The Relationship Between Agility and Endurance Capacity, Breathing Parameters, and Gravity.

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ABSTRACT

Agility is the ability to adjust the body's position rapidly and efficiently. Agility requires physical fitness and neuromotor skills. It is critical for efficient movement in space. Several intrinsic factors including Maximum Oxygen Consumption (VO_2max), Forced Expiration Volume-1 second(FEV1), and Forced Vital Capacity (FVC) along with extrinsic factors such as gravity with added weight, may play a role in agility performance.

PURPOSE: The purpose of the study is to examine the influences of intrinsic (VO_2max, FEV1/FVC) and extrinsic factors (gravity, with added weights) on agility in healthy young adults.

METHODS: Twenty-five young men (n=16) and women (n=9) (18-23 yr) were recruited to perform the Agility T-test and NASA Agility Astro-Course test with no added weight, 5%-, 10%-, and 15%- added body weights. VO_2max, and Forced Expiration Volume-1 second/Forced Vital Capacity ratio (FEV1/FVC) were measured to identify endurance and breathing capacities, respectively.

RESULTS: VO_2max was correlated to the Agility T-test and the NASA Agility Astro-Course at no added weight and all additions (P<0.05). FEV1/FVC was not associated with either VO_2max or agility tests. While men exhibited better Agility T-test results in all added weight levels, men and women showed no difference in the NASA Agility Astro-Course test performance. However, athletes showed better agility than non-athletes at 5% and 10% weight additions on the Agility T-test and all weight levels on the NASA Agility Astro-Course.

CONCLUSION: Although agility was thought to be mainly determined by the neuromotor system, our results showed a correlation between agility and endurance capacity. Although men had a better agility performance in the simple Agility T-test, the gender difference did not exist when complexity increases in the NASA Agility Astro-Course. Athletes showed better agility than non-athletes, indicating that agility may be affected by the athletic conditioning.

BACKGROUND

Agility is the ability to adjust the body's position rapidly and efficiently. Agility training has been included in several endurance training programs. Maximum oxygen consumption rate (VO_2max) is a direct measurement of an individual's endurance capacity and its relationship to agility has not been studied. Furthermore, breathing efficiency may have an impact on oxygen consumption and added weight may help increase agility performance.

PURPOSE

The purpose of the study is to examine the influences of intrinsic (VO_2max, FEV1/FVC) and extrinsic factors (gravity, with added weights) on agility.

METHODS

SUBJECTS

- Twenty-five young men (n=16) and women (n=9)
- Age 18-23 years old
- Collegiate athletes (n=18)
- Non-collegiate athletes (n=7)

TESTING

- Maximum Oxygen Consumption (VO_2max)
  - Bruce Treadmill Protocol
- Forced Expiration Volume-1 sec (FEV1)
  - iWorx spirometer
- Forced Vital Capacity (FVC)
  - iWorx spirometer
- Agility T-test
- NASA Agility Astro-Course

PROTOCOL

Day 1	Day 2	Day 3
VO_2max **FEV1** **FVC**	**Agility T-test** with no added weight, 5%-, 10%-, and 15%- added body weights	**NASA Agility Astro-Course** with no added weight, 5%-, 10%-, and 15%-added body weights.

STATISTICS

- One-Way ANOVA, Tukey HSD
- Pearson Correlation
- Independent T-test

RESULTS

GENDER DIFFERENCE

	MALE N=16	FEMALE N=9	P-value
VO_2max * (ml·kg^{-1}·min^{-1})	48.24 ±2.41	38.46 ± 2.39	0.014
FEV1/FVC	0.955 ± 0.017	0.962 ± 0.012	0.776
Agility T-test			
No added weight (sec) *	10.31 ± 0.379	12.36 ± 0.505	0.004
5% added weight (sec) *	10.32 ±.0.388	12.43 ± 0.441	0.002
10% added weight (sec) *	10.59 ± 0.418	12.40 ± 0.499	0.013
15% added weight (sec) *	10.61 ± 0.377	12.73 ± 0.473	0.002
NASA Agility Astro-Course Test			
No added weight (sec)	17.50 ± 0.797	18.68 ± 0.700	0.330
5% added weight(sec)	17.49 ± 0.669	18.60 ± 0.650	0.291
10% added weight (sec)	17.54 ± 0.605	18.63 ± 0.701	0.271
15% added weight (sec)	17.59 ± 0.557	18.73 ± 0.816	0.247

Values are Mean ± SEM, * P<0.05

ATHLETIC STATUS

	ATHLETE N=18	NON-ATHLETE N=7	P-value
VO_2max (ml·kg^{-1}·min^{-1})	46.16 ± 1.60	40.99 ± 5.841	0.422
FEV1/FVC	0.962 ± 0.015	0.945 ± 0.020	0.524
Agility T-test			
No added weight (sec)	10.60 ± 0.302	12.22 ± 0.924	0.139
5% added weight (sec) *	10.59 ± 0.313	12.34 ± 0.847	0.023
10% added weight (sec) *	10.72 ± 0.297	12.57 ± 0.909	0.018
15% added weight (sec)	10.84 ± 0.288	12.73 ± 0.883	0.080
NASA Agility Astro-Course Test			
no added weight (sec) *	16.67 ± 0.279	21.13 ± 1.31	<0.001
5% added weight (sec) *	16.76 ± 0.259	20.79 ± 1.01	<0.001
10% added weight (sec) *	16.91 ± 0.239	20.56 ± 1.03	<0.001
15% added weight (sec) *	16.98 ± 0.242	20.63 ± 1.04	<0.001

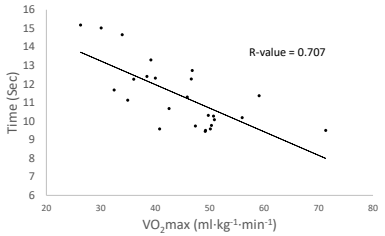
Values are Mean ± SEM, * P<0.05

RESULTS

CORRELATION between VO_2max and AGILITY T-TEST

	Agility T-test No weight	Agility T-test 5%	Agility T-test 10%	Agility T-Test 15%
VO_2max	R= 0.623 P= 0.001	R= 0.683 P< 0.001	R= 0.675 P< 0.001	R=0.707 P< 0.001

Relationship between Agility T-Test at 15% added weight & VO_2max



CORRELATION between VO_2max & NASA Agility Astro-Course

	NASA Agility Astro-Course No weight	NASA Agility Astro-Course 5%	NASA Agility Astro-Course 10%	NASA Agility Astro-Course 15%
VO_2max	R= 0.660 P< 0.001	R= 0.652 P< 0.001	R= 0.693 P< 0.001	R=0.678 P< 0.001

CONCLUSION

Maximum Oxygen Consumption (VO_2max) and added weights may influence agility performance. With increased weight, when the task becomes more challenging, oxidative capacity is more important for agility performance. Our results are consistent with others that men have a higher VO_2max then women due to their higher portion of lean mass and hematocrit. Men showed an advantage at the Agility T-test but did not hold advantage when performing the more complicated NASA Agility Astro-Course test. Athletes perform better once weight is added on the agility T-test, but once the weight reaches 15% of their body weight, athletic conditioning was not significant anymore. With training, athletes show consistently higher agility. Athletes performed better on the more complicated NASA Agility Astro-Course, potentially due to their training.

We have showed the relationship of intrinsic and extrinsic factors and agility in the present study. Further studies are warranted to further identify the effects of these factors on agility.

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