ȺŪʔȽȾɃ Ⱦȷ Ƚ Ⱦȷ ɄɃȹȽɆȼɅȴ ȾɃ Ʉȷ ʔȺɄȽɆȼ¢ȥ ȽɃ ȷ Ū¢ ʔɋ ʔ

ȼȥ ¢ȥ ȷ ȺɄȽɆȼ¢ȥ ¢Ɇ ū Ɉ ɆȽȾ¢Ɇ ȷ ũɋ ũ¢Ɇ Ⱦȷ Ƚȷ Ūȿ ¢ȼȽɆȥ ɃɈ

ȼɃȥ Ⱥȷ Ɇ ȷ Ūȿ ¢ȼȴ ȼɅȽȾ¢Ɇ Ⱦȷ ȽȸȽɃȿ ɃũȽȴ Ɇ ȼ¢Ɇ ȷ ɆȾ¢Ɇ¢Ɇ

«ȺȾȼȽȥ ¢Ɇ¢ ȼ¢Ɇ Ƀȥ ɃȽɃɆȼȷ ȼȽȾ¢Ɇ ȹɈ ʔȷ ȥ ȽȾ¢Ɇ

ȼ¢Ɇ ũȿ Ɉ ȾɃȻ¢Ɇ-ȹɅȷ Ɇ¢Ɇ ȽʔɆɃɈ ȿ Ƚʔ¢Ɇ

ȷ Ūȿ ¢ȼɋ ʔ ȷ ʔȼɃɉ ¢Ɇ Ⱦȷ Ƚȼȷ ɉ Ɉ ȼ¢ȼȷ Ɇ»

Ⱦ ɤ ɜůŰŬɞŰɞɞɠʔ ɘŸɘŬɈ ɖɠ

ȥ ŮŰŬ Űɠɢɘŭɘɐ ȹɘŬŰɉɕɐ

ɄɅɃũɅȷ ȥ ȥ ȷ ȥ Ⱥȼȷ ɄȼɈ ɉ ȴ Ⱦɋ ʔ ɆɄɃɈ ȹɋ ʔ

«ȸȽɃȿ ɃũȽȴ ȼ¢Ɇ ȷ ɆȾ¢Ɇ¢Ɇ»

ȷ Ū¢ ʔȷ 2001

ȖȽʔ ȷ Ȣ ȷ Ɇ ȖȺɅȽȺɟ Ƀʐ Ⱥʔ ɋ ʔ

Ɇ Ǔ ɞ ɑ̆ Ǔ

ɆŮǝɑĭŬ

ⱢŮǻɑĭŬ

Ƭȷ ȼȷ ȿ ƁũƁȄ Ȅϳ ȼ ζ ȷ ȼ ɋ ʔ

ȄǕϑαϊǓ

Ɇǖǻǿǚǜ

ΤϳϵϳϨ ΒΰΒΕ ϴΕʔϳΤϥ ʔ

ΕΰϧϢΰ

1. [illegible]

[illegible] (Bjorntrorp, et. al., 1972; Lohmann, et. al., 1978). [illegible] (Rodnick, et. al., 1987). [illegible] (Soman, et. al., 1979; Mikines, et. al., 1988; Dela, et. al., 1992; Dela et. al., 1995; Heath, et, al., 1983). [illegible] (Mikines, et. al., 1989; Vestergaard, et. al., 1994; Vukovich, et. al., 1996) [illegible] (Miller, et. al., 1994; Soman, et. al., 1979; Tonino, 1989).

[illegible] (GLUT4), [illegible] (Bjorntorp, et. al., 1972; Despres, et. al., 1991; Schwartz, et. al., 1991; DeFronzo, et. al., 1981; Lillioja, et. al., 1987; Goodyear, et. al., 1990; Ebeling, et. al., 1993; Rodnick, et. al., 1987; Lohman, et. al., 1978; Soman, et. al., 1979; Mikines et. al., 1988) [illegible] (Borghouts, et. al., 1999; Cortez, 1991). [illegible] (Daniel, et. al., 1975; DeFronzo, et. al., 1981; Baron, et. al., 1988) [illegible] (Miller et. al., 1984; Yki-Jarvinen & Koivisto), [illegible]

(MacDougall, et. al., 1977; Tesch, et. al., 1986; Miller, et. al., 1994) [illegible] (Craig, et. al., 1989; Treuth, et. al., 1994; Treuth, et. al., 1995).

1.1. [illegible]

[illegible]

[illegible]

1.2. [illegible]

[illegible] Bergman [illegible] (1981), [illegible] Langerhaus [illegible] Cederholm [illegible] Wibell (1985), [illegible] Bergman [illegible]

[illegible] (OGTT-75g). [illegible] Cederholm [illegible] Wibell, [illegible]

[illegible] OGTT-75g. [illegible]

[illegible] OGTT-75g.

[illegible]

Ǘෂgɠ ǚɨǝ ǗɡǗෂɨɠ əǗə Ÿəɟɤɠ ǗɞǗɗǕǗෂgɠ Ǘɨ´ǝgɠ ´ɟǝ´ɧɜɖůɖɠ (ǗɞǗǕɉɧɞɞg, ǗǕɉɧɞɞg) ůǗɖɜ ɕɛɕɞůǗǗǗɘ ǚgɜǗɛɞɐ Ǘɖɠ ɔəgəɧɕɖɠ-ǚɟŸůɖ ɞůɕgəɞɖɠ. Ɇgɔəǖɟɶɏɜǖ, ɕɟɖůɶɛ´ɕɐ ɜǗǗɠ Ǘɖ ǚɕəɶǗůɖǗ Ǘɞɕɕɐɠ ɔəgəɧɕɖɠ, əǗɛ ɞŸɜɕɜǗǗɠ ůǗǗɖǕɉɐ´ɕůɧǗɖǗǗɔəgəɧɕɖɠ Ǘ ɧ Ǘෂ ůǗɧɛǗ (OGTT-75g), ǗəǗɛɐɖɖəǗ Ǘ) ɖ Ǘ ǗəǕgɖǕɉɕɨɛǗɜɖ ɞůɕgəɞɖ əǗə ɖ ǗɞǗǗ ɧəɟɞůɖ ǗɡǗɛɠ ůǗɖ ɔəgəɧɕɖ, ɞ) ɕ ɟgɖɛɧɠ ǚəŸɖǕůɖɠ-ɛǗǗɞɕəɞůɛɧɠ Ǘɖɠ ɔəgəɧɕɖɠ ´ɟɕɠ Ǘෂgɠ ɞůǗෂɨɠ-ůǗɧɕɕɠ (ɛgɠ, əɗɕɠ, ɐ´Ǘɟ), ɔ) ɖ ůɕǕǗǗɘɐ ´Ǘɟɞǘɉɐ ǗɞǗůǗǗɖ ɛɏůɤ Ǘɖɠ ɕ´ɕǗɠ ǗəǘɟŸůɖɖəǕ Ǘෂ ůɨɜɕəɕ Ǘɤɜ ´ǗɟǗɞɧɜǗɤɜ (ɞůɕgəɞɕǗəǗɟǗɨ ɛǗɜɕgɠ əǗə ɛɖ) ´ɕg ´ɟɕɤɖɕɨɜ Ǘɖ ǚəŸɖǕůɖ Ǘɖɠ ɔəgəɧɕɖɠ ´ɟɕɠ Ǘෂgɠ ɞůǗෂɨɠ-ůǗɧɕɕɠ əǗə ǚ) ɖ ůgɜɕəɞɐ ǗɞǗůǗǗɖ Ǘɤɜ ɞůǗɜ ɏɜǗɞǗə ůǗɖɜ ɞůɕgəɞɖ.

1.3. Ɇəɕ´ɧɠǗɖɠɏɟǕgɜǗɠ

Ɐ ůəɕ´ɧɠ Ǘɖɠ ɏɟǕgɜǗɠ ǗɡǗɛɠ ǗɞǗə ɜǗ ǗəǗŸůǗɕ ɛǕ Ǘɖ ɛɏɖɕǚɕ əɐɣɖɠ ůǗǗɖǕɉɐɠ ´ɕůɧǗɖǗǗɠ ɔəgəɧɕɖɠ Ǘ ɧ Ǘෂ ůǗɧɛǗ (OGTT-75g), Ǘɖɜ ǕɗɟǗůɖ Ǘɤɜ ´ɟɕůǗɟɛɕɔɩɜ Ǘɖɠ ǗǕɉɧɞəǗɠ ´ɟɕ´ɧɜɖůɖɠ Ǘɗəɖɨ ɜ ǗɞǗɛɕɐɠ əǗə Ǘɖɠ ǗɞǗǕɉɧɞəǗɠ ´ɟɕ´ɧɜɖůɖɠ Ǘɗəɖɨ ɜ ǚɟɧɛɤɜ ǗǗɕɨǗɖǗǗɠ Ǘෂg əəǗůɞɕɨ Ǘɗəɖǘəɛɕɨ, ůǗɖ ǚgɜǗɛɞɐ Ǘෂg ɕɛɕɞůǗǗǗɘɕɨ ɛɖɕǗɞɞůɛɕɨ Ǘɖɠ ɔəgəɧɕɖɠ, ǗəǗɛɕɨɛǗɜɖ ɛɏůɤ Ǘɖɠ ´ɕůɧǗɖǗǗɠ Ǘɖɠ Ǘ ǗəǕgɖǕɉɕɨɛǗɜɖɠ ɞůɕgəɞɖɠ əǗə Ǘɖɠ ǗɞǗůǗǗɖɠ Ǘɤɜ ɞůǗɜ-ůǗɧɕɕɠ (ɛgɠ, əɗɕɠ, ɐ´Ǘɟ) ɏɜǗɞǗə Ǘɖɠ ǗəůɧǚɕgǗɖɠ ɔəgəɧɕɖɠ.

