

Institute of Medical Physics
Friedrich-Alexander-University of Erlangen-Nuremberg
Henkestrasse 91
D-91054 Erlangen
Germany

Energy expenditure during a 30-minute exercise unit with the “FLEXI-BAR®” – Pilot Study

Dippert T., Moeller K., v. Stengel S., Kemmler W.

Background

Weight- and especially fat reduction are not the least of preventive health and fitness training goals, and for many, these goals provide the primary motivation to become active in sports. To positively influence achievement of these goals, cyclical, aerobic training methods such as walking and/or running are generally advocated. Such types of exercise do in fact provide comparatively large muscle groups with primarily moderate stimuli over an extended period of time, which, in addition to effectively increasing acute energy expenditure, also have a positive effect in the reduction of risk factors associated with the cardiovascular system and improving physical stamina. However, with regard to complaints or diseases of the musculoskeletal system, their protective effects can only be classified as marginal. Given the time constraints of our predominantly physically inactive society, it is an advantage to engage in forms of fitness training methods which simultaneously address a number of different health-related risk factors at once.

In this respect, a recently published study about the “FLEXI-BAR®” shows impressive results regarding increased muscular stimulation and an increase in muscular exertion induced by the oscillations of the FLEXI-BAR®¹. From this it can be surmised that the increased effectiveness of the training also influences muscular strength and muscular endurance. In the past, improvements in core stability by means of increased activation of the deep rotational core musculature through reflexive stimuli were often the subject of discussions regarding FLEXI-BAR® training. To what degree a targeted training program with the FLEXI-BAR® yields a relevant increase in energy expenditure as a determining factor of weight- and fat loss is presently not known. However, the activation of large muscle groups with moderately high intensity within a given time span as part of a classical FLEXI-BAR®-training module should at least directly correlate with distinct increases in active metabolic rate.

In the pilot study at hand, the metabolic rates of 8 female subjects were examined, by means of spiroergometric measurements, during a specifically defined training protocol with the FLEXI-BAR®. The protocol was distinguished by an intermittent applied load, and the measurements obtained were compared with reference values as published for other recreational sports activities such as walking, jogging, bicycling or aerobics.

Our hypothesis is that the training module as realized here by the FLEXI-BAR® yields a significant energy expenditure which is at least comparable to that of cyclical, aerobic activities used in health- oriented fitness activities, and in this wise could represent an effective training method for targeted weight loss, in addition to its positive effects on the musculature.

¹ Mileva KN, Kadr M, Amin N, Bowtell JL. Acute effects of Flexi-bar vs. Sham-bar exercise on muscle electromyography activity and performance. *J Strength Cond Res.* 2010 Mar; 24(3):737-48

Materials and Methods

The study was conducted between May and June 2010 at the Institute of Medical Physics at the University of Erlangen. Upon being informed about the study's background, uses and risks, signed consent forms were obtained from all participants.

A total of 8 female subjects, ranging in ages between 25 and 53, participated in this study. The collective Collectively, the fitness training levels of the participants were low to moderate, whose relevant characteristics are depicted in Table 1.

Table 1: Anthropometric profiles of individual participants as well as mean values for the group (segmental bio-impedance measurements (Inbody 230, Biospace, Seoul, Korea))

Subject	Age (years)	Height (cm)	Weight (kg)	BMI	Body Fat (%)	Basal Metabolic Rate (kcal)
1	26	183	72.6	21.7	19.5	1633
2	53	167	68.2	24.5	37	1298
3	27	165	53.9	19.8	19	1313
4	27	162	55.7	21.2	13.4	1412
5	26	169	52.9	18.5	22.9	1251
6	25	160	64.6	25.2	32.1	1318
7	26	158	46.4	18.6	10.4	1268
8	37	183	75.0	22.4	24.7	1590
Total Ø	31	168	61.2	21.5	22.4	1385

Every participant completed a defined 30-minute training session with the FLEXI-BAR® (Flexisport, Munich). The training program was distinguished by intermittent periods of loading, during which swinging exercises with the FLEXI-BAR® were done for approx. 30 seconds (see Table 2), and alternated with 30 seconds of various aerobic steps (marching in place, dynamic knee flexions, lunges and sidesteps).

