean values for both lower limbs are small (no more than 1°). More significant differences are noticed in analysis of extreme values, that shows differences in movement patterns during the initial contact. Disparity of the results in all cases oscillates between several degrees. The highest relative value regards the ankle joint.

At the onset of the stance the ankle joint has the same angular position as in IC. Knee joint flexes significantly from the onset of the gait cycle to the singular support phase of approximately 29°. In the first phase of double support, the hip joint is stabilized but also its flexion angle decreases smoothly reaching about 31° in the end.

The joints of the lower extremities have, at the initial contact (IC) the following mean angular values: ankle joint 3° dorsal flexion, knee joint 17° flexion and hip joint 35° flexion. The differences between mean values for both lower limbs are small (no more than 1°). More significant differences are noticed in analysis of extreme values, that shows differences in movement patterns during the initial contact. Disparity of the results in all cases oscillates between several degrees. The highest relative value regards the ankle joint.

As far as the knee joint is concerned, in the mid stance, it achieves the smallest value of angle flexion (approximately 12°), with just 1° difference between right and left limb. Considerable changes however, are found in minimum and maximum values (about 15°).

Table 1 shows the results of the base statistic analysis of the angular changes.

Table 1. Base statistics of the analyzed variables in the lower limbs

	MEAN VALUE	MINIMUM	MAKSIMUM	STANDARD DEVIATION
PS_A	2,8	0,1	6,6	2,08
LS_A	2,5	0,0	6,8	2,16
PS_B	2,5	0,3	6,3	1,71
LS_B	2,3	0,1	5,3	**1,64**
PS_C	14,2	8,9	20,6	3,95
LS_C	12,8	2,4	17,6	4,82
PS_D	**12,3**	7,8	18,5	3,89
LS_D	**6,9**	0,9	15,1	4,43
PS_E	**14,8**	3,2	**28,3**	**7,66**
LS_E	**17,7**	7,4	**31,3**	6,51
PS_F	7,2	0,1	11,8	3,50
LS_F	7,1	2,1	12,1	2,98
PK_A	17,1	9,4	24,9	4,23
LK_A	16,0	7,1	24,0	4,95
PK_B	29,5	21,4	38,0	5,55
LK_B	28,5	21,0	35,1	5,05
PK_C	12,8	6,3	20,3	4,68
LK_C	11,7	2,0	18,8	4,81
PK_D	**20,2**	12,0	32,4	5,08
LK_D	**24,9**	14,0	35,3	4,75
PK_E	**56,4**	46,3	63,1	5,13
LK_E	**51,8**	42,7	62,2	5,36
PK_F	71,0	65,0	80,4	4,55
LK_F	70,1	63,9	78,2	3,59
PB_A	35,7	29,7	45,5	5,00
LB_A	35,4	29,0	42,2	4,48
PB_B	32,3	25,5	43,1	4,63
LB_B	30,4	24,5	39,4	3,78
PB_C	8,3	0,5	15,2	4,86
LB_C	8,9	1,0	19,4	5,51
PB_D	4,9	0,0	12,0	3,93
LB_D	4,6	0,3	11,2	3,47
PB_E	37,8	28,5	48,3	5,34
LB_E	37,3	30,7	45,2	4,86

P – right lower limb, L – left lower limb, S – ankle joint, K – knee joint, B – hip joint, ABCDEF – points that characterize phases of the gait

Ankle joint plantar flexion (13°) is clearly seen but differences of several degrees are noted in extreme values. In the second double support phase of the gait the increasing angle of knee flexion is documented (approximately 20° - right limb and 25° - left limb). These parameters reflect significant asymmetry of the gait patterns between lower extremities at the same phase of the gait cycle. The analysis also reveals a 6° difference in the angle of ankle plantar flexion between right and left limb. In this phase there is about 8,5° of extension of the hip joint. The differences regarding the mean values for both limbs are not statistically significant (no more than 0,5°). Significant differences are found in extreme values, which confirm different gait patterns previously seen in the subjects. There are significant disparity of several degrees of the extreme values in all cases. The highest relative values refers to the hip joint.

