



Research Results

The efficacy of Switch™ as a nutritional and possible performance optimisation supplement in high performance road, track and off-road cyclists.

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AIM

The purpose of this study was to determine under controlled laboratory conditions whether a product (Switch™) has an effect on HR, VO₂, RPE, Lactate, SP0₂ and RQ levels when administered to subjects.

METHOD

RESEARCH DESIGN

The study was conducted by means of an experiment. A total number of 30 subjects, split into two groups, were included in the experiment. The 30 subjects were recruited from 3 cycling codes including, road, track and off-road cyclists. Subjects were expected to take either the placebo or Switch™ at a dosage of 25 drops daily. The drops were taken in distilled water and 15 minutes prior to the daily training session as well as 15 minutes prior to their post-test.

DATA SAMPLING

The subjects were split into two groups, an experimental group (15 subjects) and a placebo (control) group (15 subjects). Measurements were taken of their Maximum Heart Rate (HR), VO₂ Max (VO₂), Rate of Perceived Exertion (RPE), Lactate (La), Haemoglobin saturation (SP0₂) and Respiratory Quotient at VO₂ Max levels (RQ), as well as their Fat Percentage (Fat %), Lean Body Mass (LBM), Endomorphy (I), Mesomorphy (II), Ectomorphy (III), Relative Peak watt in w/kg, Rate of fatigue setting in (Fatigue Ratio), Amount of Joules relative to body weight (Total work relative) and Maximal Power output (Watt). Subjects in the experimental group received a product (Switch™) over a period of four weeks where after measurements were taken of the following to see whether the intervention had any effect: Fat %, LBM, I, II, III, Relative peak watt, Fatigue ratio, Total work relative, Resting La and Resting SP0₂. The following additional measurements were also taken after the four week intervention: 70% of Max speed, 80% of Max speed and 90% of Max speed of HR, VO₂, RPE, Lac, SP0₂ and RQ. Scores for the aforementioned measures were divided by the respective maximum score, and multiplied by 100 in order to obtain a measure, which is a percentage of the maximum score.

DATA ANALYSIS (Performed by an independent statistician)

The data was captured onto excel and converted to SPSS in order to do the analysis. Firstly, the analysis of data was aimed at determining whether significant differences existed between the two groups on all variables measured. Secondly, the analysis was aimed at determining whether significant differences existed between the pre- and post measurements within the same group. Since the sample was relatively small and consisted of only 15 and 15 subjects per group respectively, use was made of non-parametric statistics to analyse the data. The following statistical analysis procedures were used to analyse the data:

- a. **Descriptive statistics.** Descriptive statistics are primarily aimed at describing the data. The mean, standard deviation, minimum and maximum scores for each measurement per group were determined for reference purposes.

- b. **Inferential statistics:** *Test hypotheses about differences in populations on the basis of measurements made on samples of subjects* (Tabachnick & Fidell, 1996: p.9).
 - (1) **The Mann-Whitney Test:** The Mann-Whitney test is used for testing differences between means when there are two conditions and different subjects have been used in each condition (Field, 2000: p.49). The test is often thought of as the distribution free analogue of the t-test for two independent samples. Its null hypothesis, is the hypothesis that the two samples were drawn at random from identical populations (not just populations with the same mean), but it is especially sensitive to population differences in central tendency (Howell, 1992: p.611). The rejection of the null hypothesis is generally interpreted to mean that the two distributions had different central tendencies. This test was used to determine differences between the placebo (control) group and the experimental group on all variables measured.

- (2) **The Wilcoxon Signed Ranks Test**: The Wilcoxon test is used in situations in which there are two sets of scores to compare, but these scores come from the same subjects (Field, 2000: p.54). This test is the distribution-free analogue of the t test for related samples. According to Howell (1999, p.402) it tests the null hypothesis that two related (matched) samples were drawn either from identical populations or from symmetric populations with the same mean. This test was used to determine whether statistically significant differences existed between the pre- and post scores obtained for various measurements within the same group.
- (3) **Friedman's rank test for k correlated samples**: This test is the distribution free analogue of the one-way repeated measure analysis of variance. *"It is a test on the null hypothesis that the scores of each treatment were drawn from identical populations, and it is especially sensitive to population differences in central tendency* (Howell, 1992:p.624). This test was used to determine whether statistically significant differences existed between the scores obtained at the different percentage of the maximum measurement intervals within the same group.

RESULTS

The results will be presented in the following order:

- a. Descriptive statistics for the two groups on all measurements.
- b. Results of the analysis of the comparison of the two groups on all measurements.
- c. Results of the analysis of the comparison of the pre- and post intervention scores within the same group, across the various measurements mentioned above. This analysis was repeated for both groups.

- d. Results of the analysis of the comparison of the same group across various measurements at different speed intervals. This analysis was repeated for both groups, but only for post test measurements.

DESCRIPTIVE STATISTICS FOR THE TWO GROUPS ON ALL MEASUREMENTS.

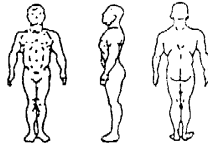
These results are included simply as frame of reference for the reader to see how the two groups performed on all the measurements. Where no results for a specific variable in either the pre- or post intervention results are shown, this is an indication that the variable was not measured for the specific pre- or post intervention measurement. The results are presented in Tables 1 to 14:

Table 1: Descriptive statistics of Fat %, LBM, I, II and III variables for the experimental group

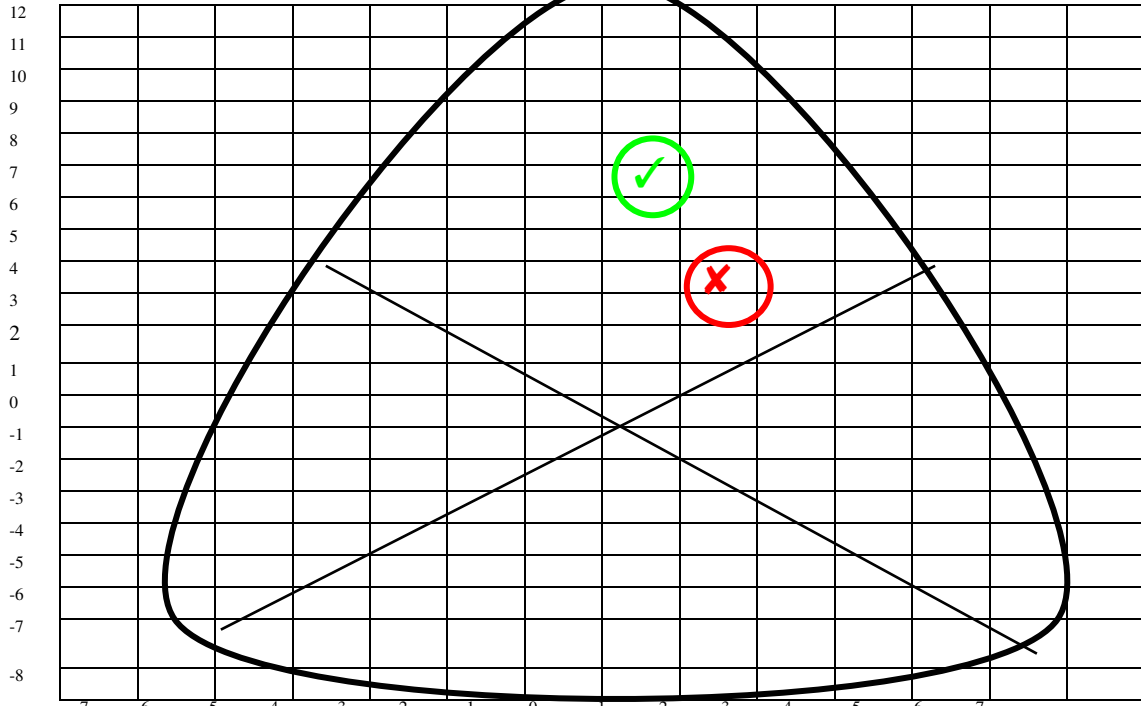
| | N | Minimum | Maximum | Mean | Std. Deviation |
|-----------------|----|---------|---------|---------|----------------|
| Fat % Pre | 15 | 9.60 | 30.00 | 16.3364 | 6.77293 |
| LBM Pre | 15 | 47.60 | 70.00 | 61.9727 | 7.04388 |
| Endomorphy Pre | 15 | 1.50 | 4.90 | 2.8455 | 1.08293 |
| Mesomorphy Pre | 15 | 3.50 | 6.40 | 4.7000 | .93702 |
| Ectomorphy Pre | 15 | .80 | 4.10 | 2.6455 | 1.00336 |
| Fat % Post | 15 | 9.20 | 39.60 | 16.6409 | 9.01806 |
| LBM Post | 15 | 47.20 | 69.40 | 62.4636 | 7.21918 |
| Endomorphy Post | 15 | 1.60 | 4.80 | 2.7273 | 1.09095 |
| Mesomorphy Post | 15 | 4.20 | 6.50 | 5.1818 | .74942 |
| Ectomorphy Post | 15 | .70 | 4.10 | 2.6455 | 1.00932 |

