

# Cinematic and electromyographic analysis of a basic athletic test: the walkover in well trained and beginners young female gymnasts

Foidart-Dessalle M, Krier P, De Pasqua V, Crielaard JM.

Department of Physical Medicine and Rehabilitation, Superior Institute of Physical Learning and Physiotherapy, University of Liege, Belgium

## Introduction

Walkover is a basic acquisition in gymnastic. It is frequently used as a test for beginners in the French clubs. It results of the successive impulsion developed by the lower limb and the upper limbs with hip remaining extended and without flying phase (Figure 1). However, publications about it are very few and not recent.

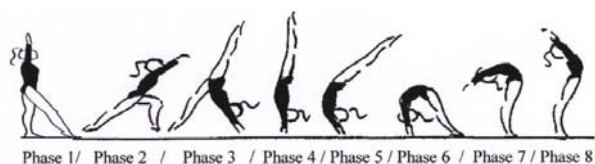


Fig. 1. Walkover different phases

The aim of our study is: to actualise the knowledge on optimal realisation of the test and to analyse the test in individuals in order to improve and personalise the training.

## Material and methods

Two groups are tested: six high level gymnasts and six beginners.

### High level gymnasts:

Subjects	Age (years)	Height (cm)	Weight (kg)	Level	Practice Hrs/week	Last competition (Belgium championship)
MF	14	150	40	D2	17.5	1 <sup>st</sup> place
SY	13	154	41.5	D2	20	1 <sup>st</sup> place
NL	11	145	27	D1	17.5	12 <sup>th</sup> place
NS	11	138	28	D2	17.5	10 <sup>th</sup> place
JM	11	140	29.6	D2	16.5	13 <sup>th</sup> place
FQ	14	149	41.4	D2	17	6 <sup>th</sup> place
M ± EC	12.3 ± 1.5	146 ± 6.2	35.6 ± 7.0	/	17.6 ± 1.2	/

### Beginners:

Subjects	Age (years)	Height (cm)	Weight (kg)	Level	Practice Hrs/week	Last competition (Regional gymnastic association)
LG	13	152	37	D5	9	4 <sup>th</sup> place
EH	12	158	45.2	D5	9	7 <sup>th</sup> place
LM	13	160	50.5	D4	12	15 <sup>th</sup> place
AB	13	155	42	D5	9.5	8 <sup>th</sup> place
MC	12	142	39	D5	5.5	11 <sup>th</sup> place
EB	12	143	34	D5	5.5	13 <sup>th</sup> place
M ± EC	12.5 ± 0.5	151.7 ± 6.7	41.9 ± 6.0	/	8.4 ± 2.5	/
P	0.80	0.19	0.11	/	0.0002	/

Cinematic data are acquired by infrared camera (Elite system) simultaneously with electromyograms of 4 periscapular muscles (Figures 2 and 3).



Fig. 2. Markers position

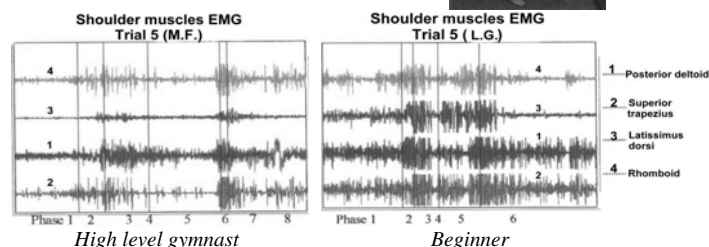


Fig. 3. Periscapular muscles EMG during walkover – comparison between a high level gymnast (M.F.) and a beginner (L.G.)

## Results and discussion

Comparison data	Subjects	Mean values	SD	P
Markers 4-5 distance thigh	High level gymnasts Beginners	33.4 mm 37.3 mm	1.7 mm 3.8 mm	0.046
Markers 5-6 leg	High level gymnasts Beginners	34.8 mm 37.3 mm	2.2 mm 1.7 mm	0.052
Shoulders backup ER	High level gymnasts Beginners	36.71 mm 4.45 mm	22.7 mm 8.5 mm	0.008
Hips maximal angle AH max	High level gymnasts Beginners	267.43° 252.35°	6.47° 15.29°	0.05
Vmax hips fall	High level gymnasts Beginners	-1060.21 mm/ms -1475.41 mm/ms	126.04 mm/ms 159.86 mm/ms	0.001
Vmax knees fall	High level gymnasts Beginners	-2201.16 mm/ms -3455.84 mm/ms	383.51 mm/ms 722.29 mm/ms	0.004

Confirmed gymnasts have a quite different morphology from beginners: shorter lower limbs. They control better the descending velocity of the trunk, open more the angle between hip and trunk, and backup more the shoulders in ATR posture (phase 4 to 5). Michotte (1) had already defined such differences. In addition, compared to the beginners, the confirmed gymnasts restrict the electromyographic activity of the periscapular muscles clearly to the phases 2 and 3 in the just time to provide adequate power for the second impulsion depending on shoulder extension. In phases 4 and 5, the electrical activity of these muscles acting in the same direction as gravity is supposed contributing to a slower descending velocity of the trunk.

An analysis of individual parameters in the two groups helps to detect specific errors such as lack of impulsion velocity, insufficient backup of the shoulder, lack of muscle contraction.

## Conclusion

Proprioception and strength of scapular muscles are mandatory to succeed in the walkover. Individual analysis of the cinematic and electromyographic parameters (Elite system) could led to personalise training programs in beginners as well as in experimented gymnasts.

## References

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