Foot off phase that is the onset of the swing phase: knee joint rapidly flexes providing approximately 56°(right limb) and 52° (left limb) angle values. The foot flexes to 16° (to avoid floor contact). There are very clear differences noted in the individual values (of 20-24°oscillations).

At the end of the mid stance the maximum values are found in knee flexion (about 70,5°). The angle is almost the same for right and left limb. The difference (of approximately 15°) is found in extreme values. Hip joint moves to achieve the highest angle flexion of 37,5°. Disparity in the results is also the most significant here – with regard to extreme values. The ankle joint stays in dorsiflexion 7°. There is a relatively high disparity in this joint in the subjects.

To summarize: the results of the base statistics do not reveal many differences between mean values for both extremities. However, more significant differences are noted with regard to extreme values analysis, that shows individual differences in movement patterns between the subjects.

The next approach is to evaluate relationship among the corresponding parameters in the subjects group by means of the Pearson coefficient correlation. The results of the analysis tend to determine parameters relationship among movement patterns. In this case it refers to the angular joints in the right and left limb. In order to verify the relationship between pairs of parameters using r index, Guilford's share was applied (Ryiko 1989):

Correlations are statistically significant with applying p=0,05.

Table 2. The coefficient correlation values between the corresponding variables in both extremities in:

a) Ankle joint:

	LS_A	LS_B	LS_C	LS_D	LS_E	LS_F
PS_A	0,68					
PS_B		0,80				
PS_C			0,71			
PS_D				0,67		
PS_E					0,73	
PS_F						0,53

b) Knee joint

	LK_A	LK_B	LK_C	LK_D	LK_E	LK_F
PK_A	0,80					
PK_B		0,90				
PK_C			0,78			
PK_D				0,77		
PK_E					0,62	
PK_F						0,75

c) Hip joint:

	LB_A	LB_B	LB_C	LB_D	LB_E
PB_A	0,93				
PB_B		0,93			
PB_C			0,85		
PB_D				0,43	
PB_E					0,93

The analyses of the correlation between right and left limb show that:
- very high correlation regards to the parameters of:
the knee joint PKB (0,90);
the hip joint in relation to the following variables: PBA, PBB, PBE (0,93);
- high correlation regards to the parameters of:
the ankle joint: PSB, PSC , PSE (0,71 – 0,80);
the knee joint: PKA, PKC, PKD, PKF (0,75 – 0,80);
the hip joint: PBC (0,85);
- other parameters have a moderate correlation reaching values 0,43 – 0,68.

The analyses of the correlation reflect very similar gait patterns in the given phases, where in others the differences are more significant. In other words it means higher asymmetry in the lower limbs behavior.

The purpose of the next approach is to determine, whether differences in angular joint positions during gait are statistically significant. Table 3 shows the results of t-Student test for dependent variables. The hypothesis regarding statistically significant differences between mean values of the studying parameters are tested by applying a=0,05.

T-Student test reveals not all parameters achieved values larger than a=0,05. That is why in such cases, there are foundations to reject the hypothesis. As it said, there are not statistically significant differences between mean values of the studying parameters.

Discussion. Gait interpretation in able-bodied subjects often assume lower limbs symmetry, whereas asymmetry is seen as a sign of abnormal behavior. However, if we accept asymmetry in the healthy subjects as a normal phenomenon, we can better understand the functional differences between lower extremities. The studies report that this phenomenon can be associated with the different contributions of the lower limbs in carrying out propulsion and control tasks (Hirokawa 1989, Sadeghi 1997). These researchers suggested that the activity of the leading limb (responsible for propulsion) is related to that of the trailing limb (stabilizing).