2-DIMENSIONAL REPRESENTATION OF THE BODY COMPOSITION

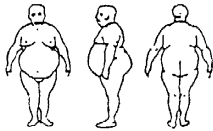
✗ = present position
✓ = recommended position



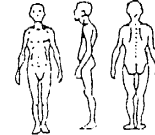
MESOMORPHY



ENDOMORPHY



ECTOMORPHY



| NORMS - % Fat (male) | | | | |
|----------------------|--------|---------|---------|------|
| Excellent | Good | Average | Fair | Weak |
| < 7 | 8 - 10 | 11 - 13 | 14 - 16 | > 16 |

| NORMS - % Fat (female) | | | |
|------------------------|--------|---------|---------------|
| Age | Ideal | Average | Below average |
| 15-18 | 11-13% | 14-17% | >17% |
| 19-21 | 13-14% | 15-21% | >21% |

| | | | |
|-------|--------|--------|------|
| 22-25 | 13-14% | 15-21% | >21% |
| 26-30 | 14-15% | 16-22% | >22% |
| 31-35 | 15-18% | 19-23% | >23% |
| >35 | 16-20% | 21-24% | >24% |

Table 2: Descriptive statistics of Fat %, LBM, I, II and III variables for the Placebo (control) group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|-----------------|----|---------|---------|---------|----------------|
| Fat % Pre | 15 | 11.50 | 25.10 | 15.8000 | 5.20854 |
| LBM Pre | 15 | 41.80 | 68.20 | 55.4700 | 9.28476 |
| Endomorphy Pre | 15 | 1.60 | 4.10 | 2.6100 | .78379 |
| Mesomorphy Pre | 15 | 2.60 | 6.80 | 4.7400 | 1.29803 |
| Ectomorphy Pre | 15 | 1.70 | 5.30 | 2.9100 | 1.20596 |
| Fat % Post | 15 | 11.40 | 24.80 | 15.7400 | 5.23051 |
| LBM Post | 15 | 44.00 | 69.50 | 56.5700 | 7.93894 |
| Endomorphy Post | 15 | 1.70 | 4.20 | 2.6100 | .78944 |
| Mesomorphy Post | 15 | 2.80 | 6.90 | 4.8200 | 1.25769 |
| Ectomorphy Post | 15 | 1.60 | 5.30 | 2.8500 | 1.17969 |

Table 3: Descriptive statistics of maximum values of HR, VO₂, RPE, La and RQ variables for the experimental group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|-------------------------|----|---------|---------|----------|----------------|
| Max HR Pre | 15 | 172.00 | 190.00 | 181.9091 | 6.37894 |
| VO ₂ Max Pre | 15 | 39.45 | 55.24 | 48.5636 | 5.06962 |
| Max RPE Pre | 15 | 16.00 | 20.00 | 18.0909 | 1.22103 |
| Max La Pre | 15 | 4.00 | 11.20 | 8.4636 | 2.11626 |
| RQ Max Pre | 15 | 1.09 | 1.31 | 1.1745 | .06330 |

Table 4: Descriptive statistics of maximum values of HR, VO₂, RPE, La and RQ variables for the placebo (control) group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|-------------------------|----|---------|---------|----------|----------------|
| HR Max Pre | 15 | 166.00 | 196.00 | 184.2000 | 10.50714 |
| VO ₂ Max Pre | 15 | 31.58 | 61.44 | 47.5470 | 8.42062 |
| RPE Max Pre | 15 | 14.80 | 20.00 | 18.2800 | 1.54402 |
| La Max Pre | 15 | 8.10 | 19.60 | 11.8800 | 3.51909 |
| RQ Pre | 15 | 1.12 | 1.35 | 1.2060 | .06222 |

Table 5: Descriptive statistics of maximal power output, La rest, La 5 min, La 10 min, Relative Peak watt and SP0₂ at rest variables for the experimental group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|-------------------------------|----|---------|---------|----------|----------------|
| Maximal power output Pre | 15 | 475.00 | 705.00 | 587.4545 | 76.03468 |
| La at rest Pre | 15 | 1.30 | 2.70 | 1.7182 | .46437 |
| La after 5 min recovery Pre | 15 | 6.40 | 13.90 | 10.2182 | 2.80992 |
| La after 10 min recovery Pre | 15 | 5.00 | 12.90 | 8.4109 | 2.88057 |
| Relative Peak watt Pre | 15 | 8.90 | 13.40 | 10.9091 | 1.40247 |
| SP02 resting Pre | 15 | 94.00 | 99.00 | 97.0000 | 1.48324 |
| Maximal power output Post | 15 | | | | |
| La at rest Post | 15 | 1.30 | 2.80 | 1.9182 | .50955 |
| La after 5 min recovery Post | 15 | | | | |
| La after 10 min recovery Post | 15 | | | | |
| Relative Peak watt | 15 | 8.50 | 13.40 | 11.1182 | 1.32651 |
| SP02 resting Post | 15 | 95.00 | 98.00 | 97.0000 | 1.00000 |

Table 6: Descriptive statistics of maximal power output, La rest, La 5 min, La 10 min, Relative Peak watt and SP0₂ at rest variables for the placebo (control) group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|-------------------------------|----|---------|---------|----------|----------------|
| Maximal power output Pre | 15 | 320.00 | 752.00 | 515.5000 | 122.29404 |
| SP02 resting Pre | 15 | 95.00 | 98.00 | 96.6000 | 1.07497 |
| La at rest Pre | 15 | 1.60 | 2.90 | 2.1000 | .41633 |
| La after 5 min recovery Pre | 15 | 7.20 | 17.40 | 11.2900 | 3.13845 |
| La after 10 min recovery Pre | 15 | 5.10 | 14.70 | 9.8600 | 3.47313 |
| Relative Peak watt Pre | 15 | 9.00 | 15.40 | 11.4100 | 1.81135 |
| Maximal power output Post | 15 | | | | |
| SP02 resting | 15 | 92.00 | 97.00 | 96.0000 | 1.63299 |
| La at rest Post | 15 | 1.40 | 3.00 | 2.1000 | .53333 |
| La after 5 min recovery Post | 15 | | | | |
| La after 10 min recovery Post | 15 | | | | |
| Relative Peak watt Post | 15 | 9.00 | 930.00 | 269.3700 | 416.79022 |

Table 7: Descriptive statistics of Fatigue ration and Total work relative variables for the experimental group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|--------------------------|----|---------|---------|----------|----------------|
| Fatigue Ratio Pre | 15 | 48.00 | 85.00 | 63.5455 | 12.06121 |
| Total Work Relative Pre | 15 | 221.00 | 312.00 | 270.0000 | 30.37104 |
| Max SP02 | 15 | 94.00 | 99.00 | 97.0000 | 1.48324 |
| Fatigue Ratio Post | 15 | 49.00 | 82.00 | 61.8182 | 11.16081 |
| Total Work Relative Post | 15 | 223.00 | 319.00 | 273.7273 | 31.64835 |
| Max SP02 Post | | | | | |

Table 8: Descriptive statistics of Fatigue ration and Total work relative variables for the placebo (control) group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|--------------------------|----|---------|---------|----------|----------------|
| Fatigue Ratio Pre | 15 | 26.00 | 78.00 | 60.8000 | 14.25794 |
| Total Work Relative Pre | 15 | 224.00 | 318.00 | 275.4000 | 28.30077 |
| Max SP02 Pre | 15 | 95.00 | 98.00 | 96.6000 | 1.07497 |
| Fatigue Ratio Post | 15 | 35.00 | 74.00 | 58.7000 | 12.78932 |
| Total Work Relative Post | 15 | 224.00 | 338.00 | 283.1000 | 33.59712 |
| Max SP02 Post | | | | | |

Table 9: Descriptive statistics of all HR and VO₂ variables for the experimental group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|--------------|----|---------|---------|----------|----------------|
| 70% HR Post | 15 | 109.00 | 155.00 | 128.6364 | 16.40288 |
| 80% HR Post | 15 | 126.00 | 172.00 | 145.8182 | 18.20889 |
| 90% HR Post | 15 | 139.00 | 181.00 | 158.1818 | 15.41310 |
| Max HR Post | 15 | 172.00 | 190.00 | 181.9091 | 6.37894 |
| 70% V02 Post | 15 | 19.83 | 31.21 | 24.4209 | 3.22999 |
| 80% V02 Post | 15 | 25.15 | 41.88 | 30.2227 | 4.41341 |
| 90% V02 Post | 15 | 31.19 | 44.08 | 37.5936 | 3.80711 |
| VO2 Max Post | 15 | 39.45 | 55.24 | 48.5636 | 5.06962 |