1.4. ɋɞǗǗ´ɤůɖ Ǘɟ Ǘgɜɖǘəɩɜ Ǘɟɤ ǗɖɛŸǗɤɜ

1) Ɉ´ŸɟɕǗə ǚəǗǗɕɟŸ ůǗɖɜ ǗɞǗǗ ɕəɟɞůɛɧǗɖǗǗ Ǘɤɜ ɞ-əgǗǗŸɟɤɜ Ǘෂg ´Ǘəɟɏǘǘෂɠ ůǗɖ ɔəgəɧɕɖ əǗə ůǗɖɜ ɏəɟɞůɖ-Ǘ ǗəǕgɖɏɟɤůɖ ɞůɕgəɞɖɠ ɛǗǗɞɨ Ǘɤɜ Ǘɗəɖǘɜ ɛǗ Ǘෂɜ ǗǕɉɧɞɞ əǗə ǗɞǗǕɉɧɞɞ Ǘɨ´ɕ ´ɟɕ´ɧɜɖůɖɠ əǗǗŸ Ǘɖ ǚəŸɟəǗɞǗ Ǘɖɠ ǚɕəɛǗůɖǗɠ OGTT-75g;

2) Ɉ´ŸɟɕǗə ǚəǗǗɕɟŸ ůǗɖɜ ǗɡǗɞůɖɖůɖǗ Ǘɖɠ ɞůɕgəɞɖɠ ɐ ůǗɖɜ ´Ǘɟɞǘǘɟɞɐ ǗɞǗůǗǗɖ ǗəůɧǚɕgǗɖɠ ɔəgəɧɕɖɠ ůǗෂgɠ ɞůǗෂɨɠ ɛǗǗɞɨ Ǘɤɜ Ǘɗəɖǘɜ ɛǗ Ǘෂɜ ǗǕɉɧɞɞ əǗə ǗɞǗǕɉɧɞɞ Ǘɨ´ɕ ´ɟɕ´ɧɜɖůɖɠ əǗǗŸ Ǘɖ ǚəŸɟəǗɞǗ Ǘɖɠ ǚɕəɛǗůɖǗɠ OGTT-75g;

3) Ʉɕɞɕɠɕ ɟɧəɕɠǗෂg ´ɕůɕɨ Ǘɖɠ ɛgɸɐɠ ɛŸɕǗɠ əǗə Ǘෂg ´ɕůɕɨ Ǘෂg ůɤɛǗǗɘɕɨ əɗɕgɠ ůǗɖ ǚgɜǗɛɞɐ Ǘෂg ɕɛɕɞůǗǗǗɘɕɨ ɛɖɕǗɞɞůɛɕɨ Ǘɖɠ ɔəgəɧɕɖɠ;

1.5. Ʌɟ Ǘgɜɖǘəɏgɠ g´ɕɖɏůǗɞɠ

1) ¢ ɞǗůɞɐ g´ɧɖǕůɖ Ǘɖɠ ɛǗəɏǗɖɠ ǗɡǗɛɠ ǗɞǗə ɧǗə ɕə Ǘɗəɖǘɏɠ ɛǗ ǗǕɉɧɞɞ Ǘɨ´ɕ ´ɟɕ´ɧɜɖůɖɠ ɖǗ ´ɟɏ´Ǘə ɜǗ ɏɕɕgɜ ɛǗǗəɨǗɟɖ ǗɡǗɞůɖɖůɖǗ ůǗɖɜ ɞůɕgəɞɖ əǗə əǗǗŸ ůgɜɏ´ǗɞǗ ůɖɛǗɞǗəŸ ɛɞɟɧǗɟɖ ´Ǘɟɞǘǘɟɞɐ ǗɞǗůǗǗɖ ɏɜǗɞǗə Ǘɖɠ ɞůɕgəɞɖɠ ǗɞŸ əɞɧ ůɤɛǗǗɘɕɨ ɞŸɟɕgɠ ůǗ ůɨɔəɟɞůɖ ɛǗ Ǘෂgɠ Ǘɗəɖǘɏɠ ɛǗ ǗɞǗǕɉɧɞɞ Ǘɨ´ɕ ´ɟɕ´ɧɜɖůɖɠ əǗǗŸ Ǘɖ ǚəŸɟəǗɞǗ Ǘɖɠ ǚɕəɛǗůɖǗɠ OGTT-75g.

2) ¢ ´ɕůɧǗɖǗǗ Ǘෂg ůɤɛǗǗɘɕɨ əɗɕgɠɖǗ ´ɟɏ´Ǘə ɜǗ ǗɞǗə ɏɜǗɠ Ǘ ɧ Ǘෂgɠ ůɖɛǗɞǗəɧǗǗɟɕgɠ ´ǗɟŸɔɕɜǗǗɠ ´ɕg ǗɖɟǗŸɕgɜ Ǘɖ ǚgɜǗɛɞɐ Ǘෂg ɕɛɕɞůǗǗǗɘɕɨ ɛɖɕǗɞɞůɛɕɨ Ǘɖɠ ɔəgəɧɕɖɠ əǗə Ǘɖ ǚɟŸůɖ Ǘɖɠ ɞůɕgəɞɖɠ.

1.6. ɋɞǗgəɟɞɖůɖ ɞǗůɞɩ ɜ ɧɟ ɤɜ

✓ ***ⱯɛɕɞůǗǗǗɘɐ ǚgɜǗɛɞɐ Ǘɖɠ ɔəgəɧɕɖɠ***

¢ ɕɛɕɞůǗǗǗɘɐ ǚgɜǗɛɞɐ Ǘɖɠ ɔəgəɧɕɖɠ ǗɞǗə ůgɜɩ ɜgɛɖ ɛǗ Ǘෂɜ ɧɟɕ Ǘɞɕɐ ůǗɖ ɔəgəɧɕɖ (Glucose tolerance) əǗə ǗəǘɟŸǗə Ǘɖɜ ɞǗɧǗɖǗǗ Ǘෂg ůɩ ɛǗෂɠ ɜǗ Ǘ ɕɛǗəɟɨ ɜǗə Ǘෂ ǘɕɟǗෂ ɔəgəɧɕɖɠ, ´ɕg Ǘɤɔɞɩ ɠ ɏɕǗə ɕɕɟɖɔɖɖǗ, Ǘ ɧ Ǘෂ Ǘɛ Ǘ ´ɟɕɠ Ǘෂgɠ ɞůǗෂɨɠ, ǚəǗǗɖɟɩ ɜǗǗɠ Ǘɖɜ ɕɛɕɞůǗǗǗɘɐ Ǘɖɠ ɞůɕɟɟɕ´ɖǗ.

✓ ***ɋɟŸůɖ ɞůɕgəɞɖɠ***

¢ ŭɟŸůɖ ǘɖɠ ɕůɞɡɚɞɖɠ, əǓǗŸ ǘɖ ŭɘŸɟəǓǓ ǘɖɠ ŭɞəɕǓůɖǓɠ OGTT-75g, ǓǎǘɟŸɛǓə əɡɟ ɑ ɠ ǘɖɜ ǓɡǓɐůɖɖůɖǓɠ ǘɖɠ, ɛɏůɤ ǘɖɠ ɞ´ɞɖǓɠ Ǔǎŭɖɚ ɜǓǗǓə ɖ ɚǓɜɧǘɖǗ ǓɡǗɐɠ ɜǓ ŭɘǓɡəɞɚɨɜǓǎ ǘɖɜ Ǔǎɞŭɞǘɖɠɔɚɡəɧɕɖɠ´ɟɞɠǗɞɡɠɐůǗɞɨ ɠ.

✓ ***ɄǓǚ ɐǘǚ ɐɐ ǓɜǗǘůǗǗůɖ***

ɟ ɡǗɐ ǓǎǘɟŸɛǓǎ ǘɖɜ ǓɜǗǘůǗǗůɖ ǗɤɜɐůǓ ɜ ɏɜǓɜǗǎǘɖɠǓɐůɧŭɞɡ ǘɖɠɔɚɡəɧɕɖɠ ´ɟɞɠ ǓɡǗɞɨ ɠ əǓə ǓǎǓɟǗŸǗǓə Ǔ ɧ ɕůɞɡɚɕɞǓǎǓɟǗ ɛǓɜɞɡɠ əǓə ɛɖ ɕůɞɡɚɕɞǓǎǓɟǗ ɛǓɜɞɡɠ ´ǓɟŸɔɞɜǗǘɠ.

2. ɉ ʔ ɉ ɆȾɃɄ₵ Ɇ₵ ɇ₵ Ɇ
ȸȽȸʂ ȽɃũɅɉ ū Ƚɉ Ɇ

2.1. Ƀɛɞɜʂ ůǗǗǕɐ ŭɡɜǙɛɜɐ Ǘɖɠ ɔəɡəɧɘɖɠ-ŭɟ Ÿůɖ ɜʂůɐɡəɶɗɠ əǙɚ ůɤ ɛǙǕɐ Ÿůəɖůɖ

₵ əǕǗɞɧɖůɖ Ǘɐɡ ɐɛɞɜʂůǗǗǕɐɨ ɛɖɢǙɜʂůɛɨ Ǘɖɠ ɔəɡəɧɘɖɠ Ǘɐɡ ǙɶǕǗɐɠ ůǗɜ Ÿɜɖɟɤ´ɐ Ǚ ǙǗǕɑ Ǘɖɜ ǗɐǕɛɖůɖ ´ɐəəǙ əɿɜ ǘɡůʂɐəɔʚɩɜ ´ǙɟǙɧɜǗɤɜ, ɛǗǗɜɨ Ǘɤɜ ɐ´ɐɑɜ ůɖɛǙɜǗɐɐ ɖɏůɖ əǗǗɏɢɐɡɜ: Ǚ) ɖ ǙɜǗǗ ɧəɟʂůɖ Ǘɤɜ ɓ-əɡǗǗɟɤɜ Ǘɐɡ ´Ǚəɟɏ ǕǗɐɠ ůǗɖ ɔəɡəɧɘɖ (ǙǗɛɐɨɛǙɜɖ Ǚɧ Ǘɖ ůɡɔəɏɜǗɟɤ ůɖ Ǘɖɠ ɜʂůɐɡəɶɗɠ ůǗɐ ´əŸůɛǙ) əǙɚ ɓ) ɖ ǙɡǙʂůɖɖůɖǙ Ǘɤɜ ŭʂǗǘɧɟɤɜ ʂůǗɜ Ǘɐɡ ůɩ ɛǗǕɐɠ ůǗɖɜ ɜʂůɐɡəɶɗ (DeFronzo, et al, 1979). ɆŮ ůɡɜɖɐəǗɠ ɖɟǙɛɖǗɠ (ɜɖůǗǗɖǙ) ɖ ɛǗǗǙɶɖůɖ Ǘɖɠ ɔəɡəɧɘɖɠ Ǚɧ Ǘɐ ǙɶǙ ůǗɐɡɠ ŭʂŸǘɐɟɐɡɠ ʂůǗɐɨɠ Ǘɐɡ ůɩ ɛǗǕɐɠ (ůəǙǗǗǙɐɑɛɨǗ, əǙɟŭʂǙɧɠ ɛɡɠ, əʃɩ ŭɖɠ ʂůǗɧɠ, ʂůǗɐɑ Ǘɤɜ ů´əŸɢɜɤɜ, əǙɜǙɟʂɧ ɜǗɡɟʂɧ ůɨůǗɖɛǙ) ɛŮ əǙɚ ɢɤɟɋɠ Ǘɖ ɛǗɐəŸɓɖůɖ Ǘɖɠ ɜʂůɐɡəɶɗ ǙɜǙəɐɔʚŸ ǗɐǙɚ ´Ǚɑɐɡ ɑʂǙ (~ Ǚɧ 50%) (Klip, & Paquet, 1990). ɉ ɡɜǙɜɐɛɏɜɖɠ Ǘɖɠ ůɡɔəɏɜǗɟɤ ůɖɠ Ǘɖɠ ɔəɡəɧɘɖɠ ůǗɐ ǙɶǙ ǗǗ ɓ-əɨ ǗǗɟǙ Ǚ Ǘɑɐɜ ǗǗɚ əǙɚ Ǚəɟɶɐɡɜ Ǘɖɜ ɜʂůɐɡəɶɖ, ´ɐɡ ɛŮ Ǘɖɜ Ůɑɟ Ǚůɐ Ǘɖɠ ůǗɐ ɐ´Ǚɟ, ůǗɐɡɠ ɛɡɠ, ůǗɐ əʃɩ ŭɖ ʂůǗɧ əǙɚ ɔǙɜɞŸ ůǗɐɡɠ ʂůǗɐɨɠ, Ǚ ɐɛǙɟɨɜǙɚ Ǘɖ ɔəɡəɧɘɖ Ǚɧ Ǘɐɜ Ǚɤ əɡǗǗɟɞ ɢɩɟɐ, ɛŮ Ǚ ɐǗɏəǗɛǙ Ǘɖɜ ǙŸǗǗɤ ůɐ Ǘɖɠ əǙɚ ŭʂǗɐɟɖůɖ Ǘɖɠ ɐɛɞɧůǗǗůɖɠ (DeFronzo, et al, 1979).