Table 3. T-Student test for dependent variables using the corresponding parameters in both limbs in subjects. The significant differences are marked when p<0,05

	t	p
PK_A - LK_A	1,3353	0,203096
PK_B - LK_B	1,7552	0,101071
PK_C LK_C	1,4103	0,180269
PK_D - LK_D	-5,3944	**0,000095**
PK_E - LK_E	3,8304	**0,001837**
PK_F - LK_F	1,2404	0,235201

	t	p
PS_A - LS_A	0,50218	0,623347
PS_B - LS_B	0,71141	0,488515
PS_C - LS_C	1,52889	0,148567
PS_D - LS_D	6,11347	**0,000027**
PS_E - LS_E	-2,15266	**0,049272**
PS_F - LS_F	0,19485	0,848308

	t	p
PB_A - LB_A	0,7173	0,484959
PB_B - LB_B	4,2453	**0,000816**
PB_C - LB_C	-0,8917	0,387604
PB_D - LB_D	0,2846	0,780091
PB_E - LB_E	0,9602	0,353236

If we take our study into account, it seems to be hard to point out significant differences in angular joint ranges, that apparently confirmed symmetry. But more detailed analyses provide considerable differences in relation to some of the parameters mean values.

Asymmetry is noticed in sagittal plane regarding knee joint angle during foot off (about 60% gait cycle (GC)) and maximal knee flexion in the swing phase (70% GC). As ankle joint is concerned, there are significant differences at the onset of the second double support phase (50% GC) and in maximal ankle plantar flexion (60% GC). The patterns of hip movement point out significant differences when p=0,05 only at the end of the first double support phase (10% GC). Other parameters present just small differences among the mean values of the right and left limb. But angular change values that were achieved during our research characterizes remarkable disparity of individual results, which in turn show considerable variability of individuals.

Conclusions

1. The results of the base statistics (Tab.1) do not find many remarkable differences between mean values for both extremities. However more significant differences are noted in regard to the extreme values analyses, that shows individual differences in movement patterns in subjects.

2. The analyses of variables reveal generally high level of the Pearson coefficient correlation (r) (Tab.2a,b,c), that clearly suggests relationship between parameters of right and left limb.
3. T-Student test (Tab.3) report that not all of the parameters achieve more than a=0,05. It provides foundations to reject the hypothesis that assume lack of the differences in the range of subjects parameters.
4. Asymmetry is noticed in sagittal plane regarding knee joint angle during foot off (about 60% Gait Cycle (GC)) and maximal knee flexion in the swing phase (70% GC). As ankle joint is concerned, there are significant differences at the onset of the second double support phase (50% GC) and in maximal ankle plantar flexion (60% GC).

Reference

1. *Allard P., Lachance R., Aissoui R., Sadeghi H., Duhaime M.: Able-bodied Gait in Men and Women [w:] Three-dimensional Analysis of Human Locomotion. 1997.*
2. *Bober T., Zawadzki J., Biomechanika układu ruchu człowieka, Wydawnictwo BK. Wrocław, 2001.*
3. *Gundersen L.A : Bilateral analysis of knee and ankle during gait: an examination of the relationship between latera dominance and symmetry. Phys. Therapy J.Am.Phys. Therapy Assoc. 1989, Vol. 69, 8.*
4. *Laassel E.M., Loslever P., Angue J.C.: Patterns of relations between lower limb angle excursions during normal gait. J. Biomed. Eng. 1992, Vol.14.*
5. *Liakh V.: Symetria i asymetria ruchów u dzieci w wieku 7-17lat podczas wykonywania działań ruchowych wymagających przejawiania zdolności koordynacyjnych. Antropomotoryka 2001, 22.*
6. *Ryłko A., Metody analizy statystycznej, Wydawnictwo skryptowe nr 104, AWF im. Bronisława Czecha, Kraków, 1989.*
7. *Sadeghi H., Allard P., Prince F., Labelle H.: Gait symmetry and limb dominance in able-bodied gait: a review. Gait and Posture 2000, 12 (1).*
8. *Sadeghi H.: Contributions of lower-limb muscle power in gait of people without impairments, Physical Therapy, 2000, Vol.80 (12).*
9. *Stanisz A., Przystępny kurs statystyki, StatSoft Polska, Kraków, 1998.*
10. *Starosta W.: Symetria i asymetria ruchów człowieka [w:] Motoryczność człowieka – jej struktura, zmienność i uwarunkowania. AWF Poznań 1993.*
11. *Stokłosa H.: Kształtowanie się asymetrii funkcjonalnej i morfologicznej 7–15-letnich dziewcząt i chłopców. Katowice 1998.*