Table 10: Descriptive statistics of all HR and VO₂ variables for the placebo (control) group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|--------------|----|---------|---------|----------|----------------|
| 70% HR Post | 15 | 110.00 | 160.00 | 139.6000 | 18.50045 |
| 80% HR Post | 15 | 133.00 | 175.00 | 155.8000 | 15.85910 |
| 90% HR Post | 15 | 163.00 | 190.00 | 173.4000 | 9.72054 |
| Max HR Post | 15 | 166.00 | 196.00 | 184.2000 | 10.50714 |
| 70% V02 Post | 15 | 17.50 | 32.10 | 26.9090 | 4.15145 |
| 80% V02 Post | 15 | 26.80 | 38.36 | 32.6670 | 3.53662 |
| 90% V02 Post | 15 | 30.00 | 48.00 | 39.4770 | 5.49380 |
| VO2 Max Post | 15 | 31.58 | 61.44 | 47.5470 | 8.42062 |

Table 11: Descriptive statistics of all RPE and La variables for the experimental group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|--------------|----|---------|---------|---------|----------------|
| | 15 | | | | |
| 70%RPE Post | | 6.00 | 11.00 | 8.3636 | 1.80404 |
| 80%RPE Post | 15 | 10.00 | 14.00 | 12.1818 | 1.25045 |
| 90%RPE Post | 15 | 12.00 | 19.00 | 14.9091 | 2.02260 |
| Max RPE Post | 15 | 16.00 | 20.00 | 18.0909 | 1.22103 |
| 70% La Post | 15 | 1.80 | 3.00 | 2.3364 | .40068 |
| 80% La Post | 15 | 1.90 | 4.10 | 2.8455 | .72161 |
| 90% La Post | 15 | 2.80 | 8.70 | 5.1455 | 2.02799 |
| Max La Post | 15 | 4.00 | 11.20 | 8.4636 | 2.11626 |

Table 12: Descriptive statistics of all RPE and La variables for the placebo (control) group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|--------------|----|---------|---------|---------|----------------|
| 70%RPE Post | 15 | 6.00 | 14.00 | 9.7000 | 2.49666 |
| 80%RPE Post | 15 | 7.00 | 15.00 | 12.3000 | 2.40601 |
| 90%RPE Post | 15 | 13.00 | 19.00 | 15.4000 | 1.71270 |
| Max RPE Post | 15 | 14.80 | 20.00 | 18.2800 | 1.54402 |
| 70% La Post | 15 | 1.50 | 8.10 | 3.2400 | 1.80629 |
| 80% La Post | 15 | 2.00 | 9.50 | 4.0400 | 2.15675 |
| 90% La Post | 15 | 4.10 | 10.00 | 5.8300 | 1.78764 |
| Max La Post | 15 | 8.10 | 19.60 | 11.8800 | 3.51909 |

Table 13: Descriptive statistics of all SP0₂ and RQ variables for the experimental group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---------------|----|---------|---------|---------|----------------|
| 70%Sp02 Post | 15 | 92.00 | 97.00 | 93.9091 | 1.64040 |
| 80%Sp02 Post | 15 | 91.00 | 97.00 | 93.2727 | 1.61808 |
| 90%Sp02 Post | 15 | 88.00 | 95.00 | 91.8182 | 1.77866 |
| Max SP02 Post | 15 | 94.00 | 99.00 | 97.0000 | 1.48324 |
| 70% RQ Post | 15 | .89 | 1.03 | .9427 | .03717 |
| 80% RQ Post | 15 | .90 | 1.08 | .9655 | .05126 |
| 90% RQ Post | 15 | .93 | 1.11 | 1.0100 | .05060 |
| Max RQ Post | 15 | 1.09 | 1.31 | 1.1745 | .06330 |

Table 14: Descriptive statistics of all SP0₂ and RQ variables for the placebo (control) group

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---------------|----|---------|---------|---------|----------------|
| 70%Sp02 Post | 15 | 90.00 | 97.00 | 93.8000 | 2.09762 |
| 80%Sp02 Post | 15 | 90.00 | 96.00 | 92.9000 | 1.91195 |
| 90%Sp02 Post | 15 | 87.00 | 95.00 | 91.2000 | 2.04396 |
| Max Sp02 Post | 15 | 95.00 | 98.00 | 96.6000 | 1.07497 |
| 70% RQ Post | 15 | .92 | 1.08 | .9660 | .05358 |
| 80% RQ Post | 15 | .94 | 1.08 | .9790 | .04630 |
| 90% RQ Post | 15 | .97 | 1.12 | 1.0230 | .04739 |
| Max RQ Post | 15 | 1.12 | 1.35 | 1.2060 | .06222 |

RESULTS OF THE ANALYSIS OF THE COMPARISON OF THE TWO GROUPS ON ALL MEASUREMENTS

As indicated previously Mann-Whitney U-tests were used to determine whether statistically significant differences existed between the placebo (control) and experimental groups on all variables measured. The mean rank scores will be shown in all figures, since this statistical technique is based on mean rank. For actual mean scores please refer to the descriptive statistics above.

Statistically significant differences for pre test scores were found between the experimental and placebo (control) groups for the following measures: weight, Lean Body Mass (LBM), speed, and lactate at rest. Weight scores are significant on the 5% level of significance, whilst LBM, speed and lactate at rest scores are significant on the 10% level of significance.

Statistically significant differences between the experimental and placebo (control) groups were found on the 5% level of significance for post intervention weight and 90% HR scores. Statistically significant differences at the 10% level of significance were found between the experimental and control group post test Lean Body Mass, 70% V0₂, 80% V0₂ and 70% lactate scores. The implication of this is that differences in the weight and LBM post intervention results between the experimental and placebo (control) groups may be a result of initial differences between weight and LBM pre intervention scores and not because of an intervention. Because 70% V0₂, 80% V0₂, 70% lactate and 90% HR score were not measured before the intervention, differences

in the post intervention results may be because of differences in pre intervention results and not because of the intervention. The results are summarised in Figures 1 to 3.

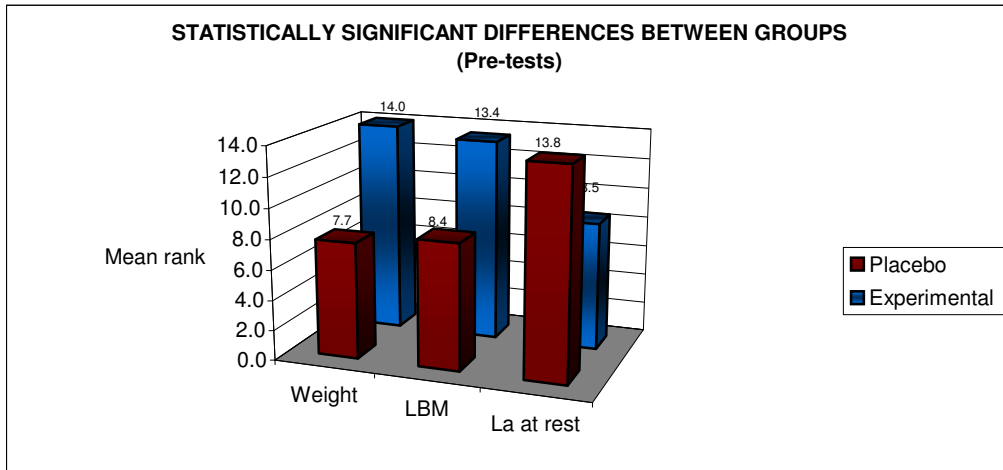


Figure 1:

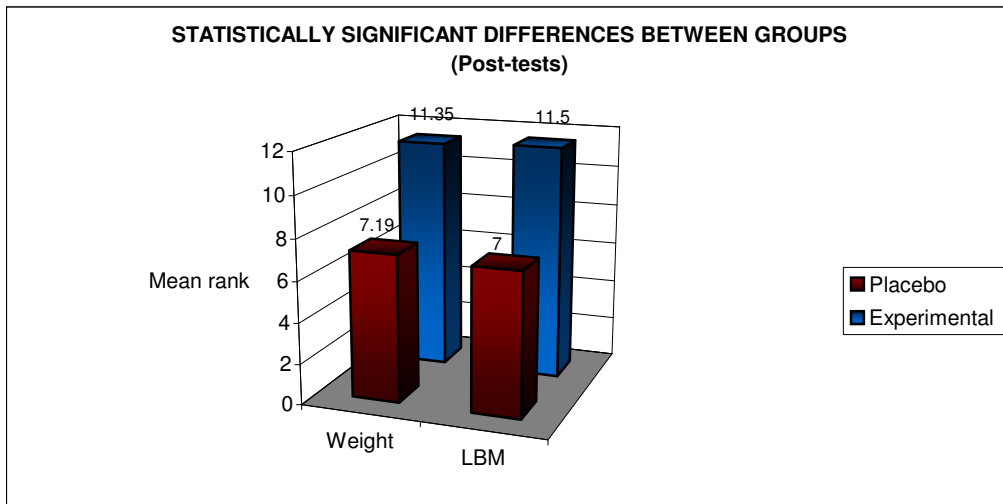


Figure 2:

