STATS

# LEG VOLUME DATA SUMMARY REPORT

I. COMPARISON OF 0 MINUTE HEAD-DOWN TILT TO 30 MINUTE AND 60 MINUTE HEAD-DOWN TILT USING LEG VOLUME DATA

II. COMPARISON OF 30° HEAD-DOWN TILT TEST TO 20° HEAD-DOWN TILT TEST USING LEG VOLUME DATA

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This is for Dr.
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# I. COMPARISON OF 0 MINUTE HEAD-DOWN TILT TO 30 MINUTE AND 60 MINUTE HEAD-DOWN TILT USING LEG VOLUME DATA

**Summary of Results**

In order to compare 0 minute head-down tilt (HDT) to 30 and 60 minute HDT, a total of six Analysis of Variance (ANOVA) tests were performed. ANOVA is a statistical technique designed to compare three or more data samples (sets) in order to detect a difference in two or more of them.

Two head-down tests were evaluated independently, i.e., 20 degree HDT and 30 degree HDT. It was verified that the data collected from each test met all criteria necessary to perform ANOVA.

For each HDT test, three ANOVA's were performed, one test corresponding to each of three body section's, e.g. total lower leg, total upper leg, and total leg. In all six ANOVA's, at the 5% significance level no significant difference was detected between 0 minute, 30 minute, and 60 minute tilt. It can be concluded that 30 minute and 60 minute head-down tilt protocols have no more significant influence on leg volume measurements than 0 minute head-down tilt - regardless of the body section measured.

With extremely small sample sizes such as the ones used in each of the tests, the significance of statistical results can be influenced by the addition of just a few data points. While all the ANOVA's indicate that there is not a significant difference between 0 and 30 or 60 minute protocols, these results could change if larger data sets were used. It is strongly recommended that the sample sizes be increased if possible.

## Analysis of Variance (ANOVA) Test Criterion and Results

30 DEGREE HEAD-DOWN TILT

| **"H" - Total Lower Leg (Rt + Lt)** | **Are the data points independent?** | **Normally distributed?** | **Variances equal?** | **Significantly different from 0min?** | **ANOVA p-value** |
|---|---|---|---|---|---|
| 30min | Yes | Yes | Yes | No | |
| 60min | Yes | Yes | Yes | No | 0.999 |
| "I" - Total Upper leg (Rt + Lt) | | | | | |
| 30min | Yes | Yes | Yes | No | |
| 60min | Yes | Yes | Yes | No | 0.9966 |
| "J" - Total Leg (Rt + Lt) | | | | | |
| 30min | Yes | Yes | Yes | No | |
| 60min | Yes | Yes | Yes | No | 0.9944 |

20 DEGREE HEAD-DOWN TILT

| "H" - Total Lower Leg (Rt + Lt) | Are the data points independent? | Normally distributed? | Variances equal? | Significantly different from 0min? | ANOVA p-value |
|---|---|---|---|---|---|
| 30min | Yes | Yes | Yes | No | |
| 60min | Yes | Yes | Yes | No | 0.9039 |
| "I" - Total Upper Leg (Rt + Lt) | | | | | |
| 30min | Yes | Yes | Yes | No | |
| 60min | Yes | Yes | Yes | No | 0.9982 |
| "J" - Total Leg (Rt + Lt) | | | | | |
| 30min | Yes | Yes | Yes | No | |
| 60min | Yes | Yes | Yes | No | 0.9973 |

Analysis of Variance for 30 Degree Head-down Tilt Data
Total Lower Leg Volume Data

Analysis of Variance Procedure
Class Level Information

| Class | Levels | Values |
|---|---|---|
| TILT | 3 | 0min 30min 60min |

Number of observations in data set = 15

p-values above 0.05 indicate that no significant difference exists between the three groups.