Ɇɨ ɛǘɤɜǙ ɛŮ Ǘɐɡɠ DeFronzo (1981), Baron (1988) əǙɚ Ǘɐɡɠ ůɡɜǙɔŸǗɠ Ǘɐɡɠ, ɧǗǗɜ ɖ ůɡɔəɏɜǗɟɤ ůɖ Ǘɖɠ ɔəɡəɧɘɖɠ ůǗɐ ǙɶǙ ǙɡŸɜǗǗǙɚ ɐɚ ůəǙǗǗɐɑ ɛɨǗɠ Ǚ ɐǗǙɐɨɜ Ǘɐɡɠ əɨɟɞɡɠ ʂůǗɐɨɠ´ɟɐɠ Ǘɐɡɠ ɐ´ɐɐɡɠ ŭʂǗǗɖǗǗǙ ɖ ɔəɡəɧɘɖ ɛŮ Ǘɖ ɛǗɐəŸɓɖůɖ Ǘɖɠ ɜʂůɐɡəɶɗɠ, Ů ɗǙɓǙɑ ɜɐɜǗǗɠ´ɟɐɖɔɐɨ ɛǙǗɠ ɛǙɏǗǗɠ ɐɚ ɐ´ɐɖǗɠ ɡ´ǗǗɐɟɞǙɜ ɧǙɐɚ ůəǙǗǗɐɑɛɨǗɠ

ǙɜǙɚ ɐɚ ů´ɐɡǙǗɟɐɚ ´ǙɟŸɔɐɜǗǗɠ ɟɨɖɛʂůɖɠ Ǘɖɠ ɔəɡəɧɘɖɠ Ǘɐɡ ǙɶǗɐɠ (in vivo) (Daniel, et. al., 1975). ɉ ɜǗɖǗǗǙ, ɖ ŭʂŸɖǗůɖ Ǘɖɠ ɔəɡəɧɘɖɠ ɛŮ Ǘɖ ɛǗɐəŸɓɖůɖ Ǘɖɠ ɜʂůɐɡəɶɗɠ ´ɟɐɠ ůǗɐ əɾ ɩ ŭɖ ʂůǗɧ ǙɶǙɚ əʃɧǗɟɐ ůɖɛǙɜǙɐɐ Ǘɧůɐ ůǗǘɡůʂɐəɔʚŸ Ůɑ ǙɑǙ ɧůɐ əǙɚ ɡɤɖəɧǗɟǙ Ůɑ ǙɑǙ ɔəɡəɧɘɖɠ ůǗɐ ǙɶǙ (Bjorntorp, & Sjostrom, 1978; Bjorntorp et. al., 1970).

ŌǗůɐ, ɖ ůɤ ɛǙǕɐ Ÿůəɖůɖ ɖǙɛ´ɐɟɐɨ ůŮ ɜǙ Ǚ ɐǗǙɏůǙɚ ů´ɐɡǙɶɐ ´ǙɟŸɔɐɜǗǗ ɟɨɖɛʂůɖɠ Ǘɐɡ ɐɛɞɜʂůǗǗǕɐɨ ɛɖɢǙɜʂůɛɨ Ǘɖɠ ɔəɡəɧɘɖɠ ǗǗɧůɐɜ ´ɟɐɧ´ɐɖɏǗǙ Ǘɖɜ ɏɜǗɜɖ əɞɖǗɐ´ɐɖůɖ Ǘɐɡ ůəǙǗǗɐɑɛɨ ɛɡɸɐɨ ůɡůǗɛǙǗɐɠ ´ɟɐəǙɐɿɜǗǗɠ ǙɜŸəɐɔǙɠ ɓɜəɐɔʚɏɠ ´ɟɐůǙɟɛɐɔɏɠ. Ɉ´Ÿɟɐɐɡɜ ´əɖɖɩɟǙ ɛǙǗɩ ɜ ůŮ ɑɩǙ (Berger, et. al., 1979; Craig, et. al., 1981; Grimditch, et. al., 1986; James, et. al., 1984; Mondon, et. al., 1980; Vinten, & Galbo, 1983; Wardzala, et. al., 1982) əǙɚ ůŮ Ǚɜɖɟɩ ´ɐɡɠ (Bjorntorp, et. al., 1972; Holloszy, et. al., 1986; Lampman, et. al., 1985; Lohman, et. al., 1978; Rosenthal, et. al., 1983; Saltin, et. al., 1979; Yki-Jarvinen, & Koivisto, 1983) ɧ´ɐɡ ɏɐɡɜ ŭǗǙǗɚ ɧǗɚ ɛŮ Ǘɖɜ Ÿůəɖůɖ ǙɡɜŸɜǗǗǙɚ ɖ ůɡɜɐəɐ ŭʂŸɖǗůɖ Ǘɖɠ ɔəɡəɧɘɖɠ Ǚɧ Ǘɐ ǙɶǙ ´ɟɐɠ ůǗɐɡɠ ʂůǗɐɨɠ. ɆŮ ɔɡɛɜǙůɛɏɜǙ ŸǗɐɛǙ ɏɢǙɚ ´ǙɟǗɖɟɖɖǙɑ Ǚɡɜɖɛɏɜɖ ŭʂŸɖǗůɖ Ǘɖɠ ɔəɡəɧɘɖɠ´ɟɐɠ Ǘɐɡɠ ʂůǗɐɨɠ ɛŮ Ǘɖ ɛǗɐəŸɓɖůɖ Ǘɖɠ ɜʂůɐɡəɶɗɠ, ɧǗǗɜ ɖ ɔəɡəɧɘɖ əǙɚ ɖ ɜʂůɐɡəɶɖ ůǗɐ ǙɶǙ ɓɟɑɩəɐɜǗǗɚ ůŮ ůǗǗɖǙɟŸ ǘɡůʂɐəɔʚŸ Ůɑ ǙɑǙ (Burstein, et. al., 1985; Rosenthal, et. al., 1983). Ⱥ´ɑůɖɠ, ůɨ ɛǘɤɜǙ ɛŮ Ǘɖ ɛǙɏǗɖ Ǘɐɡ Rodnick əǙɚ Ǘɤɜ ůɡɜǙɔǗǗɩ ɜ Ǘɐɡ (1987), ǗǗ ɔɡɛɜǙůɛɏɜǙ ŸǗɐɛǙ ǙǘǙɑɐɡɜ ǙɡɜɖɛɏɜɖǙɚ ŭɟŸůɖ Ǘɖɠ ɜʂůɐɡəɶɗɠ, ůǗɐ ɐ´Ǚɟ, ůǗɐɡɠ ůəǙǗǗɐɨɠ ɛɡɠ əǙɚ ůǗɐ əɾ ɩ ŭɖ ʂůǗɧ. ɆɡɔəǙɟɞɏɜǙ, ůǗɐ ɛǙɚ ɐ´Ǚɟ ɛǙɑ ɜǗǗǙɚ ɖ ´ǙɟǙɤɔɐ ɔəɡəɧɘɖɠ, Ǚɩ ǙɡɜŸɜǗǗǙɚ ɖ ŭʂǗɡəɐəɡɜɧɛǙɚ Ǚɧ Ǘɖɜ ɜʂůɐɡəɶɖ

[illegible] (Soman, et. al., 1979 ; Mikines, et. al., 1988).

[illegible] (Borghouts, & Keizer, 2000). [illegible]

[illegible]

2.2. [illegible]

[illegible] (insulin sensitivity) [illegible] 50% [illegible] (insulin responsiveness) [illegible] (Kahn, 1978). [illegible] (euglycemic insulin clamp technique), [illegible] (hyperglycemic clamp technique) [illegible] (DeEronzo, et. al., 1979).

[illegible] (glucose clump technique) (Bogardus, et. al., 1983; Mikines, et. al., 1988). [illegible] (oral glucose tolerance test, OGTT), [illegible] (Young, et. al., 1989). [illegible] (Richter, et. al., 1985;

Wallberg, et. al., 1988) [illegible] (Richter, et. al., 1989) [illegible] (Bjorntorp, & Sjostrom, 1978; Maehlum, et. al., 1978).

[illegible] (Braun, et. al., 1995; Young, et. al., 1989; Kang, et. al., 1996). [illegible] (Braun, et. al., 1995). [illegible]

[illegible] 2 [illegible] (15-45 [illegible]) (Bargsbo, et. al., 1990) [illegible]-GLUT4) (Goodyear, et. al., 1990; Young, et. al., 1987) [illegible] Mikines [illegible] (1988, 1989), [illegible] (2 [illegible] < 5 [illegible]) [illegible] (Borghouts, & Keizer, 2000).

2.2.1. [illegible]

[illegible] UDP-[illegible] ([illegible]) [illegible] (glycogen synthase) (Stryer, 1997). [illegible] (Devlin, et. al., 1987; Kochan, et. al., 1979). [illegible]

ÛÜĵəɐɕƒ ɕɛĵɐɔɖůɖ Üĵɛűɐɕƒ ɛ´ɛĵŮɑ ɜŰ ɛŭɖɔɐůŮɵ ůŮ ɛŮɔŰɑ-ĵŰĵŰ ŰƒɛɖɐŮĵɛ ŰƒɛɖɐŮĵɛ ŰɑɖŮŭŰ Ű ɛɖɐůŮĵɛ ɛgɯɸɛ-ɪ ɔəgəɛɔɦɜɛg ůŮ ůɕɣůɖ ɛŮŰgŰŸ´ĵɤɜ Üƒɜ Ÿůəɖůɖ (Ivy, & Kuo, 1998), g´ɛɜɛɪɜŰŰƒ Üƒ ůɖɛŰɔŮɵɦŰƒŰŰ Ű£g ĵɦəɕg Üƒɖƒ ŭəŸɖŮůɖɖƒ Üƒɖƒ ɔəgəɦɛɖɖƒ ůŰ£ ůɕɖɛŰŰɵɪɛɦ Ű£g ɔəgəɛɔɦɜɛg. TŰŰŸ ůgɜɣ´ŮɵŰ ŭŰɯŮŰŰɔ ɦŮɵ ɖ ɛŮŰŰŭɛĵŸ Üƒɖƒ ɔəgəɦɛɖɖƒ ůŰ£ ɛgɯɸɦ əɨŰŰŰĵɛ əŰɔ ɦɕɔ ɖ ŭĵŰŭŮɵɦŰƒŰŰ Ű£g Ůɔɛɨɛɕg ůgɜɖŸůɖ Ű£g ɔəgəɛɔɦɜɛg ŮɯŰɔɛ ´ŰĵɤɛĵɤɵŭŮɵɦŰƒ ´ŰĵŸɔɛɜŰŰƒ Üƒɖƒ ůɨɜɖŮůɖƒ Ű£g ɛgɯɸɛ-ɪ ɔəgəɛɔɦɜɛg (Bloch, et. al., 1994; Price, et. al., 1996; Ren et. al., 1993), Ű£ ɛ´ɛœ, ŰŮɔəŸ, ɖŸŰɔ ůŮ ŰɛűɵɓɐŰƒůɖ Ű£ɜ əgĵɖŰĵɕɛ ĵɦəɛ Üƒɖƒ ůgɜɖŸůɖƒ Ű£g ɔəgəɛɔɦɜɛg ůÜƒɜ Űɨɜɖůɖ Üƒɖƒ ŮĵɜɛɖɖůɖŰƒ Üƒɖƒ ɕsůɛgəɕɖƒ ɛŰŰŸ Üƒɜ Ÿůəɖůɖ. ĴɛɨɛűɤɜŰ ɛŮ Ű£ɜ Coderre əŰɔ Ű£ggƒůgɜŮĵɔŸŰŰƒ Ű£g (1995), ɖ g´ŸĵɕɛgůŰ ůɕɣůɖ Ûɤɜ GLUT4 ɛŮ Ű£ ŮɑŰɯɛ Ű£g Ű ɛɖɐůŮɵɦɜɛɣɜɛg ɛgɯɸɛ-ɪ ɔəgəɛɔɦɜɛg ɛ´ɛĵŮɑ ɜŰ ÛɔɖɔɐůŮɵ Üƒ ůɨɜɜŭŰůɖ Üƒɖƒ ɛŮɔɤůɖƒ Ű£g ŰŰɔŸůĵŰŰɛg, Ű ɦ Üƒɜ ´ĵɛɖɔɖɐŮɑŰŸŸůəɖůɖ, ɛŮÜƒɜ ŮĵŰůɖɖůɖŰƒ Üƒɖƒ ɕsůɛgəɕɖƒ.