DIFFERENTIATION OF MOVEMENT PATTERNS IN THE LOWER EXTREMITIES JOINTS DURING GAIT WITH NATURAL VELOCITY

W. FORCZEK, W.CHWAŁA

Academy of Physical Education in Krakow, Poland

Abstract. Walking is the most common form of locomotion. The literature review shows controversial issues with regard to gait symmetry or asymmetry. Up till now it has been assumed, that symmetry was a natural phenomenon, whereas asymmetry was seen as a sign of pathology. The purpose of this study is to show the range of asymmetrical behavior of the lower limbs in locomotion with natural velocity in able-bodied. As a result of this research asymmetry is noticed in sagittal plane regarding knee joint angle during foot off (about 60% Gait Cycle (GC)) and maximal knee flexion in the swi phase (70% GC). Refers to the ankle joint, there are significant differences at the onset of the seco double support phase (50% GC) and in maximal ankle plantar flexion (60% GC).

Key words: normal gait, asymmetry, angular changes, sagittal plane.

ВПЛИВ АНТРОПОМЕТРИЧНИХ, ФУНКЦІОНАЛЬНИХ ТА ПСИХОФІЗІОЛОГІЧНИХ ПОКАЗНИКІВ НА ТРАВМАТИЗМ БАСКЕТБОЛІСТОК ВИСОКОГО КЛАСУ

Жанетта КОЗІНА

Харківський національний педагогічний університет ім. Г.С. Сковороди
Харківська державна академія фізичної культури

Актуальність. Сучасний баскетбол – один з найбільше травмонебезпечних вид спорту [1,7]. Це, по-перше, пов'язане з тим, що баскетбольний майданчик – відносн невеликий простір для пересувань на максимальній швидкості десяти чоловік, грав двох команд, ваго-зростові дані яких істотно перевищують середні значення [1,6]. У результаті часто відбуваються зіткнення при боротьбі за м'яч, ривках і проходах п кільце, грі в захисті і швидких проривах. По-друге, зростають обсяг й інтенсивніст навантажень, які застосовуються в навчально-тренувальному процесі баскетболісто відсутність індивідуального підходу до контролю навантажень і навчання техні тактиці є причинами перевтоми і перенапруги, що призводить до травм і захворюва опорно-рухового апарату [4]. Третьою причиною травмонебезпеки баскетболу зростаюча конкуренція між гравцями і командами, поступова комерціалізація цьо виду спорту. Це змушує спортсменів працювати на межі своїх фізичних і психічн можливостей, що також приводить до травматизму. Але існують ще й функціональ антропометричні та психофізіологічні причини травматизму в баскетболі, які є мал дослідженими.

Загальноприйняті методи лікування та профілактики травм опорно-рухов апарату не завжди дають бажаний результат і часто є важкими у застосуванні. То особливої актуальності має розробка нових ефективних та простих метод профілактики та лікування травм опорно-рухового апарату.

Мета роботи полягала у виявленні фізичних та функціональних прич травматизму та ефективності застосування комплексної методики відновлен баскетболісток після травм опорно-рухового апарату.

Завдання:

1. Визначити антропометричні та функціональні причини травматизму в баскетбо
2. Визначити можливі заходи профілактики травматизму спортсменок у баскетбо
3. Визначити вплив застосування мумійо та лікарських рослин на процес відновле після травм опорно-рухового апарату в жіночому баскетболі.

Методи дослідження: теоретичний аналіз літературних і наукових дан педагогічний метод суб'єктивної оцінки ваги навантаження [9] й інтенсивності болю