CHAPTER IV

RESULTS

Description of the Subjects

The subjects consisted of a total of 136 college-aged Division I-A football players from three different NCAA programs. Those programs were Virginia Polytechnic Institute and State University, East Carolina University, and West Virginia University.

The following information was attained about the subjects from all three-football programs (Appendix F):

- Position
- Injuries prior to testing (including):
  - whether the injury was the result of a collision, contact or non-contact
  - location of injury
  - type of injury (i.e. Sprain, strain, fracture)
  - affected side of injury
- Individual scores on each FMS test
- Individual total scores attained on the FMS

Data from thirty-seven subjects of the Virginia Polytechnic Institute and State University football program were gathered. Additional information about the subjects included (Appendix F):

- Gender
- Height
- Weight
- Practices and games missed because of an injury
- Total Exposures
- Whether an injury was acute or chronic
- Prior varsity letters
- Education class (Freshman, Sophomore, Junior, Senior)
- Starter or non-starter (including how many games each started for the previous year)
- Number of strains suffered (including practices and games missed due to a strain)
- Performance testing scores:
  - Vertical jump

- 40-yard dash
- Bench press
- Squat
- Power Clean
- Push Jerk

Data from twenty-six subjects from East Carolina University were collected. The following additional information from the subjects in this program was attained (Appendix F):

- Height
- Weight
- Whether an injury was acute or chronic
- Performance testing scores:
  - Bench Press
  - Squat
  - Power clean
  - 40-yard dash
  - Vertical Jump
  - Dips
  - Sit ups

Data from seventy-three athletes from West Virginia University were gathered. This program did not record the heights and weights of its athletes. This was the reason why the correlation analyses had a maximum number of sixty-two subjects.

Hypothesis One: No significant difference exists between FMS scores of different football position groups in Division I-A football programs that conduct the FMS.

Hypothesis one was tested using ANOVA. This test statistic revealed a difference in the mean scores between the groups (Table 1), $F = 9.961$, ($p \leq 0.05$). To determine where this difference exists, a Tukey HSD was performed (Table 2). It showed a significant difference ($p \leq 0.05$) between the line-of-scrimmage group and skill group. The results also indicated that there is a significant difference ($p \leq 0.05$) between the mean FMS scores of the line-of-scrimmage group and the mean FMS scores of the combo group. However, no significant difference ($p > .05$) was demonstrated between the skill and combo groups.

Table 1

ANOVA: Player Groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	91.655	2	45.827	9.691	.000
Within Groups	581.647	123	4.729		
Total	673.302	126			

Table 2

Dependent Variable: Player Groups

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	Skill	Combo	.80	.50	.250
		LOS	2.05*	.48	.000
	Combo	Skill	-.80	.50	.250
		LOS	1.25*	.46	.018
	LOS	Skill	-2.05*	.48	.000
		Combo	-1.25*	.46	.018

It was found that the range in mean FMS scores between the groups was 1.08: skill group (15.40), combo group (14.60), and line-of-scrimmage group (13.35). A Test for Homogeneity of Variances was performed and found to be significant ($p = .008$). From this finding, it may appear that there is significance of variance between these three groups. However, because a large number of subjects were used in this analysis (126), slight differences between the groups are no so important. In order to validate the ANOVA test, the individual FMS scores for the subjects were squared, to allow for a greater range in FMS scores. This provided a larger range of mean scores between the groups' (55.992). This resulted in the ANOVA ($F = 9.011$, $p \leq .05$, $p = .000$) (Table 3) and Tukey HSD ($p \leq .05$) (Table 4) remaining significant while the Test for Homogeneity of Variances was insignificant ($p > .05$, $p = .158$).

Table 3

ANOVA: Squared Results Player Groups

	Sum of Squares	Df	Mean Squares	F	Sig.
Between Groups	67410.343	2	33705.172	9.011	.000
Within Groups	460077.66	123	3740.469		
Total	527488.00	125			

Table 4

Dependent Variable: Squared Results Player Groups

	(I) Group	(J) Group	Mean Differences (I-J)	Std. Error	Sig.
Tukey HSD	Skill	Combo	23.9550	14.1556	.208
		LOS	55.9922*	13.4243	.000
	Combo	Skill	-23.9500	14.1556	.208
		LOS	32.0422*	12.9172	.035
	LOS	Skill	-55.9922*	13.4243	.000
			-32.0422*	12.9172	.035

Hypothesis Two: No relationship exists between the body height of a Division I-A football player and the score that athletes achieve on the FMS.

Hypothesis Three: No relationship exists between the body weight of a Division I-A football player and the score that athletes achieve on the FMS.

Hypothesis Four: No relationship exists between the relative body weight of a Division I-A football player and the score that athletes achieve on the FMS.

The results of hypotheses two through four were calculated using the Pearson Product Moment Correlation Coefficient. The correlation discovered that that there was a significant correlation demonstrated in each of the hypotheses (H_2 $p \leq .05$; H_3 & H_4 $p \leq .01$). For the hypothesis two, a significant relationship ($p \leq .05$) was demonstrated. For hypotheses three and four, a significant relationship ($p \leq .01$) was demonstrated.