2.2.2. ɀ ŰŰŭɛĵŸɔəgəɦɛɖƒ

Ĵ´Ÿĵɕɛgɜ ´əɖɖɪĵŰ ůŰ£ɕɛŮɤɜ ´ɛg ŭŮɯɜɛgɜ ɦŮɵ ɖ ɛŮŰŰŭɛĵŸ Üƒɖƒ ɔəgəɦɛɖɖƒ ɛɣůŰůŰ£ ɛgɯɸɦ əɨŰŰŰĵɛ ŮɜŰŰɯŮŰŰɔɛŮÜƒɜ Ÿůəɖůɖ. ÐŰĵɛɖɛɦƒŰɤɜ ű ɛĵɤɣɤɜ ɔəgəɦɛɖɖƒ (GLUT4) (əgŰŰĵɛ´əŮůɛŰŰɵɐ ɛŮɛɓĵŸɜɖ, ŮɔəŸĵůɕəůɤəɖɜůəɛə) ŰgɜŸɜŮɵůɖɛŮɜŰɵɐŸ Űɛɣůɤƒ ɛŮŰŸ Ű£ ´ɣĵŰƒ Üƒɖƒ Ÿůəɖůɖƒ (Goodyear, et. al., 1990; Goodyear, et. al., 1990; Roy, & Marette, 1996), ɣɕɛɜŰŰƒɤƒ ŮŰɔɦəɛgɖɛ Üƒɜ Ûɨɜɖůɖ Üƒɖƒ ɛŰŰŭɛĵŸ Üƒɖƒ ɔəgəɦɛɖɖƒ. qůŰƒůɛ ɦɛɤƒ, ůɨɛűɤɜŰɛŮ Üƒɜ Goodyear əŰɔ Ű£ggƒ ůgɜŮĵɔŸŰŰƒ Üƒɖƒ (1990), ɛ Űĵɤɛɖɛɦƒ Ûɤɜ GLUT4 ůÜƒɜ əgŰŰĵɤəɐ ɛŮɛɓĵŸɜɖ ŮŰɔŸɣɕŰŰɔ ůŰŰ ŮɑŰɯŰ Üƒɖƒ dĵŮɛɖŰƒ ɛɣůŰ ůŮ ŭɨɛ ɪĵŰƒ ɛŰŰŸ Ű£ Ûƒəɛgƒ Üƒɖƒ Ÿůəɖůɖƒ. ĵ gŰĥ ůɖɛŰɯɔɦŮɵ ɖ ɛŮɔŰɔɨŰĵɖƒ ŭəŸĵəɔŰƒ (> Ű ɦ 2ɤĵɛ) ɛŰŰŭ-ŰůəɖůɤɔɔŮɔɐƒ ŮɑŭĵŰůɖ Üƒɖƒ ɤůɛgəɤɤəŸ g´ɛəɤɛɨɛŮɔɖƒ ɛŰŰŰűɛĵŸƒ ɔəgəɦɛɖƒ ɛűŰɯəŰŰɔ ůŮ Ÿəəɖ ŰəŰŰ. ÐĵɦůűŰŰŰ ɛ Hansen əŰɔ ɛɔ ůgɜŮĵɔŸŰŰƒ Ű£g (1998) ´ŰĵŰŰɛĵɖůŰɜ 3,5 ɪĵŮƒ ɛŰŰŸ Ű ɦ 30əŮ Üƒ Ÿůəɖůɖ ɦŮɵ ɖ ɛŰŰŰűɛĵŸ Üƒɖƒ ɔəgəɦɛɖƒəŰɔɖ ɛŰŰŰɔɒůŰůɖ-ɛŰŰŰɔɤɖůɖ Ûɤɜ GLUT4, g´ɛəɤɛɨɛŮɔƒ Ű ɦ ´ɛůɦŰƒŰŰ ɤůɛgəɕɖƒ Ůĵĵɦůəɦɛɔɖ ůŰ£ŰŰ ŮɔŸɕůŰŰ ŮɑŰɯŰ, ŰgɜɤɖɖəŰɔ ´ŰĵŸəəɖəŰ, ´Űĵɦəɛ ´ɛg Ű£ ůgɜɛəɤəɦ ´ŰĵɛŮ£ɦɛŮɔɛ Ûɤɜ GLUT4 ɐŰŰɔ ŰɛŰŰŸɒəɖŰ£ɛ. ÕŰŰɛ, ɖ ɛŮɔŰɔɨŰŰĵɖƒ ŭəŸĵəŮŰƒ ɛŰŰŰ-ŰůəɖůɤɔɔŮɔɐƒ ŮɑŭĵŰůɖ Üƒɖƒ Űɨɜɖůɖƒ Üƒɖƒ ɤůɛgəɕɖƒ ɛ´ɛəɤɛɨɛŮɔɖƒ ɛŰŰŰűɛĵŸƒ ɔəgəɦɛɖƒ ůŰ£ ɛgɯɸŸəɨŰŰĵŰ´ɤɖŰɔɦɜ ŮɔəɤŮɔɨɛŮɔɖ ŰɑŰĵŰ ŰƒɛɖɐŮĵɛ ɛgɯɸɛ-ɪ ɔəgəɛɔɦɜɛg (GLUT4) ůÜƒɜ ŮɑŭĵŰůɖ Üƒɖƒ ɤůɛgəɕɖƒ.

ÐgɜɛɣɑɛɜŰŰƒ, ɖ ´ĵɛɖɔɖɐŮůŰ ůɤɣɛŰŰɯɐ Ÿůəɖůɖ ɛ´ɛĵŮɑɜŰ´ĵɛəŮɔɣůŮɵŰɨɜɖůɖ Üƒɖƒ ŭĵŸůɖƒ Üƒɖƒ ɤůɛgəɕɖƒ ůŰ£ɕɛŮɤɜ Űɨɜɖůɖƒ Üƒɖƒ ɔəgəɦɛɖƒ ŮĵŰ Ű£ ŰɛŰŰŸɒəɖŰ£ɛ ůɛĵŸɜɖ Űɨɜɖůɖ Üƒɖƒ ɛŮɔɤůɖƒ Ű£g ŰŰɔŸůĵŰŰɛg, əgĵɖɑƒ ´ĵɛɖ Ű£ggƒ ůəŮɵŰŰɯɐɨɛƒɛɨŰƒ. ¢ ´ĵɛəŮɔɐɨɛŮɔɖ ɛŰŰŰ-ŰůəɖůɤɔɔŮɔɐƒ Ûɨɜɖůɖ Üƒɖƒ ŭəŸĵəŮŰƒ Üƒɖƒ ɔəgəɦɛɖƒ ɛ´ɛĵŮɑɜŰ ŭɤɔŮɔɐĵŰůɖ ůŮ ŭɨɛ űŸůŰƒ. ȳůɛɜ ŰűɛĵŸ Üƒɜ ´ĵɪ Üƒ űŸůɖ, ɖ Ûɨɜɖůɖ Üƒɖƒĵɛɛƒ ŰɑɛŰŰ£ƒəŰűɪ ƒəŮɔŰgŰɛƒ Ű£g Ûĵɤɛɖɛɨɛ Ûɤɜ űɛĵŸɜɖ ɔəgəɦɛɖƒ (GLUT4) ɖŰɤĵɛɨɜŰŰɔ ɛɔ ɛɖ ɕsůɛgəɕɖƒ ŮɔŸɕůŰŰ ɛŮɔŰƒŰűɦƒ Üƒɖƒ ŭəŸĵəŮŰƒ Üƒɖƒ ɔəgəɦɛɖƒ. ĵ ɜŰɑɖŰŰŰ, ɖ ´ŰĵŰŰɛĵɖƒɖŰɯŰ Ůgɜɖɛɣɜɖ ŭəŸĵəŮŰƒ Üƒɖƒ ɔəgəɦɛɖƒ ŰƒɛɖɐŮĵɛ ŰűŰƒ Ÿůəɖůɖƒ ŰɛůɑŰŰŰɔ ůŰƒɜ ŮɔŰŰɔɦɛŮɔɖ ůŮƒɜ ɕsůɛgəɕɖƒ, ɖ ɛ´ɛɖŰ űŰɑŮŰŰɔ ɦŮɵ ůgɜŭɣŰŰŰɔ ɛŰ Ű£ ɛɖɐɕŮɔɐůɛɦ ůɕɖɛŰŰɯɨɛɨ ɔəgəɛɔɦɜɛg əŰɔ ŮgŰ£ɨ Üƒɖƒ ɛŰŰŰűɛĵŸƒ Üƒɖƒ ɔəgəɦɛɖƒ.