Dependent Variable: MEAS

| Source | DF | Sum of Squares | F Value | Pr > F |
|---|---|---|---|---|
| Model | 2 | 2231.80767678 | 0.00 | 0.9990 |
| Error | 12 | 12780801.920571 | | |
| Corrected Total | 14 | 12783033.728248 | | |

| R-Square | C.V. | MEAS Mean |
|---|---|---|
| 0.000175 | 21.36520 | 4830.3825333 |

| Source | DF | Anova SS | F Value | Pr > F |
|---|---|---|---|---|
| TILT | 2 | 2231.80767679 | 0.00 | 0.9990 |

T tests (LSD) for variable: MEAS

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 df= 12 MSE= 1065067
Critical Value of T= 2.18
Least Significant Difference= 1422.1

Means with the same letter are not significantly different.

| T Grouping | Mean | N | TILT |
|---|---|---|---|
| A | 4841.7 | 5 | 0min |
| A | | | |
| A | 4836.0 | 5 | 60min |
| A | | | |
| A | 4813.4 | 5 | 30min |

Analysis of Variance for 30 Degree Head-down Tilt Data
Total Upper Leg Volume Data

Analysis of Variance Procedure
Class Level Information

| Class | Levels | Values |
|---|---|---|
| TILT | 3 | 0min 30min 60min |

Number of observations in data set = 15

Dependent Variable: MEAS

| Source | DF | Sum of Squares | F Value | Pr > F |
|---|---|---|---|---|
| Model | 2 | 21454.5462958 | 0.00 | 0.9966 |
| Error | 12 | 37594162.549952 | | |
| Corrected Total | 14 | 37615617.096248 | | |

| R-Square | C.V. | MEAS Mean |
|---|---|---|
| 0.000570 | 14.44601 | 12252.416733 |

| Source | DF | Anova SS | F Value | Pr > F |
|---|---|---|---|---|
| TILT | 2 | 21454.5462961 | 0.00 | 0.9966 |

T tests (LSD) for variable: MEAS

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 df= 12 MSE= 3132847
Critical Value of T= 2.18
Least Significant Difference= 2439

Means with the same letter are not significantly different.

| T Grouping | Mean | N | TILT |
|---|---|---|---|
| A | 12300 | 5 | 60min |
| A | | | |
| A | 12251 | 5 | 30min |
| A | | | |
| A | 12207 | 5 | 0min |

Analysis of Variance for 30 Degree Head-down Tilt Data
Total Leg Volume Data

Analysis of Variance Procedure
Class Level Information

| Class | Levels | Values |
|---|---|---|
| TILT | 3 | 0min 30min 60min |

Number of observations in data set = 15

Dependent Variable: MEAS

| Source | DF | Sum of Squares | F Value | Pr > F |
|---|---|---|---|---|
| Model | 2 | 18616.3356980 | 0.01 | 0.9944 |
| Error | 12 | 19909133.569916 | | |
| Corrected Total | 14 | 19927749.905614 | | |

| R-Square | C.V. | MEAS Mean |
|---|---|---|
| 0.000934 | 6.691727 | 19248.518800 |

| Source | DF | Anova SS | F Value | Pr > F |
|---|---|---|---|---|
| TILT | 2 | 18616.3356981 | 0.01 | 0.9944 |

T tests (LSD) for variable: MEAS

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 df= 12 MSE= 1659094
Critical Value of T= 2.18
Least Significant Difference= 1774.9

Means with the same letter are not significantly different.

| T Grouping | Mean | N | TILT |
|---|---|---|---|
| A | 19290.9 | 5 | 60min |
| A | | | |
| A | 19250.0 | 5 | 30min |
| A | | | |
| A | 19204.7 | 5 | 0min |

Analysis of Variance for 20 Degree Head-down Tilt Data
Total Lower Leg Volume Data

Analysis of Variance Procedure
Class Level Information

| Class | Levels | Values |
|---|---|---|
| TILT | 3 | 0min 30min 60min |

Number of observations in data set = 15

Dependent Variable: MEAS

| Source | DF | Sum of Squares | F Value | Pr > F |
|---|---|---|---|---|
| Model | 2 | 310886.611522 | 0.10 | 0.9039 |
| Error | 12 | 18311029.747228 | | |
| Corrected Total | 14 | 18621916.358750 | | |

| R-Square | C.V. | MEAS Mean |
|---|---|---|
| 0.016695 | 28.69078 | 4305.4974667 |

| Source | DF | Anova SS | F Value | Pr > F |
|---|---|---|---|---|
| TILT | 2 | 310886.611522 | 0.10 | 0.9039 |

T tests (LSD) for variable: MEAS

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 df= 12 MSE= 1525919
Critical Value of T= 2.18
Least Significant Difference= 1702.2

Means with the same letter are not significantly different.