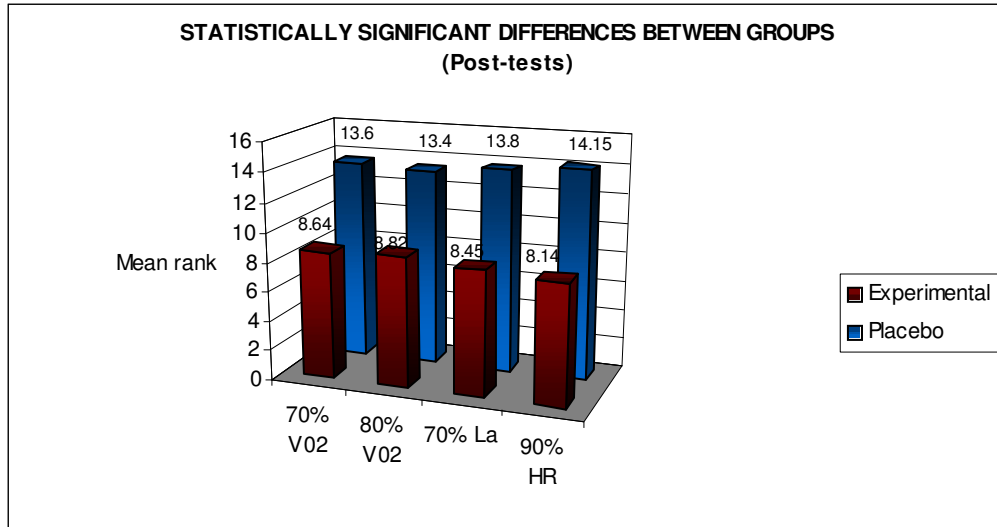


Figure 3:

Comparisons of variables at various sub maximal intensities (in % of their maximum)

| GROUP Placebo | HR | V02 | RPE | LA (Actual Values) | SP02 | RQ |
|------------------|----------|----------|----------|--------------------|----------|----------|
| 70% of Max Speed | 75.78719 | 56.59453 | 53.06346 | 27.27273 (3.21) | 97.10145 | 80.0995 |
| 80% of Max Speed | 84.58198 | 68.70465 | 67.28665 | 34.00673 (4.03) | 96.16977 | 81.17745 |
| 90% of Max Speed | 94.13681 | 83.02732 | 84.24508 | 49.07407 (5.47) | 94.40994 | 84.82587 |

| GROUP SWITCH | HR | V02 | RPE | LA (Actual Values) | SP02 | RQ |
|------------------|-----------|----------|----------|--------------------|----------|----------|
| 70% of Max Speed | 70.714643 | 50.28641 | 46.23116 | 27.60473 (2.33) | 96.8135 | 80.26316 |
| 80% of Max Speed | 80.15992 | 62.23325 | 67.33668 | 33.61976 (2.84) | 96.15745 | 82.19814 |
| 90% of Max Speed | 86.956522 | 77.41108 | 82.41206 | 60.79484 (5.14) | 94.65792 | 85.99071 |

No statistically significant differences were found between the experimental and placebo (control) groups for all of the other pre and post intervention measurements. Thus at the onset of the experiment the control group and experimental group did not differ significantly with regard to the Fat %, Endomorphy, Mesomorphy, Ectomorphy, HR, VO2, RPE, SP02 at rest, Watt, RQ, La at 5 min, La at 10 min, Relative Peak Watt, Fatigue ratio and total work relative.

No statistically significant differences were either found between the post intervention results of the experimental and placebo (control) groups with regards to the Fat %, Endomorphy, Mesomorphy, Ectomorphy, HR, VO₂, RPE, SP0₂, RQ, 70% HR, 80% HR, 90% V0₂, 70% SP0₂, 80% SP0₂, 90% Sp0₂, 70% RQ, 80% RQ, 90% RQ, 80% La, 90% La, total work relative and fatigue ratio measurements.

This indicates that no statistically significant changes existed between the post intervention results of the control and experimental groups regarding the above-mentioned measurements.

As mentioned before, the following additional measurements were also taken after the four week intervention: 70% of Max, 80% of Max and 90% of Max of HR, V0₂, RPE, Lac, SP0₂ and RQ. Scores for the aforementioned measures were divided by the respective maximum score, and multiplied by 100 in order to obtain a measure, which is a percentage of the maximum score. Mann-Whitney U-tests were used to determine whether statistically significant differences existed between the placebo (control) and experimental groups for these variables.

A statistically significant difference on the 5% level of significance was found between the experimental and placebo (control) group for the 90% HR score as a percentage of the maximum HR scores. Results are summarised in figure 4 below.

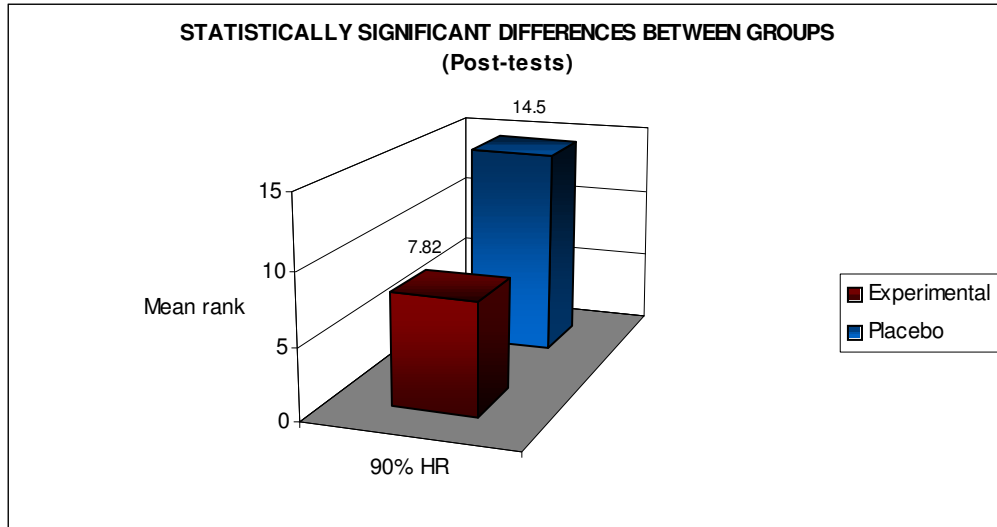


Figure 4:

RESULTS OF THE ANALYSIS OF THE COMPARISON OF THE PRE AND POST-TESTS OF THE SAME GROUP ACROSS VARIOUS MEASUREMENTS

Wilcoxon Signed Ranks tests were used to determine whether statistically significant changes took place between the pre- and post tests within the same group regarding the following variables: Fat%, LBM, I, II, III, Relative Peak Watt, Fatigue Ratio, Total Work Relative, Resting La and Resting SP0₂.

Results of tests for differences between the pre- and post tests of the Placebo (Control) Group

The following significant differences in distribution on the 5% level of significance were found between the pre- and post test scores in the *Placebo Group (Control Group)*. The results are summarised in figure 5:

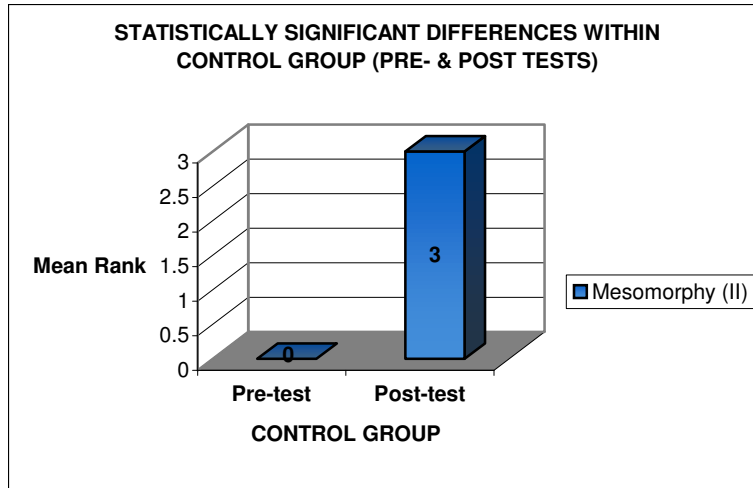


Figure 5:

The results of figure 5 indicate the following:

- a. The distribution of the mesomorphy (II) pre test score is significantly different from the distribution of the mesomorphy post test score. Thus, the mesomorphy pre test score was lower than the mesomorphy post test score.