2.3. qŋ Ŷůd ǝůєgǝǝdɗ ɤ ɗǓ єǕǝǕεǓ ǗǖǗǝǕǝ ɐɗ ůɤ εǓǝɐɗ Ŷůǝdůdɗ ǝǓǝ ´ɟє´ђзdůdɗ

¢ ´ɟє´ђзdůd ´ɟєǝǓǝǕ ´єǝǝǓ εǕǕǓбєǝǝι з ´ɟєůǓɟεєɔι з, ŭǝєзǕǕɗ Ǘɗ ŭgзǓǗђǗɗǕ ůǕǕ ǝǓǝY´ɟє´єзdεɏзǓ YǗεǓ зǓ бǓǝǕ зєgз ůdεǓзǗǝY Ǘɗ ůɤ εǓǗǝǝdǗǝɏɗ Ǘєgɗ Ů ǝǗђůǓɗ. Ά´ɘ´ɟђůdǗǕǕ, єǝ ´ɟєůǓɟεєɔɏɗ ǓgǗɏɗ Ǘɗɗ ůɤ εǓǗǝɐɗ Ŷůǝdůdɗ ε´єɟєɨ з зǓ ´ɟєǝǓǝɏůєgз ǝǓǝ ǓǝǝǓǝɏɗ ůǗ εǕǕǓбєǝǝůεђ Ǘɗ dɟǗεdǓɗ. ɀ Ǔɟǝєɑ Ǔ ђ Ǘєgɗ g´Ǘ dgзєgɗ εdɢǓзǝůεєɨ ɗ ǓgǗ з Ǘɤ з ǓǝǝǓι з ǘǓǝǓǕǕǝ ђǗǝ ůɢǗǗǝєзǕǕǝ εŮ Ǘɗ бǓǝǗɤ ůd Ǘɗɗ ǓgǓǝůdɗůdǓɗ Ǘɗɗ ǝůєgǝǝdɗ ǝǓǝ Ǘɗз Ǘɨ зdůd Ǘɗɗ ŭǝYdǗůd Ǘɗɗ ɔǝgǝђєdɗ. Άǝǝђ ǕǓ Ǔ, ǗǕ ´ɟє´єзdεɏзǓ YǗεǓ ůǓ ůɨ ɔǝɟǝůd εŮ ǗǕ Ǔ ɟє´ђзdǗǕ ǗεǘǓзєєgз εǝɟђǗǓd ǓзǗǕ ђǝɟǝůd ǝůєgǝǝdɗ ůǓ ŭǗǗєεɏзє ǘєɟǗє ɔǝgǝђєdɗ (Bjorntrorp, et. al., 1972), ɢǓεdǝђǗǓ ǓŮ ɑ ǗǗǓ ǝůєgǝǝdɗ ǝǕǕY Ǘɗз dɟǗεdǓ ǝǓǝ 50% ɢǓεdǝђǗǓ Ǔ Ů ɑ ǗǗǓ ǝůєgǝǝdɗ ǝǕǕY Ǘɗ ŭǝYɟǝǗǓ ůǗǓdǓɟ ɐɗ ɏɔɢgůdɗ ɔǝgǝђєdɗ (Lohmann, et. al., 1978). Ά´ɘ´ǝɏєз, Ů ǝǗɏɟєзǕǕɗ Ǘǝзǝɐ g´Ǘ ɔǝgǝǓεdǓ ɐ g´Ǘ ǝůєgǝǝǓεǝɐ Ǔgɔǝgǝ ǓεdǓ (glucose clump technique) ůǕǕ ´ɟє´єзdεɏзǓ YǗεǓ ´ǓɟǓǕǗɟɐdǝŮ ђεєǝǓ (King, et. al., 1987) ɐ Ǔgзdεɏзd (Dela, et. al., 1992; Mikines, et. al.,1989) εɏɔǝůǗɗ ŭɟYůd Ǘɗɗ ǝůєgǝǝdɗ (insulin responsiveness) ůǓ ůɢɏůd εŮ ǓgǗε Ǘɤ з Ǔ ɟє´ђзdǗɤ з ǕǗђεɤ з. ɹ зǗdǕǕǕ, d Ǔ єɢɐ Ǔ ђ Ǘɗз ´ɟє´ђзdůd ǝǓǝ d ǓбgεзǕůdǓ εǓǝ зєgз Ǘɗз єεǝǝůǕǕǝɐ ŭgзǓεǝɐ Ǘɗɗ ɔǝgǝђєdɗ (Ǔзєɢɐ ɔǝgǝђєdɗ, glucose tolerance) ǝǓǝ Ǘɗ ŭɟYůd Ǘɗɗ ǝůєgǝǝdɗ Ǘђůє ůŮ ´ǓɟǓεǕǗђɢɤ Ǔ ђůє ǝǓǝ ůŮ Ǔзdɟι ´єgɗ (Houmard, et. al., 1993; King, et. al., 1988; Neufer, et. al., 1992).

q ůǗђůє, ǓǝǓǝ Ǔ ǓɟǓǗɗǗε зǓ ǓǝǕǕůdǓ ŮYз d бǓǝǗɤ εɏзd ŭɟYůd Ǘɗɗ ǝůєgǝǝdɗ ǓǝǓǝ Ǔ єǕǝǕεǓ Ǘɤ з ´ɟєůǓɟεєɔι з Ǘɗɗ ǗǝǗǝɐɗ ůɤ εǓǗǝɐɗ Ŷůǝdůdɗ ǝǓǝ ´ɟє´ђзdůdɗ ɐ Ǘɗɗ Ů ɑǝɟǓůdɗ Ǘɗɗ ǗǗY Ǔǝ ǘgůǝɐɗ ŭɟǓůǗɗɟǝђǗɗǕǗɗ. ũǝǓ зǓ ŭǝǗɟǓgзdǗǗ d Ů ɑǝɟǓůd Ǘɗɗ ǗǗY Ǔǝ ůɤ εǓǗǝɐɗ Ŷůǝdůdɗ ɏзǓзǗǝ ǓgǗε Ǘɗɗ ůgůǗɗεǓǗǝɐɗ ´ɟє´ђзdůdɗ, ɔgεзǕůεɏзǓ YǗεǓ ůgɔǝɟɑdǝǓз εŮ Ǔɨ εзǕǗǕ 15 ι ɟǓɗ εǕǕY Ǔ ђ Ǘɗ ůgεεǓǗɢɐ Ǘєgɗ ůŮ Ŷůǝdůd ǝǓǝ бɟɏdǝǓђǗǝd ǓgǓǝůdɗůdǓ Ǘɗɗ ǝůєgǝǝdɗ Ǘɤ з ´ɟι Ǘɤ з ɐǕǓз gɣdǝђǗǓd ǓgǗε ɗ Ǘɤ з ŭǗǗǕǓɤ з (Mikines, et. al., 1989). ȳ εɤ ɗ, Ů Ǔǝɐ ŭǓз Ǔǝɏɔɢdǝ Ů´ɟǝ Ǘɗз ´ǓɟǓεǓǗǝɐ ŭǝǓǗǝǓůdǓ, d Ů ǝYɟgзůd Ǘɗɗ Ŷůǝdůdɗ Ǘɤ з ŭɨ є єεYǗɤ з, ´ɟǓεǓǗ´єǝdɗǝŮ Ǔ ђ Ǘɗз ɑǝǓ єεYǗǓ ǓɟǓgзdǗз εǝǓ ŭǗǗǕǓd εǓǝɏǗɗ. ȄŮ ǓgǗε Ǘɗ εǓǝɏǗɗ ǓǝǕYůdɗǝǓз ɔgεзǕůεɏзǓ YǗεǓ, зǓзY, 15 ι ɟǓɗ εǕǕY Ǘɗ ǗǓǝǓgǗǕdǓ Ǘєgɗ ůgзɐdɗ ´ɟє´ђзdůd, Ǔεɏůɤ ɗ εǕǕY Ǔ ђ 1 ι ɟǓ Ŷůǝdůd εŮ 64% Ǘɗɗ εɏɔǝůǗɗ ´ɟђůǝdɣdɗ єзgɔђзєg (VO2 max) ǝǓǝεǕǕY Ǔ ђ 5 dεɏɟǓɗ Ǔ єɢɐɗ Ǔ ђ Ǘɗз ´ɟє´ђзdůd (Mikines, et. al., 1989). ȄǗɗ ŭɨ є ´ɟι Ǘɗ ůgзdɐǝǓɗ ´ǓɟǓǗɗɟɐdǝŮ Ǔɨ зdůd ǝǓǝ ůǗɗ Ǔdǖɗ εǓɤ ůd Ǘɗɗ ǓgǓǝůdɗůdǓɗ Ǘɗɗ ǝůєgǝǝdɗ (insulin sensitivity), Ǔι ŭǝǕǗɟɐdǝŮ d εɏɔǝůǗɗ Ǔ єǝɟǝůεђǗɗǕǕ Ǘɗɗ ǝůєgǝǝdɗ (insulin responsiveness) ǝǓǝ ůǗɗ ǓɟǓɗ Ǔзɤ Ǘɏɟɤ ůgзdɐǝǓɗ. Ȅɨ εǘɤ зǓεŮǗєgɗ ǓɟǓgзdǗɏɗ, d ǓgǓǝůdɗůdǓ Ǘɗɗ ǝůєgǝǝdɗ Ǔ єǗђdɗǝŮ ůǗɗз Ů ɑǝɟǓůd Ǘɗɗ ǗǓǝǓgǗǕdǓɗ ǘgůǝɐɗ ŭɟǓůǗɗɟǝђǗɗǕǗɗ, Ǔι d εɏɔǝůǗɗ Ǔ єǝɟǝůεђǗɗǕǕ ǓgǗεɗ ůǗɗ ´ɟєůǓɟεєɔɏɗ Ǘɗɗ εǓǝɟє´ɟђdǗůεdɗ ´ɟє´ђзdůdɗ.

ƟǓɟђǝǓ ǓgǗY єǝ ´ɟєůǓɟεєɔɏɗ ´єg Ů ǝǗgɔɢYзєзǕǕǝ εŮ Ǘɗз ǗǝǗǝɐ ůɤ εǓǗǝɐ Ŷůǝdůd ǝǓǝ ´ɟє´ђзdůd ǘǓǝǓǕǕǝ зǓ Ů dɟǓYєgз Ǘε бǓdεђ ǓgǓǝůdɗůdǓɗ Ǘɗɗ ǝůєgǝǝdɗ, d є´єdǓ, ђ´ɤ ɗ ǓзǗɏɟdǝŮ, ǓǝǓǝ ǝgɟɑɤ ɗ Ǔ єǕǝǕεǓ Ǘɗɗ ´ɟєdɔdɗǗǗǓɗ Ŷůǝdůdɗ. qdǝǓǗɐ, d ǓgǓǝůdɗůdǓ Ǘɗɗ ǝůєgǝǝdɗ εǕǕY Ǘɗз Ŷůǝdůd ε´єɟǓι зǓ ǓǝǓǝ gɣdǝђǗǓd ůǕǕ ´ɟє´єзdεɏзǓ YǗεǓ Ǔ ђ ђǗǝ ůǕǕ Ǔ ɟє´ђзdǗǕ ǝǓǝ Ǔɨ εзǕůǕǕ. ɹ gǗε d