| T Grouping | Mean | N | TILT |
|---|---|---|---|
| A | 4422.1 | 5 | 30min |
| A | | | |
| A | 4391.8 | 5 | 60min |
| A | | | |
| A | 4102.7 | 5 | 0min |

Analysis of Variance for 20 Degree Head-down Tilt Data
Total Upper Leg Volume Data

Analysis of Variance Procedure
Class Level Information

| Class | Levels | Values |
|---|---|---|
| TILT | 3 | 0min 30min 60min |

Number of observations in data set = 15

Analysis of Variance Procedure

Dependent Variable: MEAS

| Source | DF | Sum of Squares | F Value | Pr > F |
|---|---|---|---|---|
| Model | 2 | 32348.6222124 | 0.00 | 0.9982 |
| Error | 12 | 107899269.80129 | | |
| Corrected Total | 14 | 107931618.42350 | | |

| R-Square | C.V. | MEAS Mean |
|---|---|---|
| 0.000300 | 29.60687 | 10128.056000 |

| Source | DF | Anova SS | F Value | Pr > F |
|---|---|---|---|---|
| TILT | 2 | 32348.6222124 | 0.00 | 0.9982 |

T tests (LSD) for variable: MEAS

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 df= 12 MSE= 8991606
Critical Value of T= 2.18
Least Significant Difference= 4132.1

Means with the same letter are not significantly different.

| T Grouping | Mean | N | TILT |
|---|---|---|---|
| A | 10175 | 5 | 0min |
| A A | 10145 | 5 | 30min |
| A | 10065 | 5 | 60min |

Analysis of Variance for 20 Degree Head-down Tilt Data
Total Leg Volume Data

Analysis of Variance Procedure
Class Level Information

| Class | Levels | Values |
|---|---|---|
| TILT | 3 | 0min 30min 60min |

Number of observations in data set = 15

Dependent Variable: MEAS

| Source | DF | Sum of Squares | F Value | Pr > F |
|---|---|---|---|---|
| Model | 2 | 70212.6462847 | 0.00 | 0.9973 |
| Error | 12 | 155195964.43620 | | |
| Corrected Total | 14 | 155266177.08248 | | |

| R-Square | C.V. | MEAS Mean |
|---|---|---|
| 0.000452 | 22.39277 | 16059.857000 |

| Source | DF | Anova SS | F Value | Pr > F |
|---|---|---|---|---|
| TILT | 2 | 70212.6462851 | 0.00 | 0.9973 |

T tests (LSD) for variable: MEAS

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 df= 12 MSE= 12932997
Critical Value of T= 2.18
Least Significant Difference= 4955.6

Means with the same letter are not significantly different.

| T Grouping | Mean | N | TILT |
|---|---|---|---|
| A | 16133 | 5 | 0min |
| A | | | |
| A | 16078 | 5 | 30min |
| A | | | |
| A | 15968 | 5 | 60min |

## II. COMPARISON OF 30° HEAD-DOWN TILT TEST TO 20° HEAD-DOWN TILT TEST USING LEG VOLUME DATA

**Summary of Results**

Comparison of 20° to 30° head-down tilt (HDT) involved nine separate t-tests. In all tests, no significant difference was found between 20° to 30° HDT for any time level at any body region.

**Summary of Independent t-test Analysis - Comparison of 20° Head-down Tilt to 30° Head-down Tilt at Three Different Time Levels for Three Different Body Sections**

| Comparison of 20° to 30° HDT | t - statistic | p-value | Significant at alpha = 0.05 |
|---|---|---|---|
| **Total Lower Leg** | | | |
| 0min | -1.1307 | 0.2909 | No |
| 30min | -0.5233 | 0.6150 | No |
| 60min | -0.5895 | 0.5718 | No |
| **Total Upper Leg** | | | |
| 0min | -1.3113 | 0.2261 | No |
| 30min | -1.3535 | 0.2129 | No |
| 60min | -1.4273 | 0.1914 | No |
| **Total (U & L) Leg** | | | |
| 0min | -1.7823 | 0.1126 | No |
| 30min | -1.8591 | 0.1001 | No |
| 60min | -1.9598 | 0.0857 | No |

**Discussion**

At the 5% significance level, it can be concluded that the leg volume averages are not significantly different at any of the body sections tested. Only a few people were measured, and perhaps a larger set of data would have given a more accurate picture of the populations. To improve the accuracy of the above test results, larger sample sizes are necessary.

