

COMPARISON OF PHYSIOLOGICAL VARIABLES AND BODY COMPOSITION VARIABLES AMONG WALKING TYPES ON TREADMILL

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INTRODUCTION

With the physiological effects like that walking exercise improves cardiovascular function (Davison et al., 1991), changes physical composition (Otha et al., 1990), improves endurance (Wilmore et al., 1970), increases muscle strength (Flynn & Soutas-little, 1993), and changes the quality of blood serum (Duncan et al. 1991) etc. it can be known that walking exercise is the most effective way of reducing body fat (Choi HeaGin , 2008).

The walking patterns that are known are discussed below.

General walking way (GW) is a most safety aerobic exercise form, without special equipment and just as a little of economical load. Nordic walking (NW) is the walking types with poles. Nordic walking poles are specially constructed, rubber-tipped ski poles designed for use during walking. Using Nordic walking poles stimulates the arm motion of cross-country skiing, thus increasing not only the upper body muscle mass used but also lower limb muscle mass during walking(Porcari, J P; Hendrickson, T L; Walter, P R, 1997).

Dumbbell walking (DW) is the walking way with hand-held weights. The most widely used aerobic exercise involve predominantly leg work. Using HWs(walking with hand-held weights) during exercise may increase the energy cost of the activity by the upper body. This increase in energy cost is potentially important for low fit persons and special patient populations who cannot run, do not want to run, or are limited in the speed at which they can walk (James E. Graves et al., 1987) Also, power walking ways (PW) has motion of larger swing the arm than in general walking(Choi HeaGin , 2008).

Recently with these different methods of walking their effects and which is better has drawn much attention and curiosity. For example walking with something in your hand, the use of a walking stick, using swing a arm during walking can be seen in our daily lives and so their has been carried research out about these(Kang DukHo , 2001; Kim KyungJin, Kim BungRo, Kim YounKyung , 2005; Kim GyongTae, Choi ChunGil, 2006; Choi HeaGin , 2008) .

The purpose of this study was to measure physiological variables and body composition variables among 4 walking types on treadmill for investigating the exercise difference of walking with or without hand weights and walking with nordic poles.

METHODS

Seven healthy men (age: 23.5 ± 0.79) volunteered for this experiment. Each of them performed 4-types walking (dumbbell, nordic, power, and general walking) at speed of 3-5km/h warm up, 6km/h slow walking, 7km/h fast walking, and 5-3km/h cooling down for 40 minutes on a treadmill. Physiological variables (HR: heart rate, EE: energy expenditure) were measured by using heart checker (POLAR 810i, Finland) at aerobic slow and fast walking and body composition variables (FM: body fat mass, MM: muscle mass, %BF: percentage of body fat, BW: body water, RABW: right arm body water, RLBW: right leg body water, BMR: basal metabolic rate) were measured by bioelectrical impedance analysis (INBODY 3.0, Korea) at rest and after walking during 40 min exercise. The statistical analysis was one-way ANOVA with repeated measures to compare effects among walking tapes with something weight in hand during exercise time. The level of statistical significance for all tests was $p < .05$.

Table 1 Subjects Characteristics

Subjects(N)	Age(yr)	Ht.(cm)	Wet.(kg)	%BF(%)	CBF(%)
7	23.5 ± 0.79	175.8 ± 2.54	65.7 ± 6.10	14.2 ± 3.82	0.79 ± 0.29

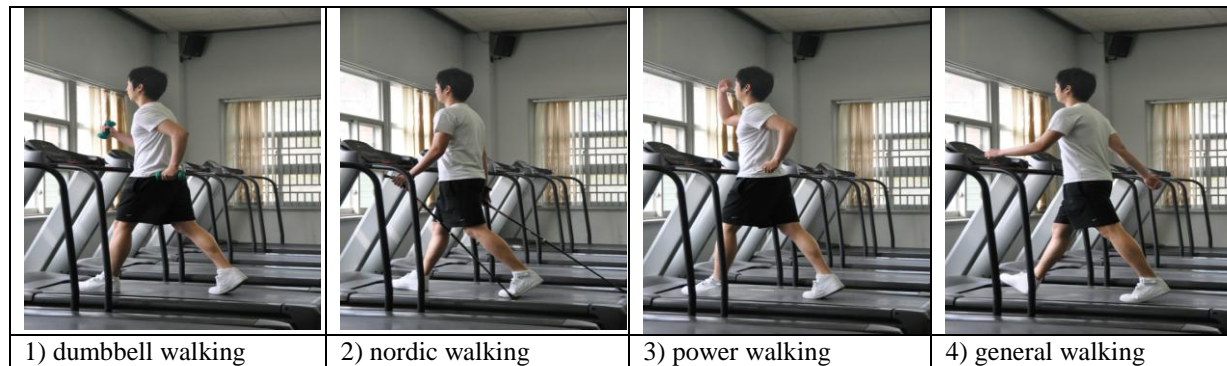


Fig. 1. Various types of walking way

Table 2 Walking exercise protocol

Exercise	Contents
Warm up	3-5 km/h slow walking for 5min
Main exercise	6 km/h slow walking for 15min 7 km/h fast walking(jogging) for 15min
Cooling down	5-3 km/h slow walking for 5min

