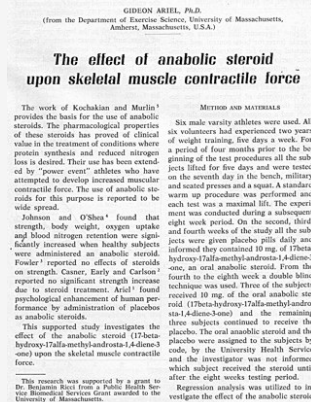




# The effect of anabolic steroid upon skeletal muscle contractile force

Their use has been extended by "power event" athletes who have attempted to develop increased muscular contractile force.

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## The Effect of Anabolic Steroid on Skeletal Muscle Contractile Force

This article by Gideon Ariel, Ph.D., from the Department of Exercise Science, University of Massachusetts, investigates the effect of anabolic steroids on skeletal muscle contractile force. The study involved six male varsity athletes who had experienced two years of weight training. The subjects were given placebo pills for the first four weeks, then for the next four weeks, three of the subjects received an oral anabolic steroid while the remaining three continued to receive the placebo.

The results showed that the experimental group, who received the anabolic steroid, were able to exert a greater maximal contractile force in the anabolic period compared to the training period. The rate of progress of the experimental group was also higher during the anabolic steroid period compared to the control group. The study concludes that anabolic steroids produce physiological effects on the contractile force of skeletal muscles.

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Below find a reprint of the 5 relevant pages of the article "The effect of anabolic steroid upon skeletal muscle contractile force" in "The Journal of Sports Medicine and Physical Fitness":

## The effect of anabolic steroid upon skeletal muscle contractile force

The work of Kochakian and Murlin<sup>1</sup> provides the basis for the use of anabolic steroids. The pharmacological properties of these steroids has proved of clinical value in the treatment of conditions where protein synthesis and reduced nitrogen loss is desired. Their use has been extended by "power event" athletes who have attempted to develop increased muscular contractile force. The use of anabolic steroids for this purpose is reported to be wide spread.

Johnson and O'Shea<sup>4</sup> found that strength, body weight, oxygen uptake and blood nitrogen retention were significantly increased when healthy subjects were administered an anabolic steroid. Fowler<sup>3</sup> reported no effects of steroids on strength. Casner, Early and Carlson<sup>2</sup> reported no significant strength increase due to steroid treatment. Ariel<sup>1</sup> found psychological enhancement of human performance by administration of placebos as anabolic steroids.

This supported study investigates the effect of the anabolic steroid (17-beta-hydroxy-17alpha-methyl-androsta-1,4-diene-3-one) upon the skeletal muscle contractile force.

This research was supported by a grant to Dr. Benjamin Ricci from a Public Health Service Biomedical Services Grant awarded to the University of Massachusetts.

### METHOD AND MATERIALS

Six male varsity athletes were used. All six volunteers had experienced two years of weight training, five days a week. For a period of four months prior to the beginning of the test procedures all the subjects lifted for five days and were tested on the seventh day in the bench, military and seated presses and a squat. A standard warm up procedure was performed and each test was a maximal lift. The experiment was conducted during a subsequent eight week period. On the second, third, and fourth weeks of the study all the subjects were given placebo pills daily and informed they contained 10 mg. of 17beta-hydroxy-17alpha-methyl-androsta-1,4-diene-3-one, an oral anabolic steroid. From the fourth to the eighth week a double blind technique was used. Three of the subjects received 10 mg. of the oral anabolic steroid (17beta-hydroxy-17alpha-methyl-androsta-1,4-diene-3-one) and the remaining three subjects continued to receive the placebo. The oral anabolic steroid and the placebo were assigned to the subjects by code, by the University Health Service and the investigator was not informed which subject received the steroid until after the eight weeks testing period.

Regression analysis was utilized to investigate the effect of the anabolic steroid

## The effect of anabolic steroid upon skeletal muscle contractile force

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THE EFFECT OF ANABOLIC STEROID

upon the maximal lifts between the training period and the anabolic period and between the control and experimental groups for the same two periods.

### RESULTS

Figure 1 presents the changes in contractile force for both control and experimental groups for the training and anabolic periods. Data is reported for the bench, military and sitting presses and the squat exercises. Also, total contractile force gain in all four exercises is reported in Table 1.

A comparison of regression lines between the training and the anabolic periods and a comparison between the control and experimental groups is reported in Table 1.

Considering the differences between the training and the anabolic steroid periods,

a comparison of regression lines yields the following results. No differences were found between the training period and the anabolic steroid period for the control group (Table 1; 1-5). Significant differences between the slopes of the regression lines were found in the bench press, seated press, and the squat exercises, for the experimental group between the training period and the anabolic steroid period (Table 1; 6, 8, 9). A significant difference was found when all exercises were combined for the experimental group (Table 1; 10).

When comparing the slopes of the control group to the experimental group, no significant difference was found in the training period in the bench press and seated press exercises (Table 1; 11, 12). However, significant differences were

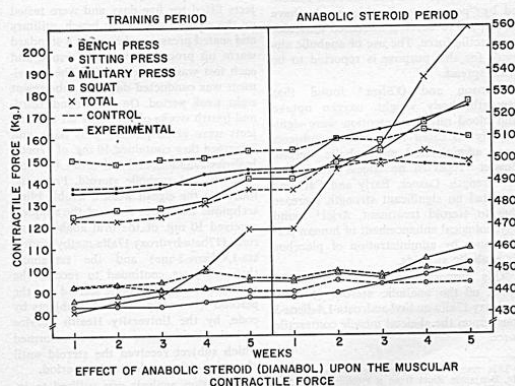


Fig. 1.—The effect of anabolic steroid (Dianabol) upon the muscular contractile force.