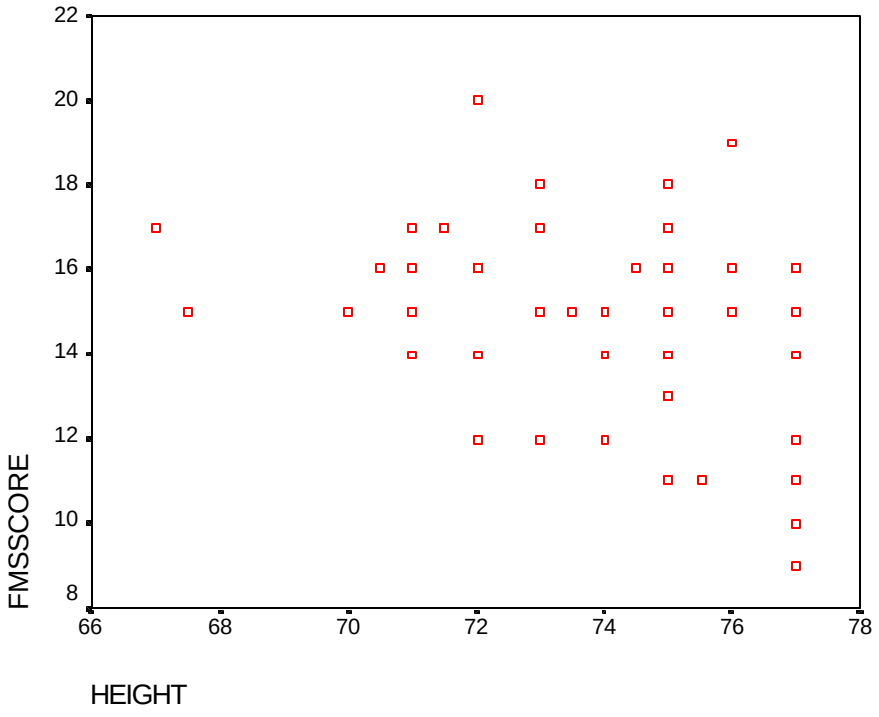
Height to FMS scores— The height for the subjects in this analysis ranged from sixty-seven to seventy-seven inches, with a total range of 10 inches. The range in FMS scores ranged from a low of nine to a high of twenty, with a total range of eleven. In this analysis, a significant negative relationship was demonstrated between the athletes' height and FMS scores, $r = -.336$, $p \leq .05$ (2-tailed) (Table 5). A visual representation of the distribution of the decrease in FMS scores as individuals' height increases is demonstrated in Graph 1.

Table 5

Correlation: FMS Scores and Height

		FMS Score	Height
FMS Score	Person Correlation	1.000	-.336*
	Sig. (2-tailed)	.	.011
	N	60	56
Height	Person Correlation	-.336*	1.00
	Sig. (2-tailed)	.011	.
	N	56	59

*. Correlation is significant at the 0.05 level (2-tailed)



Graph 1. Scatter Plot: FMS Scores and Height

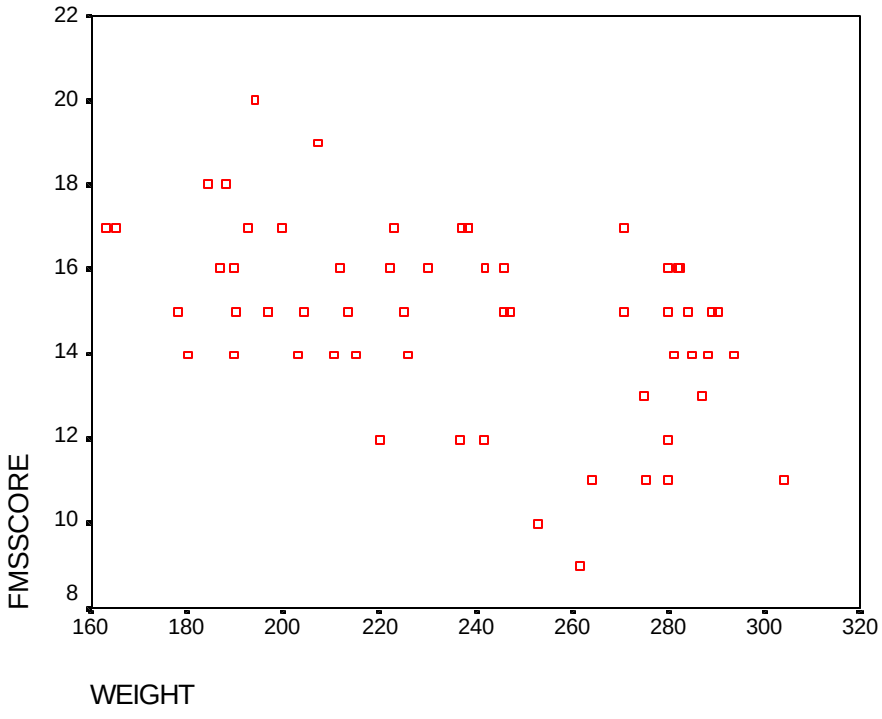
Weight to FMS scores—The range in weight of the subjects in this hypothesis went from a low of 163 pounds to a high of 304 pounds, with a total range of 141 pounds. The range in FMS scores was the same as for the previous hypothesis. Results of this analysis demonstrated a significant negative relationship between athlete's weight and FMS scores, $r = -.447$, $p \leq .01$ (2-tailed) (Table 6). A scatter plot graph, Graph 2, demonstrates the negative relationship between the two variables.