No statistically significant differences in distribution were found between the following pre- and post test scores in the *Control Group*:

- a. No statistically significant difference was found between the pre- and post test scores for Fat percentage for the control group.
- b. No statistically significant difference was found between the pre- and post test scores for LBM.
- c. No statistically significant difference was found between the pre- and post test scores for endomorphy (I) and ectomorphy (III).

- d. No statistically significant difference was found between the pre- and post test scores for Relative peak watt, fatigue ratio, total work relative, lactate at rest and SP02 at rest.

Results of tests for differences between the pre and post tests of the Experimental Group

The following significant differences in distribution were found between the pre- and post test scores in the *experimental Group*. The results are summarised in figure 6:

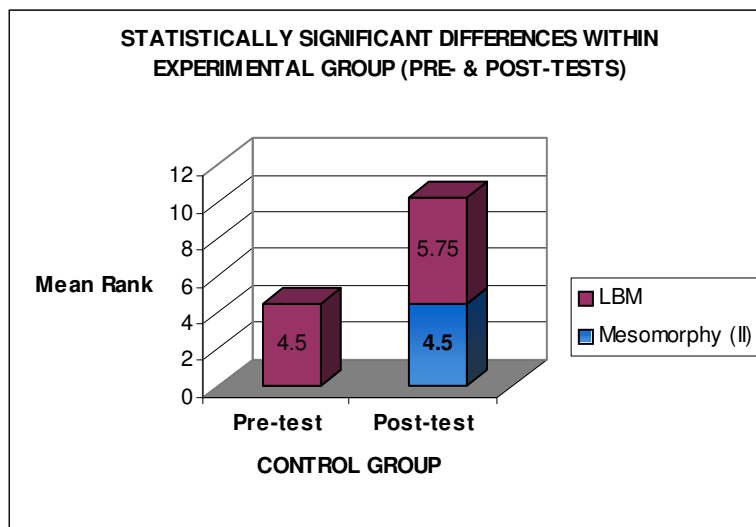


Figure 6:

The results of figure 6 indicate the following:

- a. The distribution of the mesomorphy (II) pre test score is significantly different from the distribution of the mesomorphy post test score at the 5% level of significance. Thus the mesomorphy pre test score was lower than the mesomorphy post test score.
- b. The distribution of the LBM pre test score is significantly different from the distribution of the LBM post test score at the 10% level of significance. Thus, the LBM pre test score is lower than the LBM post test score.

- c. No statistically significant difference was found for any of the other measures in the experimental group, either at the 5% or 10% level of significance.

RESULTS OF THE ANALYSIS OF THE COMPARISON OF THE SAME GROUP ACROSS VARIOUS MEASUREMENTS AT DIFFERENT PERCENTAGES OF THE MAXIMUM SCORE

As indicated previously Friedman tests were used to determine whether statistically significant changes took place within the same group across the measurements taken at different percentages of maximum scores. All significant differences reported, were significant on the 5% level of significance. The results can be summarised as follows:

Results of tests for differences within groups across HR measurements

Statistically significant differences were found for both the experimental and placebo (control) groups regarding the post tests at different percentages of the maximum. The results of the above analysis are represented in figures 7 and 8.

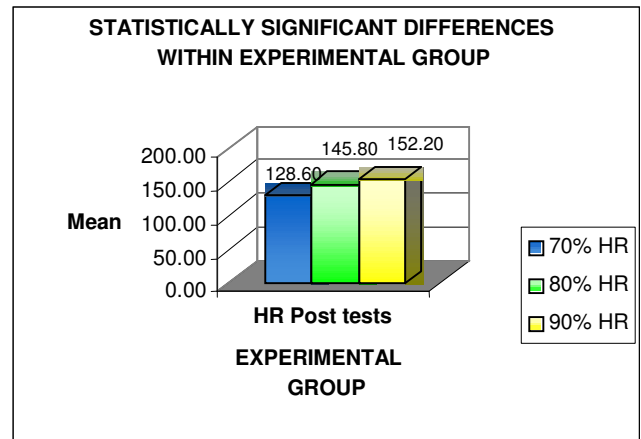
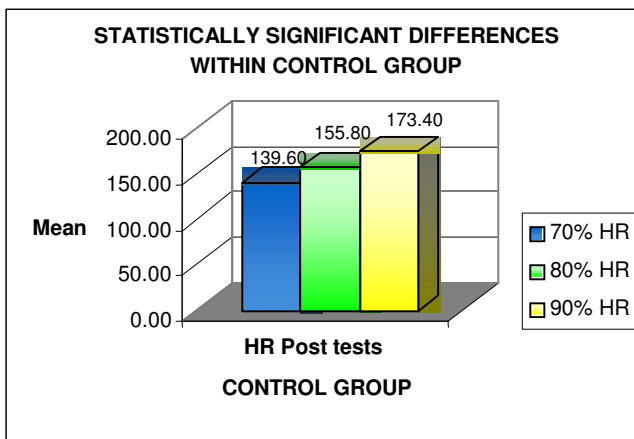


Figure 7a:

Figure 8a:

The results of figures 7 and 8 indicate the following:

The HR post tests for both the placebo (control) and experimental groups showed a significant increase from 70%HR, with a peak at 90%HR. **The control group starts and ends at higher scores than the experimental group.**

Results of tests for differences within groups across V_{O_2} measurements

Statistically significant differences were found for both the experimental and control groups regarding the V_{O_2} post tests at different percentages of the maximum. The results of the above analysis are represented in figures 9 and 10.

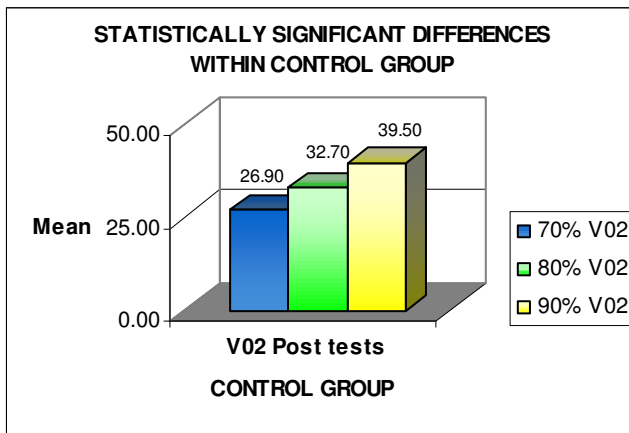


Figure 9:

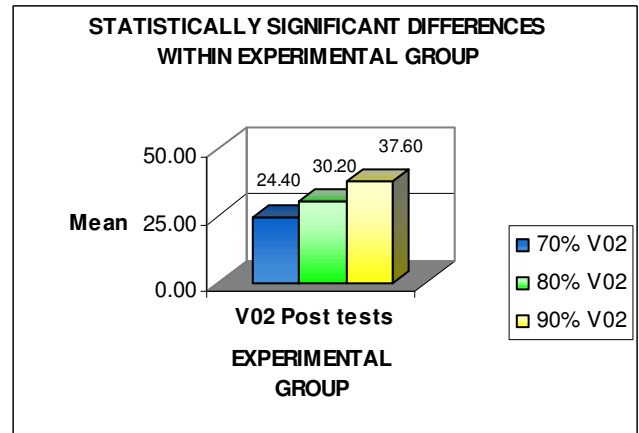


Figure 10:

The results of figures 9 and 10 indicate the following:

The V_{O_2} post tests for both the placebo (control) and experimental groups showed a significant increase from 70% V_{O_2} , with a peak at 90% V_{O_2} , with both groups showing the same trend. The control group starts with a higher score at 70% V_{O_2} and peaks at a higher score. The experimental group showed lower oxygen consumption on 70%, 80% as well as 90% of their maximum speed on the bike. Lower oxygen consumption at sub maximal work loads might be due to an increase in the economy of movement.

Results of tests for differences within groups across RPE measurements

Statistically significant differences were found for both the experimental and control groups regarding the RPE post tests at different percentages of maximum. The results of the above analysis are represented in figures 11 and 12.

