Supplementation period (21 days)

Food Record (3 days)

Food Record (3 days)

Physical performance test

(30 min)

Pre

Physical performance test

(30 min)

Pre

Post

Post

Preparation

 (7 days)

Figure 1: Study design.

Table 1: Subject characteristics a(N=7).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | CRN | GLU | CRN+GLU | PLA | P-value |
| Age (years) | 20.7 ± 0.7 | 21.2 ± 0.6 | 21.3 ± 0.7 | 21.2 ± 0.9 | 0.56 |
| Height (cm) | 175 ± 7.1 | 173 ± 5.8 | 173 ± 4.2 | 171.7 ± 6.2 | 0.78 |
| Weight (kg) | 64.9± 4.4 | 61.5± 7.6 | 59.9± 6.2 | 65.2± 7.1 | 0.35 |
| BMI(kg/m²) | 21.2 ± 1.4 | 20.5 ± 1.9 | 19.9 ± 1.6 | 22.2 ± 2.8 | 0.23 |
| Body fat (%) | 12.6 ± 3.1 | 16.3 ± 3 | 12.8 ± 3.1 | 15.5 ± 7.1 | 0.30 |
| VO2max (ml/kg/min) | 44 ± 5.3 | 45.7 ± 5.8 | 45.7 ± 2.36 | 42.1 ± 7.8 | 0.60 |
| Training history (years) | 4.4 ± 0.4 | 4.3 ± 0.6 | 4.6 ± 0.5 | 4.7 ± 0.7 | 0.55 |
| Current football training (hr/week) | 6.9 ± 1.9 | 6.9 ± 2.1 | 7.4 ± 2.5 | 6.5 ± 1.5 | 0.88 |

CRN: Carnitine supplementation group; GLU: Glutamine supplementation group;

CRN + GLU: Carnitine and Glutamine supplementation group; PLA: Control group.

a Data are presented as mean ±SD.

Table 2: Energy and macronutrient intake assessed third prior the main trials a.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | Index | Before Intervention | After Intervention | P-value b |
| CRN | Energy (kcal/d) | 3857 ± 359 | 3587 ± 336 | 0.19 |
| Protein (g/d) | 131 ± 47 | 121 ± 33 | 0.70 |
| Carbohydrate (g/d) | 600 ± 77 | 565 ± 48 | 0.29 |
| Fat (g/d) | 102 ± 19 | 91 ± 14 | 0.14 |
| GLU | Energy (kcal/d) | 3642 ± 449 | 3500 ± 480 | 0.39 |
| Protein (g/d) | 178 ± 51 | 167 ± 40 | 0.47 |
| Carbohydrate (g/d) | 528 ± 95 | 509 ± 105 | 0.46 |
| Fat (g/d) | 89 ± 13 | 86 ± 12 | 0.66 |
| CRN + GLU | Energy (kcal/d) | 3300 ± 259 | 3167 ± 625 | 0.49 |
| Protein (g/d) | 124 ± 35 | 123 ± 38 | 0.91 |
| Carbohydrate (g/d) | 490 ± 27 | 462 ± 78 | 0.38 |
| Fat (g/d) | 92 ± 18 | 90 ± 21 | 0.76 |
| PLA | Energy (kcal/d) | 3535 ± 805 | 3735 ± 563 | 0.35 |
| Protein (g/d) | 159 ± 39 | 182 ± 27 | 0.15 |
| Carbohydrate (g/d) | 535 ± 135 | 551 ± 99 | 0.64 |
| Fat (g/d) | 82 ± 21 | 87 ± 22 | 0.49 |

CRN: Carnitine supplementation group; GLU: Glutamine supplementation group;

CRN + GLU: Carnitine and Glutamine supplementation group; PLA: Control group.

a Data are presented as mean ±SD.

b paired *t* test

Table 3: Effects of glutamine with and without carnitine on biochemical parameters a

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | CRN | GLU | CRN+GLU | PLA | P-value |
| LDHb before test phase 1 | 310±54.7 | 277.4±39 | 261.3±51.2 | 306.6±43.8 | 0.193 |
| LDHb after test phase 1 | 381.9±78.7 | 332.7±88.6 | 298.4±46.4 | 343.3±59 | 0.198 |
| LDHb before test phase 2 | 278.1±43 | 260.6±42.5 | 266±35.6 | 313.3±42 | 0.098 |
| LDHb after test phase 2 | 333.7±45 | 290±54 | 329±27 | 354.4±43 | 0.069 c |
| CKb before test phase 1 | 221.6±74.7 | 152.3±41.3 | 144.9±42 | 199.8±56.5 | 0.044 c |
| CKb after test phase 1 | 250.7±81.6 | 177.9±6.34 | 177.3±35 | 229.3±68.2 | 0.095 |
| CKb before test phase 2 | 191±55.2 | 162.1±34.4 | 122.6±12.8 | 192.4±50.3 | 0.014 c |
| CKb after test phase 2 | 211.6±59 | 174.4±35.4 | 146.3±21.9 | 204.7±54.7 | 0.047 c |
| ASTb before test phase 1 | 25±6.4 | 25.9±11.3 | 28.4±13.8 | 23.4±2.2 | 0.799 |
| ASTb after test phase 1 | 35.3±4.9 | 29.6±10 | 40.4±17.4 | 27.4±3.9 | 0.117 |
| ASTb before test phase 2 | 27.9±4.8 | 23.9±3.1 | 26.3±9.8 | 22±2.4 | 0.268 |
| ASTb after test phase 2 | 33.1±6.1 | 30.9±6.6 | 30.1±8 | 25.6±2.2 | 0.158 |

CRN: Carnitine supplementation group; GLU: Glutamine supplementation group;

CRN + GLU: Carnitine and Glutamine supplementation group; PLA: Control group.

LDH, Lactate dehydrogenase; CK, Creatine kinase; AST, Aspartate aminotransferase.

a Data are presented as mean ±SD.

bU/L: Unit per Liter

c*P* < 0.05, significantly difference between groups (two-way analysis of variance).

Table 4: **Changes** in muscle soreness before (pre), immediately after (post) and 2 day (2D) after exercise before and after intervention a

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | CRN | GLU | CRN+GLU | PLA | P-value |
| **Before intervention***(Centimeter)* | Pre | 0.04±0.08 | 0.03±0.08 | 0.1±0.09 | 0.03±0.05 | 0.449 |
| Post | 6.1±0.9 | 5.3±1.1 | 5.3±1.8 | 4.9±1 | 0.307 |
| 2D | 2.7±0.7 | 2.3±0.72 | 2.06±0.9 | 2.6±0.7 | 0.346 |
| **After intervention***(Centimeter)* | Pre | 0.01±0.04 | 0.01±0.04 | 0.03±0.5 | 0.03±0.5 | 0.861 |
| Post | 5.2±0.8 | 5±1.17 | 4.3±1.13 | 5.1±1.2 | 0.403 |
| 2D | 2.1±0.5 | 1.8±0.5 | 1.9±0.62 | 2.7±0.9 | 0.057 |

*CRN: Carnitine supplementation group; GLU: Glutamine supplementation group;*

*CRN + GLU: Carnitine and Glutamine supplementation group; PLA: Control group.*

a Data are presented as mean ±SD.