During the training session, metabolic and respiratory parameters as well as heart rates were captured, using the Oxycon mobile spirometric system by Viasys (Viasys, Conshohocken, PA, USA). The parameters obtained were then related to reference data from corresponding subject literature.

Table 2: Detailed list of exercises with the FLEXI-BAR®

Body position	Oscillatory motions with the FLEXI-BAR®
Legs wide apart (90°, wide straddle)	In front of body, using both hands (vertical/horizontal)/ at sides of body, one-handed (vertical)
One-legged stance, with other leg lifted up and forwards	In front of body, using both hands (horizontal)
Standing scale (one-legged, while stretching same leg)	One-handed (horizontal)
2-legged stance, (120°, legs close)	In front of body, using both hands (horizontal)
Front lunge	One-handed, next to front left leg (horizontal)/towards front (vertical)
One-legged stance and leg abduction	One-handed with opposing arm (diagonal and upwards)
2-legged stance (90°, wide straddle), upper body leaning forward	Using both hands, with arms outstretched (horizontal)
2-legged stance, lifting heels	Using both hands, in front of body/above body (horizontal)

Results

Table 3 lists the values of the 8 female subjects and average values for the group for the parameters obtained. During the 30-minute workout unit with the FLEXI-BAR®, average energy expenditures of 351 kcal (range: 291-444 kcal) were obtained.

Additional cardiac and respiratory mean values such as average heart rates of 161 bpm and average maximum oxygen uptakes of 19.9 ml/min/kg, indicate overall that a high intensity of training was obtained.

If one compares the values obtained in the pilot study for energy expenditures with reference values of other sports activities, the results obtained in the pilot study average higher than those calculated for running at 10 km/hr, by way of example (Table 4).

Table 3: Average values of collected (HR, EE and VO₂) as well as calculated parameters (METs) for individual participants as well as for entire group

Subject	HR (bpm)	EE (kcal/30 min)	VO ₂ (ml/min/kg)	METs
1	170	444	20.5	5.86
2	155	394	19	5.43
3	164	335	20.9	5.97
4	174	372	22.5	6.43
5	173	314	20	5.71
6	165	306	16.2	4.63
7	136	352	26.7	7.63
8	148	291	13.5	3.86
Total Ø	161	351	19.9	5.69

Table 4: Energy expenditures (EE) derived and calculated during the study for each individual subject for different types of exercise (adjusted for body weight)

Subject	FLEXI-BAR® (kcal/30 min)	Jogging 8 km/hr (kcal/30 min)*	Jogging 10 km/hr (kcal/30 min)*	Walking (kcal/30 min)*	Aerobics (kcal/30 min)**	Bicycling (kcal/30 min)**
1	444	285	356	214	254	218
2	394	230	287	172	239	205
3	335	226	283	170	189	162
4	372	227	284	170	195	167
5	314	229	286	172	185	159
6	306	244	305	183	226	194
7	352	204	255	153	162	139
8	291	277	347	208	263	225
Total Ø	351	240	300	180	214	184

(*Online fitness calculator (<http://www.fitrechner.de/kalorienverbrauch/kalorienverbrauch/kalorienverbrauch-Laufsport>))

** values calculated by Inbody body fat scale software)

Concluding Remarks

The results of this pilot study show that the fitness program with the FLEXI-BAR® as given here is distinguished by energy expenditure levels well within the scope of currently advocated fitness training methods such as walking, jogging or aerobic exercise. Therefore, a FLEXI-BAR® training program of this nature can, in addition to its previously documented improvements towards muscular development (e.g.), be seen to have another benefit: as a positive influence, metabolically speaking, on the central fitness training goals of weight loss and fat loss.