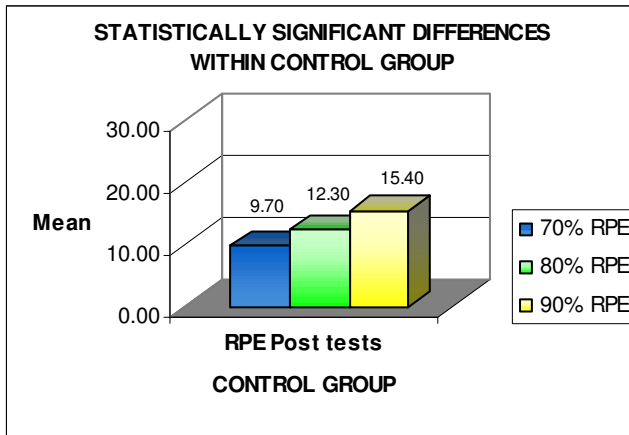


Figure 11:

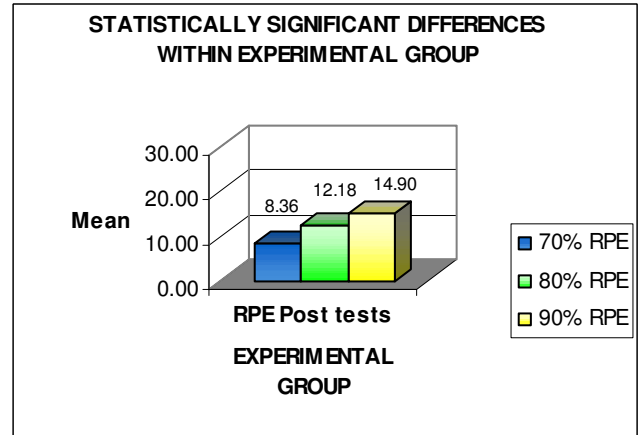


Figure 12:

The results of figures 11 and 12 indicate the following:

The RPE post tests for both the placebo (control) and experimental groups showed a significant increase from 70% RPE, with a peak at 90% RPE. The control group started at a higher 70% RPW score, and peaked at a higher 90% RPE score than the experimental group.

Results of tests for differences within groups across Lactate measurements

Statistically significant differences were found for both the experimental and control groups regarding the Lactate post tests at different percentages of the maximum. The results of the above analysis are represented in figures 13 and 14.

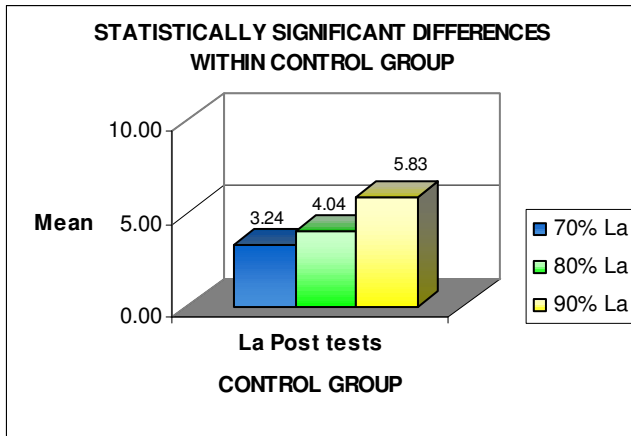


Figure 13:

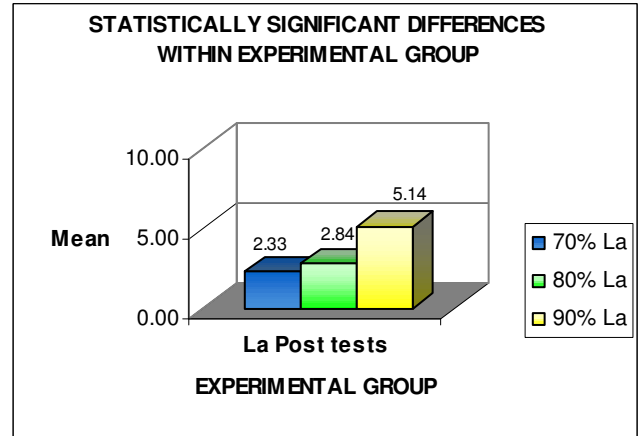


Figure 14:

The results of figures 13 and 14 indicate the following:

The Lactate post tests showed a significant increase from 70% La with a peak at 90% La for both the placebo (control) and experimental groups. The 90% La score for the control group was higher than that for the experimental group, which started at a higher 70% La score than the control group. In the experimental group, there was a slight increase from 70% La to 80% La, with a larger increase from 80% La to 90% La. This was not evident in the control group.

Results of tests for differences within groups across SP0₂ measurements

Statistically significant differences were found for both the experimental and control groups regarding the SP0₂ post tests at different percentages of the maximum. The results of the above analysis are represented in figures 15 and 16:

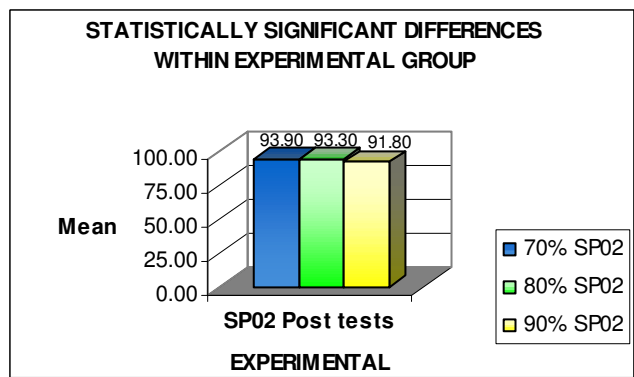
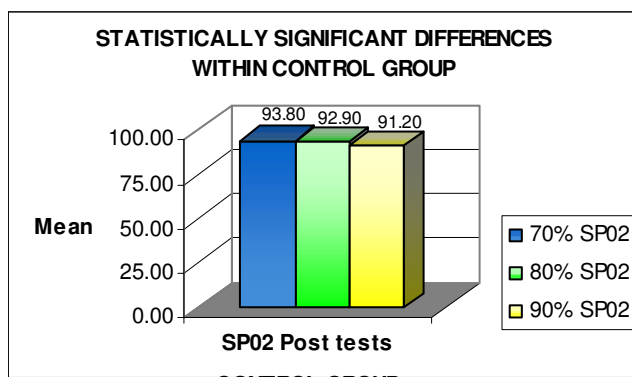


Figure 15:

Figure 16:

The results of figures 15 and 16 indicate the following:

The SP0₂ post tests showed a significant decrease from 70% SP0₂ with a peak at 70% SP0₂, for both the placebo (control) and experimental groups. The 70% SP0₂ score for the experimental group was higher than that for the control group, with a higher 90% SP0₂ score as well. The control group, however, showed a slightly sharper decline than the experimental group.

Results of tests for differences within groups across RQ measurements

Statistically significant differences were found for both the experimental and control groups regarding the RQ post tests at different percentages of the maximum. The results of the above analysis are represented in figures 17 and 18:

The results of figures 17 and 18 indicate the following:

The RQ post tests showed a significant increase from 70% RQ with a peak at 90% RQ for both the placebo (control) and experimental groups. The 70% RQ score for the control group started at a slightly higher 70% RQ score, and peaked at a slightly higher score.

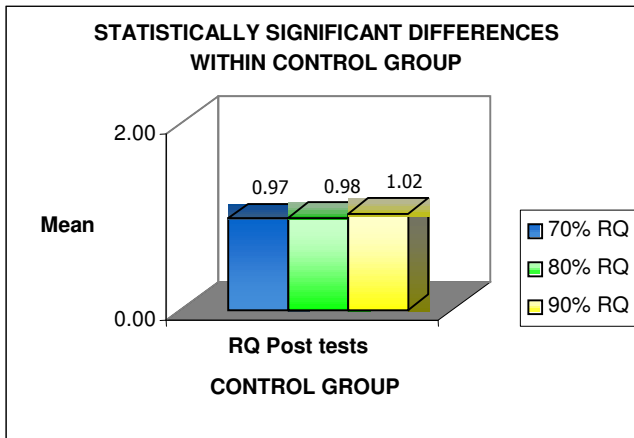


Figure 17:

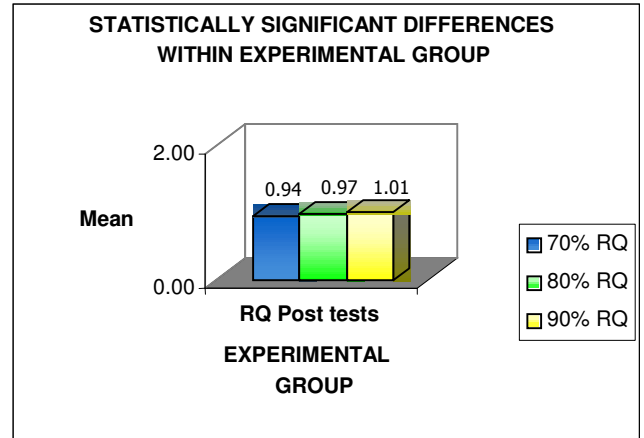


Figure 18:

SUMMARY OF RESULTS

Statistically significant differences for pre test scores were found between the experimental and placebo (control) groups for the following measures: weight, Lean Body Mass (LBM), speed, and lactate at rest. Weight scores are significant on the 5% level of significance, whilst LBM, speed and lactate at rest scores are significant on the 10% level of significance.