Ÿ ɕɣɖ ɡ´ɕůǗɖɟɕǗɖəŮ Ŭ ɧ Ǘǘ Dela əǗə Ǘǘɡɠ ůɡɜǗɟ ɔŸǗǗɠ Ǘǘɡ (1992, 1995), ɧ´ɕɡ ɓɟɐəǗɜ ɛǗǗǗǗǗɟɖ ǚəŸɖǗůɖ ɔəɡəɧɕɖɠ Ŭ ɧ Ǘǘ ǗœŬ ´ɟɕɠ Ǘǘɡɠ ɛɨǗɠ ůǗǘ ɔɡɛɜǗůɛɏɜɕ ůəɏəɕɠ ůŮ ůɨɔəɟɘůɖ ɛŮ Ǘǘ Ǘɨɛɜǘůǘǘ, 16 ɩ ɟǗɠ ɛǗǗŸ Ǘǘ Ǘɏəɕɠ Ǘɖɠ Ÿůəɖůɖɠ. ¢ Ÿ ɕɣɖ ǗɡǗɐ Ǘɘůɕɨ ɖɖəŮ əǗə Ŭ ɧ Ǘǘɜ Heath əǗə Ǘǘɡɠ ůɡɜǗɟ ɔŸǗǗɠ Ǘǘɡ (1983), ɧ´ɕɡ ´Ǘɟ ǗǗɐɟɖůǗɜ ɛǗǗǗǗɟɖ Ů ɑǗɟ Ǘůɖ Ǘɖɠ´ɟɕɖɔɖɖǗǗůǗɠŸůəɖůɖɠůǗɖɜ ǗɡǗɜůɖɖůɖǗ Ǘɖɠ ɘůɕɡəɶɖɠ ůŮŸǗɛŬ əǗǗŸ Ǘɖɜ ´Ǘɶɕǚɕ ůɡɛɛǗǗɕɐɠ Ǘǘɡɠ ůŮ ɏɜŬ ´ɟɧɔɟǗɛɛŬ ůɤɛǗǗǗɐɠ Ÿůəɖůɖɠ ůŮ ůɨɔəɟɘůɖ ɛŮ Ǘɖɜ ´Ǘɶɕǚɕ ǗǗǗɖ ɧ´ɕɡ ǗǗ ŸǗɛŬ ǗɡǗŸ Ŭ ǗɶǗə ɔəǗ 10 ɖɛɏɟ Ǘɠ Ŭ ɧ Ǘǘ ´ɟɧɔɟǗɛɛŬ ǗɡǗɧ. ɇɏəɕɠ, ɕɘ ɛǗəɟɕ´ɟɧɖǗůɛǗɠ ´ɟɕůǗɟɛɕɔɏɠ Ǘɖɠ ´ɟɕ´ɧɜɖůɖɠ, ɧůɕɜ ǗǗɕɟŸ Ǘɖ ǚɟŸůɖ Ǘɖɠ ɘůɕɡəɶɖɠ, Ů ɘŮ ɓǗɜ ɜɕɜǗǗə əǗə Ŭ ɧ Ǘɖ ůɨɔəɟɘůɖ Ǘɤɜ Ŭ ɕǗǗǗůɛŸǗɤɜ ɛǗǗǗǗɨ Ǘ Ǘɡɜɩ ɜ ůŮ Ǘɨɛɜǘů ǗǗ Ÿǘɛ Ŭ ǗǗ ɕ´ɕɖŬ ǚɏɕɖɖəǗɜ əŸ ɕɘŬ´ɟɕ´ɕɜɖǗɐɐ ´Ǘɟɏɛ ɓǗůɖ (ǗǗɧɓɘŬ ´ɟɕ´ɧɜɖůɖ ɐ ´ɟɕ´ɧɜɖůɖ ɛŮ ǗɜǗůǗǗůɖ) (Miller, et. al., 1994; Soman, et. al., 1979; Tonino, 1989) əǗəůŮǗɖəɖǗɏɠ (Mikines, et. al., 1989; Vestergaard, et. al., 1994; Vukovich, et. al., 1996). Ǝɡɔəǘɟɶɏɜ Ŭ, ůǗǘɡɠ Ǘɖəɖ Ǘɏɠ ´ǗɟǗǗɖɟɐɖɖəŮ ɛǗǗǗǗɨ Ǘɟɖ ǚɟŸůɖ Ǘɖɠ ɘůɕɡəɶɖɠ.

¢ ɛǗǗǗǗɕɟŸ əǗə ɕ ɛǗǗǗɓɕəɘůɛɧɠ Ǘɖɠ ɔəɡəɧɕɖɠ, ɕ ɛǗǗǗɓɕəɘůɛɧɠ Ǘɤɜ əɘ ɩ ɜ, əǗɖ ɩ ɠ əǗə ɖ ´Ǘɟɕɕɐ Ǘɖɠ ɖ´ǗǗǗɐɠ ɔəɡəɧɕɖɠ ǘǗǗǗǗə ɧǗə ǗɜǗə ɕɘ əɡɟɘǗǗɟ ɕɘ ´ɘǗɜɕɑ ɛɖɕǗɜɘůɛɕɑ´ɕɡ Ǘɛ´əɏəɕɜǗǗə ůǗɖ ɓǗǗǗɤ ɛɏɜɖ ǚɟŸůɖ Ǘɖɠ ɘůɕɡəɶɖɠ əǗə Ǘǚɘɧ ǗǗɟŬ Ǘɖɠ ǗɡǗɜůɖɖůɖǗɠ ǗɡǗɐɠ ɛǗǗŸ Ŭ ɧ ǗǗəǗǗɐ ůɤɛǗǗǗɐ Ÿůəɖůɖ əǗə ´ɟɕ´ɧɜɖůɖ.

2.3.1. ɀ ǗǗǗɕɟŸ əǗə ɛǗǗǗɓɕəɘůɛɧɠ ɔəɡəɧɕɖɠ

ǺŸɜ ɖ ´ɟɕ´ɧɜɖůɖ ǗɶǗə ɘǗɜɐ ɜŬ ǗɡɜɐůǗə Ǘɖ ɛǗǗǗǗɕɟŸ əǗə Ǘǘ ɛǗǗǗɓɕəɘůɛɧ Ǘɖɠ ɔəɡəɧɕɖɠ ǗɧǗǗ ɔɘŬ ɜŬ ǗɜǗůǗǗɘůɖǗɕ

Ů Ǘɟəɐɠ ǗǗɕǚɘǗůɛɧɠ ɔəɡəɧɕɖɠ ɖŬ Ŭ ǗɜǗǗǗǘ əǗə ǗɜŸəɕɔɖ Ǘɨɜɖůɖ Ǘɖɠ ǗœŸǗɤ ůɖɠ Ǘɤɜ ɛɡɩ ɜ. Ʉɟ Ÿɔɛ ǗǗ, ɛŮ Ǘɖɜ ǗǗɟɧɓɘŬ ´ɟɕ´ɧɜɖůɖ ɖ ´ɡəɜɧǗɖǗǗ Ǘɤɜ Ǘɟ ɕɕǗǗɩ ɜ ǗɡɜŸɜǗə Ǘɧůɕ ůǗǗ ɡɔɶ ŸǗǘɛŬ (Allenberg, et. al., 1988) ɧůɕ əǗə ůŮ ɘůɕɡəɶɕǗɜǗŸɟ ǗɖǗǘɡɠ ǚəǗɓɖǗǗɕɨ ɠ ǗůɖǗɜǗɠ (non-insulin dependent diabetes mellitus, NIDDM) (Andersen, & Henriksson, 1977). ɀ ɏůɤ ǗɡǗɐɠ Ǘɖɠ ´ɟɕůǗɟɛɕɔɐɠ ǗɶǗə ǚɡɜǗǗɧɜ ɜŬ Ǘɡɜɖɖǘɕ ɛɏůɕɠ ɕɟɧɜɕɠ ǚɏəǗɡůɖɠ Ǘǘɡ ǗœŬǗǘɠ (blood mean transit time), ´Ǘɟ ǗǗǗɶɕɜǗǗɠ ɏǗɘ Ǘǘ ɕɟɧɜɕ ɏəɖǗůɖɠ Ǘɤɜ ɘůǗɜ ůǗɖ ɛǗǗǗǗɟɧɛǗɖ Ŭ ɧ Ǘǘ ǗœŬ ɘůɕɡəɶɖ əǗə ɔəɡəɧɕɖ. ɀ Ÿəɘůǘ ɕ Holmang əǗə ɕɘ ůɡɜǗɟ ɔŸǗǗɠ Ǘǘɡ (1992) ´ǗɟǗǗɐɟɖůǗɜ ɧǗɖ ǚɏůɛǗɡůɖ Ǘɖɠ ɘůɕɡəɶɖɠ Ŭ ɧ Ǘǘ ɛɡɸɧ ǗɔǗǗǗɧ ǗǚɕɖɐəɘəǗə ɖ ɛǗǗǗəɶɖůɖ ǗɡǗɐɠ ´ɟɕɠ Ǘǘ ɛɡɸɧ ɘǗǗɧ ǗɶǗə ǗɜŸəɕɔɖ Ǘǘɡ ǚɘǗɕɡ Ǘɤɜ ǗɡɕǗǗǗɩ ɜ. ū ǗɶǗǗɜ, əɕɘ ɧɜ, ɧǗə ɖ əǗɨǗǗɟɖ ǗœŸǗɤ ůɖ Ǘɤɜ ɛɡɩ ɜ, ɤɠ Ŭ ɕǗɏəǗůɛǗ Ǘɖɠ ´ɟɕ´ɧɜɖůɖɠ, ɛ´ɕɟǗɑɜŬ ɓǗǗǗ ůǗǗ Ǘǘɜ ǗǗɕǚɘǗůɛɧ Ǘǘɡ ɘůǗɨ ɛŮɔəɡəɧɕɖ, ɡ´ɕɜɕɩ ɜǗǗɠ´ǗɟŸəɖəǗ əǗə Ǘɖ ůɡɛɓɕəɐ Ǘɧɠ ɛɖɕǗɜɘůɛɕɨ ɕ ɕ´ɕɶɕɠ ɖŬ ɛ´ɕɟǗɑɜŬ ǚəǗǗɟɘůɖǗɑ Ǘǘɜ Ǘɡɜɖɛɏɜɕ ǗɡǗɧɜ ǗǗɕǚɘǗůɛɧ. ɟ ɡǗɧ ɖŬ ɛ´ɕɟɕɨ ůŮ ɜŬ ůɖɛǗɶǗə ǗɜŸəɕɔǗɠ ǗǚɕəɡǗǗǗɟɘɏɠ ´ɟɕůǗɟɛɕɔɏɠ əǗə ůɡɔəǘɟɶɏɜŬ ůǗǘ Ů ɑǗɕ ɛǗǗǗǗɕɟŸɠ əǗə ɛǗǗǗɓɕəɘůɛɕɨ Ǘɖɠ ɔəɡəɧɕɖɠ.

ÿůɕɜ ǗǗɕɟŸ Ǘɖ ɛǗǗǗǗɕɟŸ Ǘɖɠ ɔəɡəɧɕɖɠ (ǚəŬ ɛɏůɕɡ Ǘǘɡ ůǗɟəǗɶɐɛǗǗɡ) ǗɡǗɐ ɓǗůɶǗǗǗə ůǗɖɜ ´ɕůɧǗɖǗǗ Ǘɤɜ ǘɕɟɏɤɜ ɔəɡəɧɕɖɠ (GLUT4) Ů ɑ Ǘɖɠ əɡǗǗǗɟɕ´əǗůɛǗǗɐɠ ɛǗɛɓɟŸɜɖɠ əǗə ůǗǘ ůɨůǗɛŬ ǗəŸɟůɤɜ ůɤəɖɜɑəɤɜ (T-tubules). ǺŸɜ ɖ ůɡɜɕəɘɐ ´ɕůɧǗɖǗǗ Ǘɤɜ ´ɟɤǗǗɪɜ GLUT4 ǗɡɜɖɖǗɑɧ´ɤɠ, Ů ɑɖɠ, əǗə ɖ ɛǗǗǗɧ´ɘůɐ Ǘǘɡɠ Ŭ ɧ Ǘǘ ǗɤǗǗɟɘɧ Ǘǘɡ əɡǗǗŸɟɕɡ ´ɟɕɠ Ǘɖ ɛǗɛɓɟŸɜɖ (GLUT4 translocation) ɛŮ Ǘɖ ǚɏɔǗɟůɖ Ǘɖɠ ɘůɕɡəɶɖɠ, ǗɧǗǗ ɖ ɘǗɜɧǗɖǗǗ ɛǗǗǗǗɕɟŸɠ Ǘɖɠ ɔəɡəɧɕɖɠ ǗɡɜŸɜǗə ɟ ɜǗɖǗǗǗ, ɖ

[illegible] GLUT4 [illegible] (internalization) (Borghouts, & Keizer 2000). [illegible] GLUT4 [illegible] (Gulve, & Spina, 1995; Houmard, et. al., 1995; Houmard, et. al., 1993), [illegible] (Hughes, et. al., 1993) [illegible] NIDDM [illegible] (Dela, et. al., 1994). [illegible] GLUT4 [illegible] (Hirshman, et. al., 1989). [illegible] Hardin [illegible] (1995) [illegible] (upregulation) [illegible] GLUT4 [illegible] GLUT4 [illegible] (Brozinick, et. al., 1993; Ivy, et. al., 1989), [illegible] GLUT4 [illegible] GLUT4 [illegible] Etgen [illegible] (1997) [illegible] (Zucker rats) [illegible] GLUT4 [illegible] (Goodyear, et. al., 1991) [illegible] GLUT4 [illegible] (Etgen, et. al., 1997) [illegible] (Ivy, et. al., 1989).