RESULTS

In an aspect of physiological variables, at slow walking, it was found that dumbbell walking way with 3-pound hand weights resulted in and average of the highest score (HR:127.8±8.27bpm, EE:85.4±14.51 kcal/min respectively) responses compared to general walking way (104±8.2bpm, and 70.4±10.99kcal/min respectively). Nordic walking way (121.4±11.74bpm, 77.0±16.83kcal/min respectively) was second, power walking way (118.5±9.98bpm, 68.7±20.62kcal/min respectively) was next. For fast walking (jogging), there is the same trend. Especially, at the end of 40min aerobic walking exercise, it was found that dumbbell walking way with 3-pound hand weights resulted in and average of the highest score responses compared to general walking way. Especially, total heart rate (THR) represented a significant difference (t=2.792 p=0.016 p<.05).

Table 3 Heart rate difference according to walking types on treadmill (beats/min)

	PW	NW	DW	GW	F	p
WU	97.1±11.24	101.4± 9.14	103.5±8.32	94.0± 9.00	1.714	0.191
SW	111.8±11.65	115.1±10.38	122.5±8.71	111.4± 7.20	2.003	0.14
ASW	118.5± 9.98	121.4±11.74	127.8±8.27	117.4± 7.27	1.701	0.193
FW	143.2± 9.16	143.2±10.23	152.4±7.84	140.1±11.36	2.547	0.08
AFW	149.7±12.56	156.7±10.82	160.1±8.72	148.4±11.94	1.781	0.178
CD	125.1±10.47	121.8±10.60	130.0±7.46	121.5±10.86	1.088	0.373
THR	5054.7±337.85	5078.1±427.02	5412.0±303.14*	4955.1±309.02*	2.283	0.016

* p<.05 PW: power walking NW: nordic walking DW: dumbbell walking GW: general walking
 WU: warm up SW: slow walking ASW: after slow walking FW: fast walking AFW: after fast walking CD: cooling down
 THR: total HR

Table 4 Energy expenditure difference according to walking types on treadmill (kcal/h)

	PW	NW	DW	GW	F	p
WU	15.1±9.37	17.2±7.11	20.8±7.26	13.8±5.66	1.174	0.34
SW	68.7±20.62	77.0±16.83	85.4±14.51	70.4±10.99	1.548	0.228
FW	109.2±17.64	113.5±14.51	126.1±13.86	109.0±4.70	1.897	0.157
CD	33.0±5.19	31.2±6.60	35.8±4.70	30.1±4,59	1.519	0.235
TEE	222.8±42.11	245.1±72.73	266.0±61.89	219.8±48.46	0.981	0.418

WU: warm up SW: slow walking ASW: after slow walking FW: fast walking AFW: after fast walking
 CD: cooling down TEE: total energy expenditure

In other hand, in an aspect of body composition variables, FM, %BF decreasing and MM, BW, RABW, RLBW and BMR increasing change after 40 min walking exercise were founded. Dumbbell walking type was first(MM:0.66kg, FM:-1.03kg, %BF:-1.50%, BW:0.46L RABW:0.10 L RLBW:0.09L BMR:16.97kcal), and nordic, power was next. It was that the increasing of MM, and decreasing of FM were mean the more exercise was performed.

Table 5 Body composition factors difference after performing walking types on treadmill

	PW	NW	DW	GW	F	p
MM(kg)	0.50±0.42	0.64±0.61	0.66±0.51	0.40±0.28	0.468	0.707
FM(kg)	-0.89±0.19	-0.94±0.57	-1.03±0.56	-0.80±0.25	0.348	0.791
%BF(%)	-1.30±0.22	-1.33±0.76	-1.50±0.78	-1.13±0.35	0.479	0.7
BW(L)	0.37±0.27	0.46±0.45	0.46±0.39	0.29±0.25	0.385	0.765
RABW(L)	0.07±0.04	0.06±0.06	0.10±0.05	0.04±0.03	2.142	0.121
RLBW(L)	0.09±0.13	0.12±0.10	0.09±0.09	0.03±0.05	0.995	0.412
BMR(kcal)	13.77±10.53	17.04±15.92	16.97±13.94	10.23±7.56	0.475	0.702

MM: muscle mass, FM: body fat mass, %BF: percentage of body fat, BW : body water, RABW: right arm body water, RLBW: right leg body water, BMR: basal metabolic rate

CONCLUSIONS

With the same subject, while they have performed for 4 different types of walking, their heart rate, energy expenditure and physical composition factors were recorded. There was no statistical difference but there was a strong trend discovered. In conclusion, from the results it can be known that the dumbbell and nordic walking had a higher heart rate of energy expenditure than the general walking, especially for the upper body where there is a large difference discovered.

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