Comparison of 30 Degree and 20 Degree HDT at Three Measurement Locations During Various Time Lengths of Tilt

TTEST PROCEDURE

********** TYPE=lower TILT=0min **********

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 4102.653000 | 1045.228478 | 467.4403856 | Unequal | -1.1307 | 8.0 | 0.2909 |
| 30degree | 5 | 4841.670600 | 1021.437633 | 456.8007962 | Equal | -1.1307 | 8.0 | 0.2909 |

For H0: Variances are equal, F' = 1.05 DF = (4,4) Prob>F' = 0.9655 - for values above 0.05 use equal variances

********** TYPE=lower TILT=30min **********

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 4422.060800 | 1313.110950 | 587.2410694 | Unequal | -0.5233 | 7.6 | 0.6158 |
| 30degree | 5 | 4813.441800 | 1035.760796 | 463.2063097 | Equal | -0.5233 | 8.0 | 0.6150 |

For H0: Variances are equal, F' = 1.61 DF = (4,4) Prob>F' = 0.6570

********** TYPE=lower TILT=60min **********

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 4391.778600 | 1327.024679 | 593.4634779 | Unequal | -0.5895 | 7.6 | 0.5728 |
| 30degree | 5 | 4836.035200 | 1038.780639 | 464.5568246 | Equal | -0.5895 | 8.0 | 0.5718 |

For H0: Variances are equal, F' = 1.63 DF = (4,4) Prob>F' = 0.6468

********** TYPE=total TILT=0min **********

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 16133.00720 | 3647.247370 | 1631.098610 | Unequal | -1.7823 | 4.9 | 0.1360 |
| 30degree | 5 | 19204.65100 | 1244.512980 | 556.563124 | Equal | -1.7823 | 8.0 | 0.1126 |

For H0: Variances are equal, F' = 8.59 DF = (4,4) Prob>F' = 0.0607

********** TYPE=total TILT=30min **********

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 16078.12760 | 3599.197378 | 1609.610000 | Unequal | -1.8591 | 5.0 | 0.1225 |
| 30degree | 5 | 19249.99920 | 1264.993670 | 565.722367 | Equal | -1.8591 | 8.0 | 0.1001 |

For H0: Variances are equal, F' = 8.10 DF = (4,4) Prob>F' = 0.0672

********** TYPE=total TILT=60min **********

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 15968.43620 | 3541.518879 | 1583.815391 | Unequal | -1.9598 | 5.1 | 0.1060 |
| 30degree | 5 | 19290.90620 | 1352.132335 | 604.691963 | Equal | -1.9598 | 8.0 | 0.0857 |

For H0: Variances are equal, F' = 6.86 DF = (4,4) Prob>F' = 0.0889

**** TYPE=upper TILT=0min ****

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 10174.76380 | 2998.858975 | 1341.130505 | Unequal | -1.3113 | 6.4 | 0.2350 |
| 30degree | 5 | 12207.03500 | 1736.874610 | 776.753939 | Equal | -1.3113 | 8.0 | 0.2261 |

For H0: Variances are equal, F' = 2.98 DF = (4,4) Prob>F' = 0.3152

**** TYPE=upper TILT=30min ****

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 10144.68520 | 3022.394467 | 1351.655897 | Unequal | -1.3535 | 6.4 | 0.2223 |
| 30degree | 5 | 12250.59580 | 1723.009988 | 770.553492 | Equal | -1.3535 | 8.0 | 0.2129 |

For H0: Variances are equal, F' = 3.08 DF = (4,4) Prob>F' = 0.3019

**** TYPE=upper TILT=60min ****

Variable: MEAS

| TEST | N | Mean | Std Dev | Std Error | Variances | T | DF | Prob>\|T\| |
|---|---|---|---|---|---|---|---|---|
| 20degree | 5 | 10064.71900 | 2974.356062 | 1330.172469 | Unequal | -1.4273 | 6.7 | 0.1987 |
| 30degree | 5 | 12299.61940 | 1847.442504 | 826.201405 | Equal | -1.4273 | 8.0 | 0.1914 |

For H0: Variances are equal, F' = 2.59 DF = (4,4) Prob>F' = 0.3787