Figure 19, 20 and 21 indicate the differences at the sub-maximal levels in a percentage difference

70% of Maximum Speed

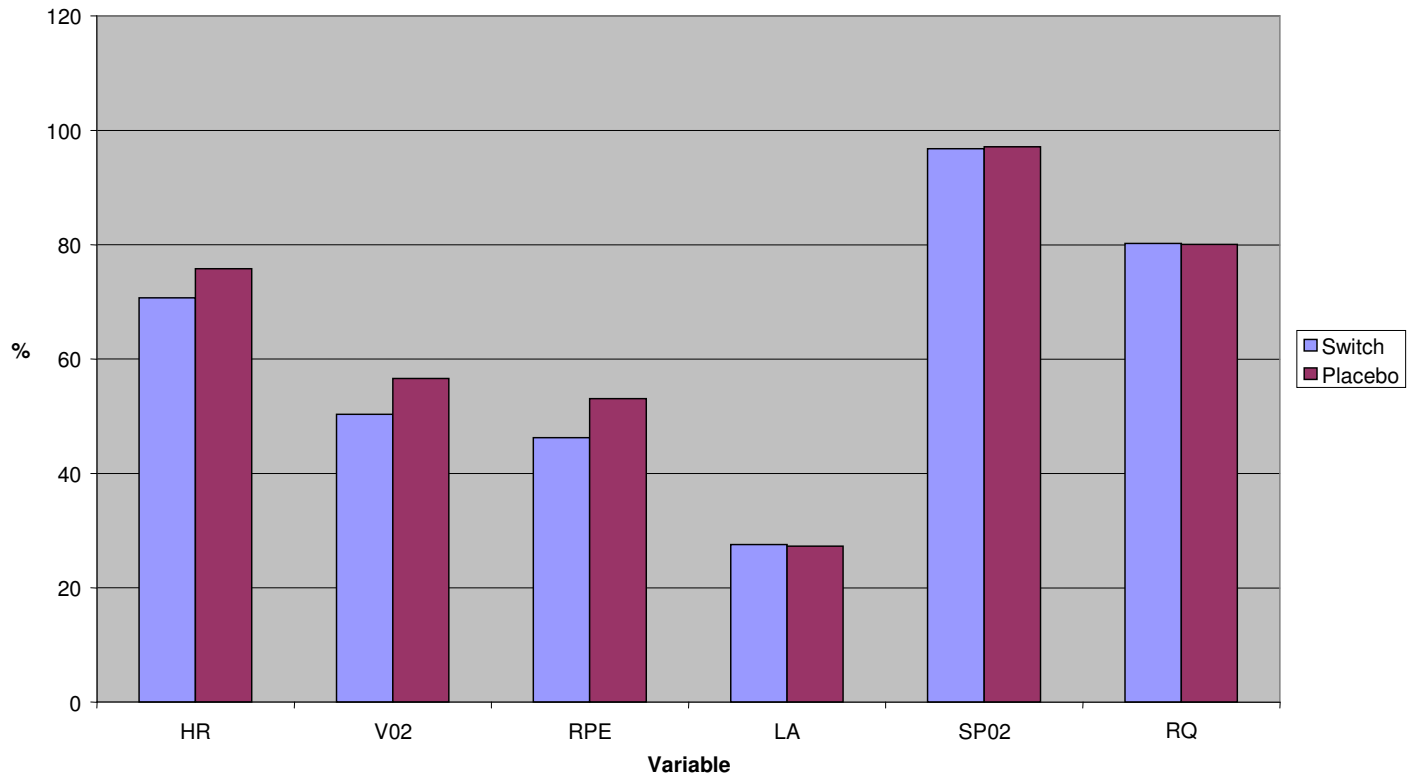


Figure 19

80% of Maximum Speed

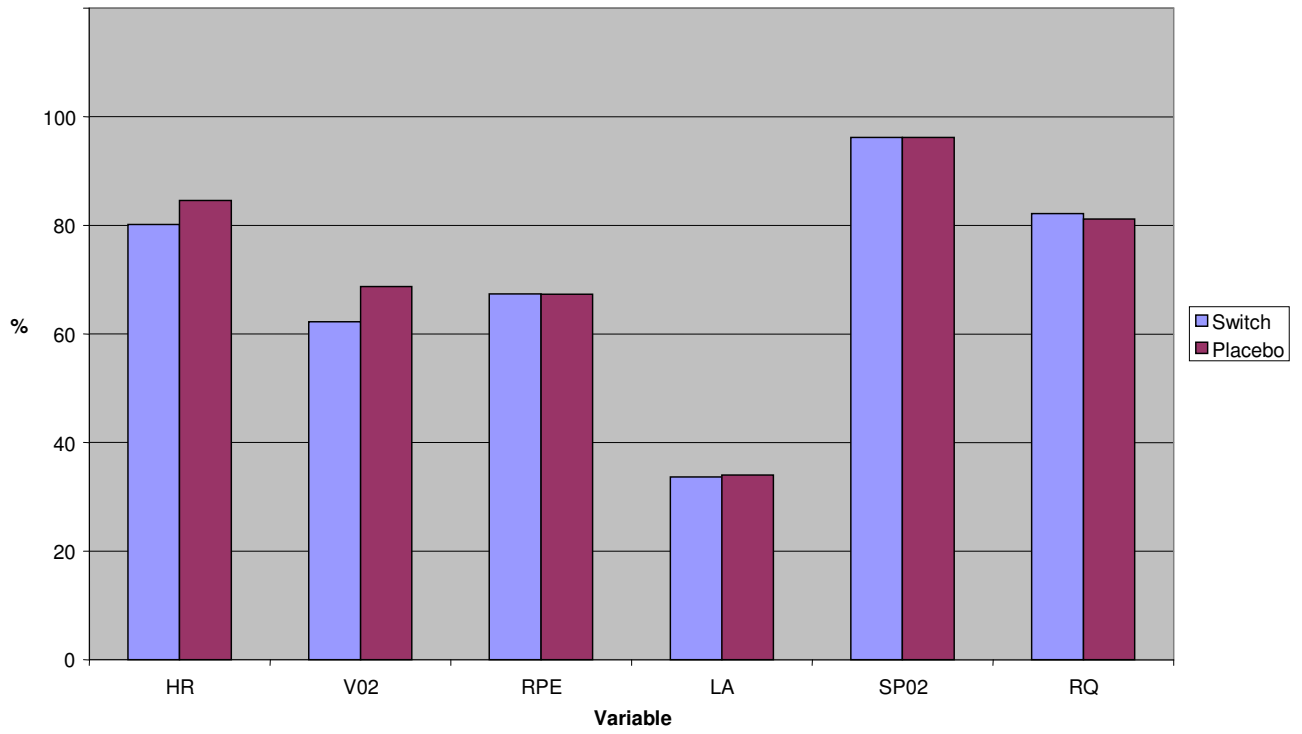


Figure 20

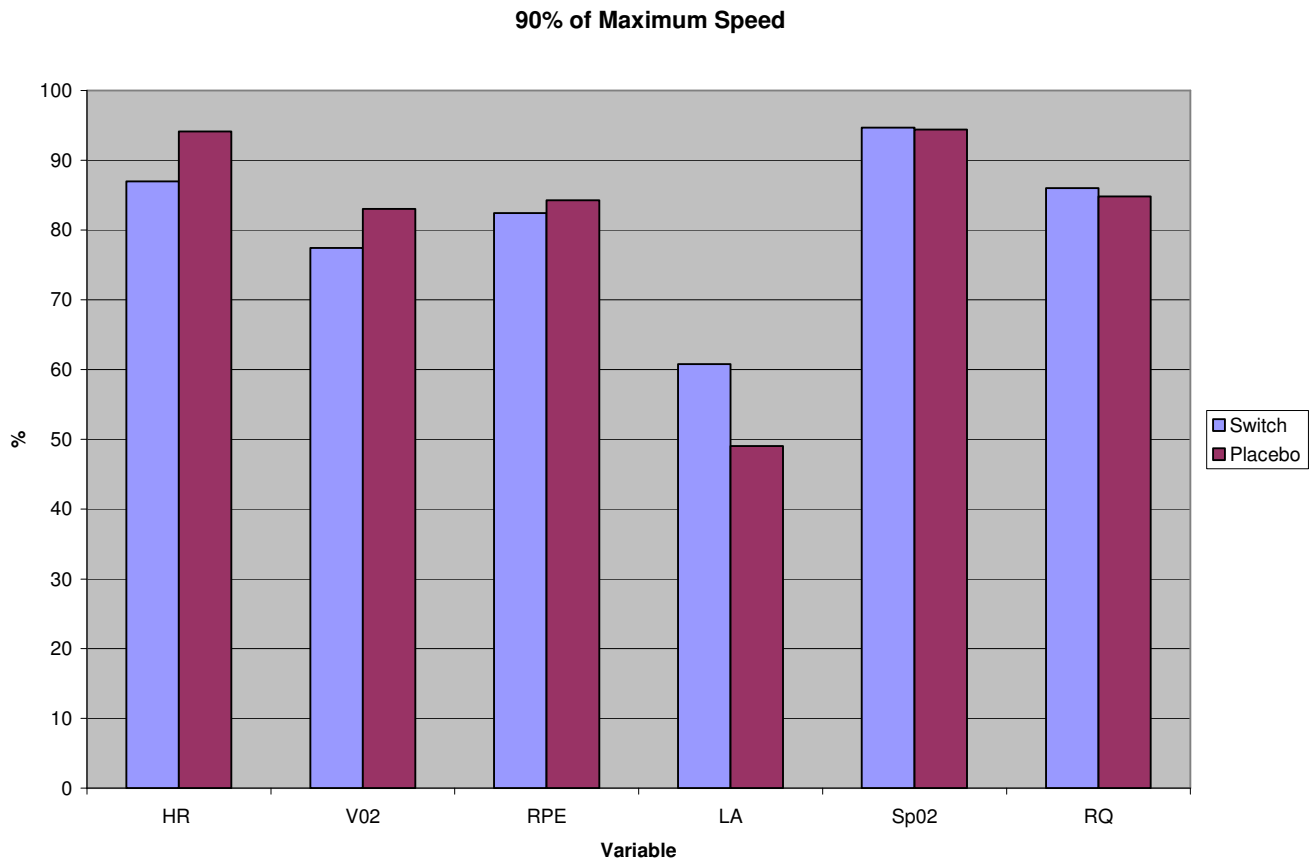


Figure 21

Statistically significant differences between the experimental and placebo (control) groups were found on the 5% level of significance for post test weight and 90% HR scores. Statistically significant differences at the 10% level of significance were found between the experimental and control group post test Lean Body Mass, 70% V_{O_2} , 80% V_{O_2} and 70% lactate scores. The implication of this is that differences in the weight and LBM post intervention results between the experimental and placebo (control) groups may be a result of initial differences between weight and LBM pre intervention scores and not because of an intervention. Because 70% V_{O_2} , 80% V_{O_2} , 70% lactate and 90% HR score were not measured before the intervention, differences in the post intervention results may be because of differences in pre intervention results and not because of the intervention.

No statistically significant differences were found between the experimental and placebo (control) groups for all of the other pre and post test measurements. Thus at the onset of

the experiment, the control group and experimental group did not differ significantly with regards to the Fat %, Endomorphy, Mesomorphy, Ectomorphy, HR, VO₂, RPE, SP0₂ at rest, Watt, RQ, La at 5 min, La at 10 min, Relative Peak Watt, Fatigue ratio and total work relative.

No statistically significant differences were either found between the post intervention results of the experimental and placebo (control) groups with regards to the Fat %, Endomorphy, Mesomorphy, Ectomorphy, HR, VO₂, RPE, SP0₂, RQ, 70% HR, 80% HR, 90% VO₂, 70% SP0₂, 80% SP0₂, 90% SP0₂, 70% RQ, 80% RQ, 90% RQ, 80% La, 90% La, total work relative and fatigue ratio measurements.

This indicates that no statistically significant changes existed between the post intervention results of the control and experimental groups regarding the above-mentioned measurements.

A statistically significant difference on the 5% level of significance was found between the experimental and placebo (control) group for the 90% HR score as a percentage of the maximum HR scores

Wilcoxon Signed Ranks tests were used to determine whether statistically significant changes took place between the pre- and post tests within the same group regarding the following variables: Fat%, LBM, I, II, III, Relative Peak Watt, Fatigue Ratio, Total Work Relative, Resting La and Resting SP0₂.

When the pre- and post tests of the *control* group were compared, the following significant differences were found: The mesomorphy (II) pre test score was significantly lower than the mesomorphy post test score.

The following significant differences in distribution were found between the pre- and post test scores in the experimental group: The mesomorphy and LBM pre test scores were significantly lower than the post test scores.

When the groups were compared to themselves across different percentages of the maximum score, significant differences were found for all measurements. All measurements, apart from SP0₂, for the pre tests as well as the post tests, showed a

significant increase from 70% of max with a peak at 90% of the max for both the control and experimental groups. SP_{O_2} showed a significant decrease from 70% max to 90% max in both the experimental and control groups.

Summary: Heinrich

1. Body Composition

Anthropometric segmentation of body structure is important for performance evaluation of athletes and the monitoring of training and changes in body composition. The classification of body type as described by Sheldon is the best known method. Sheldon's morphological classification includes ectomorph (III), the mesomorph (II), and the endomorph (I). An ectomorph is a slender person with a light frame, the legs and arms are slender and long, and the muscle tissue has little definition. A mesomorph is an athletic-looking individual with broad shoulders, narrow hips with predominant muscle tissue. An endomorph is a bigger individual, the arms and legs are short compared with the torso, while the chest and waist are about the same size. Of importance is the change that takes place in these classifications due to intervention (i.e. diet and / or exercise). Body composition is thus an important aspect of fitness or physical activity.