[illegible] Marin [illegible] (1994) [illegible] NIDDM [illegible] (Simoneau, & Kelley, 1997).

[illegible] 6-[illegible] 6-[illegible] (Stryer, 1997). [illegible] Holloszy

əǕэ Coyle (1984) ɖ ´ɟɞ´ɧɜɖůɖ ɛ´ɞɟǕɑɜǕ ɓǕэǕɑ ůǕэ Ǘɖɜ ǕɞɡɛɐɐƏ ɐƏǕɜɧǗɖǗǕ ůǗɞɡɠ ůəǕэǕǗɐƏɞɨɠ ɛɨǕɠ ɡɔɑ ɜ ǕǗɧɛɤɜ, ɧ´ɤɠ Ɏэəɤ ůǗǕ ůɡɛɓǕɞɓǕэ əǕэ ůǕ NIDDM ǕůɖǕɜǕɡɠ(Allenberg, et. al., 1988).

Ɇɡɜ Ǖɩ ɠ, ɛǗɎ Ǖ ɧ ɏɜǕ ´ɟɧɔɟǕɛɛǕ ǗэǗɐƏɠ ůɤ ɛǕǗɐƏɠ Ɏůəɖůɖɠ ɖ ɐƏǕɜɧǗɖǗǕ ɛǕǗǕɓɞəɐƏůɛɞɨ ǗɖɠɔəɡəɧɛɖɠǕɡɜɎɜǕэ ´ǕɟɎэəɖəǕ ɛǕǗɖɜ ɐƏǕɜɧǗɖǗǕ ɛǕǗǗɞɟɎɡ Ǘɖɠ ɔəɡəɧɛɖɠ ůɡɛɓɎэəɞɜǗǕɡɠ, ɏǗɑɥ ůǗɖ ɓǕэǕɤ ůɖ ǗɖɠǕɡǕɐůɖůɖǕɡ ǗɖɠɐƏůɞɡəɞɖɠ.

2.3.2. Ɇɤ ɛǕǗɐƏ ůɨůǗǕůɖ, ɛǕǗǕɓɞəɐƏůɛɧɠǗɛɡ ůɤ ɛǕǗɐƏɞɨ əɑ ɞɡɠ

ɅɞǕэ ɔɜɤůǗɧ ɧǗэ ɖ ´ǕɡůǕɟəɖǕ ǕɞǕэ ǕɜǗǕ ɛǕɤůɖɠ Ǘɖɠ ǕɡǕɜůɖɖůɖǕɡ Ǘɖɠ ɐƏůɞɡəɞɖɠ (ǕɡɜɎɜǕǗэ ɖ ǕɜǗůǗǕůɖ Ǘɤɜ ɐƏůǗ ɜ ůǗɖɜ ɐƏůɞɡəɞɖ) (Helmrich, et. al., 1991; Kohrt, et. al., 1993). ɅɐƏɧǗɟǕ, ɖ ǕɜɞəɞɐƏǕэɐƏ ůɡůůɩ ɟǕɡůɖ əɑ ɞɡɠ ɛ´ɞɟǕɑ ɛǕэɟɞ´ɟɧɖǗɛǕ ɜǕ´ɟɞəǕэɏůǕэ ɛɐƏǕůǕɟɎ ɛǕǗǕɓɞəɐƏɩɜ ɐƏǗǕɟǕɞɩɜ ɛǕǗǕɨ Ǘɤɜ ɞ´ɞɑɤɜ ǕɞǕэɖ ǕɜǗůǗǕůɖ ůǗɖɜ ɐƏůɞɡəɞɖ əǕэ ɖ Ǖɨɜɖůɖ Ǘɖɠ ůɡɔəɏɜǕɤůɖɠ ǕɡǗɛɠ ůǗɛ Ǖɛ Ǖ(Golberg, et. al., 1995; Despres, 1997; Krotkiewski, & Bjorntorp, 1986). ɸǕɞɛɏɜɞɡ ɧǗэ ɞɘ ůəǕэǕǗɐƏɞɑ ɛɨǕɠ Ǖ ɞǗǕэɞɨɜ Ǘɛɡɠ əɨɟɐƏɡɠ ɐƏǗɛɨɠ ɛǕǗǕɓɞəɐƏůɛɞɨ Ǘɖɠ ɔəɡəɧɛɖɠ ɛǕ Ǘɖ ɛǕɞəɎɓɖůɖ Ǘɖɠ ɐƏůɞɡəɞɖɠ, ɛɐƏǕ ůɤ ɛǕǗɐƏɐƏ ůɨůǗǕůɖ ɡɣɖəɐƏ ůǕ ɛɡɸɐƏ ɛɎɞǕ əǕэ ɢǕɛɖəɐƏ ůǕ əɑ ɩ ǔɖ ɖǕ ɛ´ɞɟɞɨůǕɜǕ ůɡɜɞǔǕɨǗǗэ Ǖ ɧ ɓǕэǗɤůɖ Ǘɖɠ ǕɡǕɜůɖɖůɖǕɡ Ǘɖɠ ɐƏůɞɡəɞɖɠ. ɆɡɔəǕэɟɐƏɏɜǕ, ɖ Yki-Jarvinen, əǕэ ɞ Koivisto, (1983) ´ǕɟǗɛɟɖůǕɜ ɧǗэ ɖ ɛǕǗǕɓɞəɐƏ Ǘɖɠ ůɤ ɛǕǗɐƏɐƏɠ ůɨůǗǕůɖɠ Ǖ ɧ ɏɜǕ əɑ ɩ ǔɖ ůǕ´ɐƏ ɛɡɸɧ Ǘɨ´ɞ ǕɨɜɖůǕǗɖ ůɡɜɞəɐƏɐƏ ǔɐƏɎɖǕɖ Ǘɖɠ ɔəɡəɧɛɖɠ.

Ƀɘ ǕůɖǕɜǕɡɠ NIDDM ´ǕɟɞɡůɐƏɎɞɡɜ Ǖɡɜɖɛɏɜ Ǖ ɑǕǕ ǕэǕɖǕɟɤɜ əɑ Ǖɟ ɩ ɜ ɞɜɏɤɜ (FFA) əɧɔɤ Ǘɖɠ Ǖɡɜɖɛɏɜɖɠ əɑ ɧəɡůɖɠ ɛǗɎ Ǖ ɧ ɜɖůǗǗɖǕ, Ǘɖɠ ǕɜǗǕůǗǕůɖɠ Ǘɖɠ ɐƏůɞɡəɞɖɠ ůǗɖɜ əǕǗůǗɛəɐƏ Ǘɖɠ əɑ ɧəɡůɖɠ, əǕɖ ɠ Ǖ ɑůɖɠ

əǕэ ůǗɖ ɛǕɤ ůɖ Ǘɖɠ ǕэəǕǗɎɟɐƏůɖɠ Ǘɛɡ ´əɎůɛǕǗɛɠ Ǖ ɧ ǗǕ FFA (Groop, et. al., 1989; Taskinen, et. al., 1985). ȼ Ǖ ɡɣɖəɎ Ǖ ɑ ǕǕ Ǘɤɜ FFA ǕɞǕэ ǔɡɜǕǗɧɜ ɜǕ ɢǕɟ ɞǗɟɏɣɞɡɜ Ǘɖɜ ǕɜɎəɖɣɖ Ǘɖɠ ɔəɡəɧɛɖɠ əǕэ Ǘɛ ɛǕǗǕɓɞəɐƏůɛɧ ǕɡǗɛɠ ůǗɛɡɠ ůəǕэǕǗɐƏɞɨɠ ɛɨǕɠ (Hargreaves, et. al., 1991; Saloranta, et. al., 1993) əǕэ ´ɐƏǕɜɧɜ ɜǕ ɞǔɖɔɐƏůɞɡɜ ůǕ ɛǕэǕɐƏǗǕɟ ɖ ´ǕɟɞɢɐƏ ɔəɡəɧɛɖɠǕ ɧ Ǘɛ ɐƏ´Ǖɟ (Consoli, 1992).

¢ ǗэǗɐƏ ǔɡůɐƏ ǔɟǕůǗɟɐƏɧǗɖǗǕ ǕɞǕэ ɖ ǕэǗǕ Ǘɖɠ ´ǕɟǕǗɟɞɨ ɛǕɜɖɠ Ǖɨ ɜɖůɖɠ Ǘɖɠ ɞɜǕǔɤ ůɖɠ Ǘɤɜ əɑ ɩ ɜ ůǗɖɜ ɖɟǕɛɖǕ (Poehlman, et. al., 1994; Tremblay, et. al., 1992) ǕэəɎ əǕэ əǕǗɎ Ǘɖ ǔɐƏɎɟəǕэǕ Ǘɖɠ Ɏůəɖůɖɠ (Klein, et. al., 1994) ǕэǕǗǗɩ ɜɞɜǗɠ, ɏǗɑɥ Ǘɛ ůɨɜɞəɞ Ǘɛɡ ůɤ ɛǕǗɐƏɞɨ əɑ ɞɡɠ əǕɑ ɠ əǕэ ǕɡǗɧ Ǘɖɠ ǕэǔɞəɞɐƏɐƏǕэɐƏɠ ɢɩ ɟǕɡ (Despres, et. al., 1991; Krotkiewski, & Bjorntorp, 1986), ɏɢɞɜǗɠ ůǕэ Ǖ ɞǗɏəǕůɛǕ Ǘɖ ɛǕэɤ ůɖ Ǘɤɜ FFA ůǗɛ ´əɎůɛǕ. Ʌ´ɑ ɟɧůɖǗǕǕ, ɞ Mauriege əǕэ ɞɘ ůɡɜǕɟɔɎǗɠ Ǘɛɡ (1997) ɓɟɐƏəǕɜ ǕэǕǗɤ ɛɏɜɞ Ǘɛ ɛɏɔǕɖɞɠ Ǘɤɜ əɑ ɞəɡǗɎɟɤɜ əǕэ Ǘɖ ǔɟǕůǗɐƏɧǗɖǗǕ Ǘɖɠ əɑ ɞ´ɟɤǗǗɟɐƏɐƏɠ əɑ Ɏůɖɠ ůǗɖɜ ɡ´ɞǔɧɟɐƏǕ əɞɐƏɐƏǕэɐƏ ´ǕɟɐƏɞɐƏ ɔɡɛɜǕůɛɏɜɤɜ ɔɡɜǕэɑ ɜ ůǕ ůɞɏůɖ ɛǕ Ǘɤɜ ǕɟɛɜǕůǗɤɜ, Ǖɩ ɞ Lavoie (1993) əǕэ Suda (1993) ɛǕ Ǘɛɡɠ ůɡɜǕɟɔɎǗɠ Ǘɛɡɠ ´ǕɟǗɛɟɖůǕɜ ǕɟɜɖůǕɖ Ǘɖɠ ǕɜǗɐƏəɑ ɞəɡǗɐƏɐƏɠ ǔɟɎůɖɠ Ǘɖɠ ɐƏůɞɡəɞɖɠ ůǕ ´ɞɜǗɐƏɞɨɠ. Ɇɡɜ Ǖɩ ɠ, ůɨ ɛǔɤ ɜǕ ɛǕ ǗǕ ´ǕɟǕ Ɏɜɤ, ǔǕɞǗǗэ ɔǕ ɛɐƏǕ ǕэɧɛɖÌ ǔɞɟɎ ɖ ǔɡɜǕɛɐƏɐƏ Ǘɖɠ ůɡůǗɖɛǕǗɐƏɐƏɠ ůɤ ɛǕǗɐƏɐƏɠ Ɏůəɖůɖɠ ůǗɖ ɓǕэǕǗɤ ůɖ ɐƏ ůǗɛɜ ɏəǕɔɞ Ǘɖɠ ɔəɡəɧɛɖɠǗɛɡ ǕɛǕǗɛɠ ɛɏůɤ Ǘɖɠ ɛǕɤ ůɖɠ Ǘɛɡ ůɤ ɛǕǗɐƏɞɨ əɑ ɞɡɠ əǕэ Ǘɖɠ ɓǕэǕɤ ůɖɠ Ǘɛɡ ɛǕǗǕɓɞəɐƏůɛɞɨ Ǘɛɡ.