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THE EFFECT OF ANABOLIC STEROID

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TABLE 1.—A slope analysis of regression lines representing skeletal muscle contractile force between the training period and the anabolic steroid period and between the control and the experimental groups.

	Reg. Coef.		d.f.	M.S.	F-ratio
<b>Control group</b>					
	TP	AP			
1. Bench P.	(1.591)	(0.454)	1	6.464	1.97 (1.6)
2. Military P.	(1.336)	(0.378)	1	4.589	2.25 (1.6)
3. Seated P.	(-0.605)	(0.607)	1	7.345	2.87 (1.6)
4. Squat	(1.138)	(1.363)	1	0.253	0.08 (1.6)
5. Total	(3.260)	(2.802)	1	1.049	0.05 (1.6)
<b>Experimental group</b>					
6. Bench P.	(2.689)	(6.475)	1	71.669	9.98* (1.6)
7. Military P.	(1.915)	(3.637)	1	14.826	5.53 (1.6)
8. Seated P.	(0.986)	(3.864)	1	41.414	52.73** (1.6)
9. Squat	(3.865)	(8.637)	1	113.860	13.41** (1.6)
10. Total	(9.055)	(22.613)	1	1919.100	35.09** (1.6)
<b>Training period</b>					
	C	E			
11. Bench P.	(1.591)	(2.689)	1	6.033	1.79 (1.6)
12. Military P.	(1.336)	(1.915)	1	1.676	1.17 (1.6)
13. Seated P.	(-0.605)	(0.986)	1	12.656	12.34* (1.6)
14. Squat	(1.138)	(3.865)	1	37.183	6.20* (1.6)
15. Total	(3.260)	(9.056)	1	167.910	8.13* (1.6)
<b>Anabolic period</b>					
16. Bench P.	(0.454)	(6.475)	1	181.262	25.54** (1.6)
17. Military P.	(0.378)	(3.637)	1	53.105	16.20** (1.6)
18. Seated P.	(0.607)	(3.864)	1	53.050	22.72** (1.6)
19. Squat	(1.363)	(8.637)	1	276.469	47.85** (1.6)
20. Total	(3.260)	(9.056)	1	1962.379	75.85** (1.6)

\*F-ratio significant at the .05 level of confidence.

\*\*F-ratio significant at the .01 level of confidence.

Reg. Coef. = Regression coefficients; TP = Training period; AP = Anabolic steroid period; C = Control group; E = Experimental group.

found in the same exercises during the anabolic period (Table 1; 16, 17). Significant differences between the control and the experimental groups were found in the seated press, and the squat exercises and when all exercises combined, for the training period as well as the anabolic steroid period (Table 1; 13, 14, 15, 18, 19, 20).

### DISCUSSION

From these findings it is apparent that the experimental group were able to exert a greater maximal contractile force in the anabolic period when compared to the

training period. The rate of progress was higher during the anabolic period as compared to the control group which did not alter significantly in their rate of progress.

With the acceptance of the bench press and the military press exercises, all the other exercises yield significant differences between the control and the experimental groups under the experimental conditions.

From these findings and those cited in previous studies<sup>1</sup> it appears that anabolic steroids produce physiological as well as psychological effects on contractile force of skeletal muscles.

## SUMMARIES

## G. ARIEL

**The effect of anabolic steroid upon skeletal muscle contractile force.**

The purpose of this study was to investigate the effect of anabolic steroid (17beta-hydroxy-17alpha-methyl-androsta-1,4-diene-3-one) upon skeletal muscle contractile force.

A double blind technique was used to examine the effect on six male subjects. From these findings it was apparent that the experimental group were able to exert a greater maximal contractile force in the anabolic steroid period when compared to the training period. Also, the rate of progress of the experimental group was higher during the anabolic steroid period as compared to the control group.

From these findings it appears that anabolic steroids produce physiological effects on contractile force of skeletal muscles.

[*J. Sports Med.*, 13, 187-190, 1973]

## G. ARIEL

**L'effet des stéroïdes anaboliques sur la force contractile du muscle squelettique.**

Le but de cette étude a été de rechercher l'effet du stéroïde anabolique (17bêta-hydroxy-17alpha-méthyl-androsta-1,4-diène-3-one) sur la force contractile du muscle squelettique.

Une technique double blind a été utilisée pour examiner son effet sur six sujets masculins. On a trouvé que le groupe expérimental était capable d'exercer une force contractile maximale plus grande dans la période sous l'action du stéroïde anabolique par rapport à la période d'entraînement. Le taux de progrès du groupe expérimental était également plus élevé pendant la période sous l'action du stéroïde anabolique par rapport au groupe témoin.

Il apparaît de là que les stéroïdes anaboliques produisent des effets physiologiques sur la force contractile des muscles squelettiques.

[*J. Sports Med.*, 13, 187-190, 1973]

## G. ARIEL

**El efecto de los esteroides anabólicos sobre la fuerza contráctil del músculo esquelético.**

El objeto de este trabajo ha sido el de investigar sobre los efectos del esteroide anabólico (17beta-hidroxi-17alfa-metil-androsta-1,4-diene-3-one) sobre la fuerza contráctil del músculo esquelético.

Una técnica "double blind" se empleó para examinar el efecto sobre seis sujetos varones. Se ha encontrado que el grupo experimental podía efectuar una fuerza contráctil maximal mayor en el período bajo la acción de esteroide anabólico en relación al período de entrenamiento. La tasa de progreso del grupo experimental era igualmente más elevada durante el período bajo la acción de esteroide anabólico en relación al grupo de control.

De aquí resulta que los esteroides anabólicos producen efectos fisiológicos sobre la fuerza contráctil de los músculos esqueléticos.

[*J. Sports Med.*, 13, 187-190, 1973]

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