The following changes took place in the morphological classification of the placebo and control groups:

- The group taking Switch™ showed a **decrease of 4.15% in the endomorph (fat) component** while the placebo group showed no change.
- The Switch™ group showed **an increase of 10.25% in the mesomorph (muscle) component** which would indicate an increase in lean body mass, while the placebo group only showed an increase of 1.68%
- The group taking Switch™ showed no change in the ectomorph component (lean) while the placebo group showed a decrease of 2.06%.
- Statistically significant differences at the 10% level of significance were found between the experimental and control group post test Lean Body Mass. The implication of this is that differences in the LBM post intervention results between the experimental and placebo (control) groups **may** be a result of

initial differences between LBM pre intervention scores and not because of an intervention. Although the increase in the mesomorphy component might confirm the above changes.

- The distribution of the mesomorphy (II) pre test score is significantly different from the distribution of the mesomorphy post test score at the 5% level of significance. Thus the mesomorphy pre test score was lower than the mesomorphy post test score.
- The distribution of the LBM pre test score is significantly different from the distribution of the LBM post test score at the 10% level of significance. Thus, the LBM pre test score is lower than the LBM post test score.
- **Conclusion: The Switch™ group showed significant changes in their body composition during the four-week intervention period, with an increase in lean body mass and an increase in their mesomorphy component (muscle component. Both these changes would be beneficial to the athletes as well as the non-athletic population.**

2. Significant differences between groups for pre and post test measurements.

- Statistically significant differences at the 10% level of significance were found between the experimental and control group post-test at 70% of maximum speed for V02 and lactate scores. At 80% of maximum speed for V02 and 90% of maximum speed for heart rate scores:
- This indicates that at **70% of maximum speed the Switch™ group functioned at 50%** of their maximum oxygen capacity while the placebo group used 56%.
- This indicates that at **80% of maximum speed the Switch™ group functioned at 62%** of their maximum oxygen capacity while the placebo group used 68%.
- This indicates that at **90% of maximum speed the Switch™ group functioned at 86%** of their maximum heart rate while the placebo group achieved a heart rate of 94% of their maximum.
- The significance of the above mentioned is the following:

- Historically, VO_2 max has been believed to be the best predictor of endurance performance. This, however, has shown to be the case only in a heterogeneous group of athletes. Within a group of athletes with similar abilities, VO_2 max has shown to be a poor performance predictor. More important, however, is the cyclist's submaximal oxygen uptake: the lower the oxygen consumption for a given submaximal workload, the better. This fractional utilisation of oxygen and economy of effort, as well as the anaerobic threshold, are important performance predictors (Faria, 1992).
- The Switch™ group showed **lower oxygen consumption on both 70% and 80%** of their maximum speeds compared to the placebo group.
- **Conclusion: It seems as if the group taking Switch™ showed better economy during their post test when compared to the placebo group.**

3. No statistically significant differences were found between the groups for the following variables

- No statistically significant differences were found between the post intervention results of the experimental and placebo (control) groups with regards to the Fat %, Endomorphy, Ectomorphy, HR, VO_2 , RPE, SP0_2 , RQ, 70% HR, 80% HR, 90% VO_2 , 70% SP0_2 , 80% SP0_2 , 90% SP0_2 , 70% RQ, 80% RQ, 90% RQ, 80% La, 90% La, total work relative and fatigue ratio measurements.

4. Posters

- Decrease in body's endomorph component (fat component)
- Increase in lean body mass (fat free mass)
- Increase in body's muscle component (mesomorph component)
- **These changes all aid in lowering fat percentage and increasing lean body mass (muscle). This is important in power to weight ratio's**
- Lower sub-maximal oxygen consumption at 70% of maximum speed output
- Lower sub-maximal oxygen consumption at 80% of maximum speed output

- Lower sub-maximal heart rate at 90% of maximum speed output
- **These changes all aid in improved economy of movement during endurance events**