Table 6

Correlation: FMS Scores and Weight

		FMS Score	Weight
FMS Score	Person Correlation	1.000	-.447**
	Sig. (2-tailed)	.	.000
	N	62	59
Weight	Person Correlation	-.447**	1.00
	Sig. (2-tailed)	.000	.
	N	59	60

**. Correlation is significant at the 0.01 level (2-tailed)



Graph 2. Scatter Plot: FMS Scores and Weight

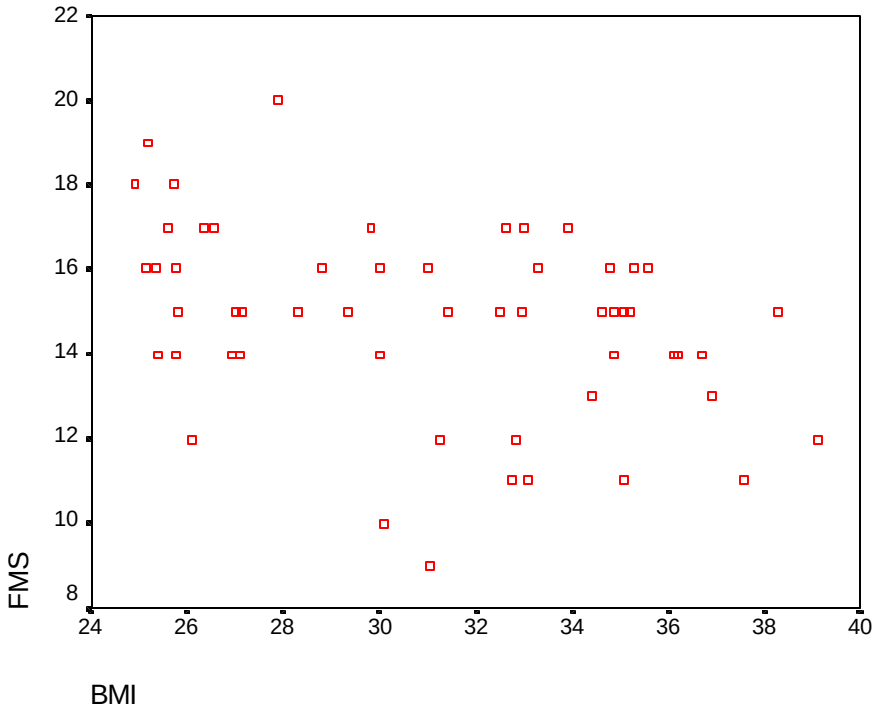
Relative body-weight (BMI) to FMS scores—Data from this analysis revealed a range in player relative body weights from a minimum of 24.6 to a maximum of 39.1, a 14.5 range. Ranges in FMS scores were the same as hypotheses two and three. The results of the Pearson correlation demonstrated a significant negative relationship between athletes' relative body weight (BMI) and FMS scores, $r = -.362$, $p \leq .01$ (2-tailed) (Table 7). As can be viewed from Graph 3, a negative relationship is demonstrated between the two variables.

Table 7

Correlation: FMS Scores and BMI

		FMS Score	BMI
FMS Score	Person Correlation	1.000	-.362**
	Sig. (2-tailed)	.	.006
	N	59	56
BMI	Person Correlation	-.362**	1.00
	Sig. (2-tailed)	.006	.
	N	56	60

**. Correlation is significant at the 0.01 level (2-tailed)



Graph 3. Scatter Plot: FMS Scores and BMI

Summary

The ANOVA analysis revealed that there is strong evidence to suggest that the mean FMS scores of the position groups are not equal. The Tukey HSD indicated that there is a significant difference in mean FMS scores between the line-of-scrimmage group and the skill groups. Also, the post hoc test also identified a significant difference in average FMS scores between the line-of-scrimmage group and the combo group. As discussed previously, a non-significant difference in average FMS scores was found between the skill group and the combo group. Therefore, hypothesis one can be rejected.

The correlation analyses indicated a significant negative relationship between FMS scores, and height, weight, and relative body weight. Since significant results were demonstrated in all of the hypotheses, it can be said that factors other than mobility and stability affect the outcome of scores on the Functional Movement Screen™. Therefore, hypotheses two through four can be rejected.