2.3.3. ¢ ´ǗɐƏɐƏ ´ǕɟɞɢɐƏ ɔəɡəɧɛɖɠ

¢ ´ɟɞ´ɧɜɖůɖ ǔǕэ ɓǕэǕɑ ɜǕэ ɛɧɜɞ Ǘɖ ǔɟɎůɖ Ǘɖɠ ɐƏůɞɡəɞɖɠ ůǗɛɡɠ ´ǕɟǕǗɟɐƏɞɨɠ ɐƏǗɛɨɠ (ɧ´ɤɠ Ǘɛɡɠ ůəǕэǕǗɐƏɞɨɠ ɛɨǕɠ əǕэ Ǘɛ əɑ ɩ ǔɖ ɐƏǗɧ), ǕэəɎ ǔǕɞǗǗэ ɜǕ

Ůdʃ ŮŸɛŮɔ ɔŰɔ ɣɜŰ Ÿɔɔɔ ɦʃɹɔŰɜɛ-ůŰɦɢɛ Ű̈lʃ Ůɑ̈ɹ Ű̈ůdʃ Ű̈lʃ ɯɹ Ÿůdʃ Ű̈lʃ sɑ̈ůɛgɔɔdʃ, Ű̈ɛ ɛ´Űɹʃ. ƐgɔɔůɔɹɹɛɣɜŰ, ɛ Rodnick ɔŰɔ ɛɜ ůgɜŮʃɔŸŰŰʃ Ű̈ɛg (1987) ŰɜŰű́ɣɹɛgɜ ɦŮɔ d ɔɔŰɔɦŮ̈lŰ̈Ű Ű̈lʃ sɑ̈ůɛgɔɔdʃ (ůŰű́gůɛɔɔɛɔɔɔŸŮ́d ůŰɹ Ű̈ůŰ ůgɔɔɣɜŰʃɹɣůdʃ) ůŰ̈lɜ ɔŰŰ̈ůŰ̈ɛɔɛ Ű̈lʃ ´Űɹʃɛɢɛʃ ɔɔgɔɦʃɛdʃ ŰŮ ɦ Ű̈ɛ ɛ´Űɹʃ ŮɑɜŮɔ ůdɛŰɜŰ̈ɔŸ ɛŮɔŰɔi-ŰŰʃd ůŰŰ ɔgɛɜŰůɛɣɜŰ ŸŰ̈ɛɛŰ ůŮůgɣůd ɛŮŰŰ ŰɔiɛɜŰůŰŰ. ȳɛɣʃ, ɣɢŮɔ ´ŰɹŰŰ̈lɹdʃůɔ ɦŮɔ ɣɜŰ ´ɹɦɔɹŰɛɛŰ ůɣɛŰŰɔɛʃ Ÿůɔdůdʃ (ŰŰɹɦɓɔŰ´ɹɛ´ɦɜdůd) ůŮgɔɔɛ ŸŰ̈ɛɛŰ, ɜŰɔɛŮɔ ɛ´ɛɹůɔɜŰɛůdɔɛůɔ ůŮŮɔŸŰŰɣůd Ű̈lʃ ´Űɹɛɢɛʃ ɔɔgɔɦʃɛdʃ ŰŮ ɦ Ű̈ɛ ɛ´Űɹʃ ɔŰŰŸ Ű̈lʃ ŭɔŸɹɹɔŮɔŰ Ű̈lʃ Ÿůɔdůdʃ, ɣʃ ŰɛŰɣɔůɛɛŰ Ű̈lʃ ɛŮɣɣůdʃ Ű̈lʃ ɔɔgɔɛɔɛɔɦɔgůdʃ ɔŰɔ Ű̈lʃ ɔɔgɔɛɔŮɛɔɣɜŮůdʃ, ɣůŰɦůɛ, d ɔɔɯdŰɔɛ Ű̈lʃ ɔɔgɔɦʃɛdʃ ůŰ̈lɜ ɔŰŰ̈ůŰ̈ɛɔɛ ŭɹŸůd Ű̈lʃ ɔɔgɔɛɔŮɛɔɣɜŮůdʃ, ůŰ̈ɛ ɛ´Űɹʃ, ɛŮɔɜɛɔŰŰ̈ʃ Ű̈lʃ dʃ ŰŮɛɛ ´Űɹɛɢɛ ɔɔgɔɦʃɛdʃ ůŮ ɔŰŰ̈ůŰ̈ɛɔɛ ůŰ̈lɜ ɔŰŰ̈ůŰ̈ɛɔɛ ůŰ̈lʃ dʃ ŰŮɛɛ ´Űɹɛɢɛ ɔɔgɔɦʃɛdʃ ůŮ ɔŰŰ̈ůŰ̈ɛɔɛ ůŰ̈lʃ dʃ ŰŮɛɛ (DeFronzo, et. al., 1987). ŸŰɹɦɛɛɜŰ ŮɣɹɛɛŰŰ̈Ű ŰɜŰű́ɣɹdʃɔŰɜ ɔŰɔ ůŰ̈l ɛŮɔɣŰ̈l Ű̈ɛg Bogardus ɔŰɔ Ű́ɣɜ ůgɜŮʃɔŰŰ́ɜ Ű̈ɛg (1984) ɦʃɛg ůŮŰůdŮɜŮɑ̈ʃ (NIDDM), ɛɜɛ´ɛɑɛɜɣ´ɛɓɔɛdʃɔŰɜ ůŮɣɜŰ ŰŮɹɦɓɔɛ ´ɹɦɔɹŰɛɛŰ Ÿůɔdůdʃ (12 ŮɓűɛɛŸŰůɑ̈ʃ), ´ŰɹŰŰ̈lɹɛdʃɔŮ ůdɛŰɜŰ̈ɔŸ ŮɔŸŰŰ́ɣůd Ű̈lʃ dʃ ŰŮɛɛ ´Űɹɛɢɛʃ ɔɔgɔɦʃɛdʃ ɔŰŰ̈ůŰ̈ Ű̈lɜ dʃ ŰŮɛɛ (17%) ɔŰɔ ɔŰŰ̈ůŰ̈ Ű̈l ŭɔŸɹɹɔŮɔŰ Ű̈lʃ Ÿůɔdůdʃ (25%).

ŮŰůɜ ´ɣɹŰɜ Ű̈lʃ ɓŮɔŸůdʃ Ű̈lʃ ŮɑŰůdʃůdŰʃ Ű̈lʃ sɑ̈ůɛgɔɔdʃ ůŰ̈lɜ ´ŮɹůɣɹŮɔŰ, d ű́gůɔɔɛ ŭɹŰůŰ̈lɹɦŰ̈lŰ̈ Ůɑ̈ɹŸ dŰ̈ɔŸ ɔŰɔ ůŰ̈l ɹɨdɛɔůd Ű̈lʃ dʃ ŰŮɛɛ ´Űɹɛɢɛʃ ɔɔgɔɦʃɛdʃ.

ƐgɜɛɣɑɛɜŰ̈ʃ, d Ű̈ɔŰɔɛ ůɣɛŰŰɔɛ Ÿůɔdůdʃ ɛ´ɛɹŮɔ ɜŰ ɓŮɔŸůɔ ůŮɔ Ű̈lɜ ɛɛɛɔɛůŰ̈Űɔɛ ŭgɜŰɛɔɛ Ű̈lʃ ɔɔgɔɦʃɛdʃ (glucose tolerance) ŰgɜŸɜɛɜŰ̈ʃ Ű̈lɜ ŮɑŰůdʃůdŰʃ Ű̈lʃ sɑ̈ůɛgɔɔdʃ (insulin sensitivity) ɔŰɔůɣʃ Ű̈lʃ ɛɣɔɔůŰ̈l ŭɹŸůd Ű̈lʃ (insulin responsiveness). ¢ ŮɑŰůdʃůdŰ Ű̈lʃ sɑ̈ůɛgɔɔdʃ ű́ŰɔŮŰŰɔ ɦŮɔ Ůdʃ ŮŸɛŮŰŰɔ ɔgɹɣʃ Ű̈ɦ Ű̈lɜ ŰŰɔŮɑŰŰ ű́gůɔɔɛ ŭɹŰůŰ̈lɹɦŰ̈lŰ̈ ɔŰɔ ´ɹɛ´ɦɜdůd, Ůɜı d ɛɣɔɔůŰ̈l ŭɹŸůd ŰɑŰɛʃ Ű̈ɛʃ ɔɔůŰ̈lɹɛdʃ ŰŮ ɛŭɑŰŰŰɔ ůŮɑ̈ʃ ´ɹɛůŰɹɛɛɔɣʃ Ű̈lʃ ɛŰɔɹɛ´ɹɦdŰůɛdʃ ůgůŰ̈lɛŰŰ́ɔɛʃ ůɣɛŰŰ́ɔɛʃ Ÿůɔdůdʃ. q ůŰɦůɛ, ɛɜ ´ɹɛůŰɹɛɛɔɣʃ ´ɛg Ůɛ ůŰɦɔɛŸɜɛɜŰŰɔ ɛŮ Ű̈lɜ Ű̈ŰɔŮɔɔɛ ůɣɛŰŰɔɛ Ÿůɔdůdʃ ɔŰɔ ´ɹɛ´ɦɜdůd ɛ´ɛɹɛɨɜ ɜŰ Űgɜɛůgɜ Ű̈ɛ ɛɣɔŮdɛʃ Ű̈lʃ dʃ ŰŮɛɛ ´Űɹɛɢɛʃ ɔɔgɔɦʃɛdʃ ůŰŰ ´ɹɛ´ɛɜdɛɣɜŰ ŸŰ̈ɛɛŰ ůŮůgɣůd ɛŮŰŰ Ű̈ɹɦɔɹŰɛɛŰ ɔŰɔ Ű̈ɔɨɛɜŰůŰŰ. ¢ ɛŮɔŰɔi-ŰŰʃd ɜŰɔɦŰ̈lŰ̈ ɛŮŰŰɔɛɔɛůɛɛɨ ɔŰɔ ɛŮŰŰůɛɹŸʃ Ű̈lʃ ɔɔgɔɦʃɛdʃ, d ɛŮɔɣůd Ű̈ɛg ůɣɛŰŰɔɛɨ ɔɑ́ɛggʃ ɔŰɔ ɓŮɔŸůɔ ůd Ű̈ɛg ɛŮŰŰɔɛɔɛůɛɛɨ Ű̈ɣŰ̈ɛɨ, ɔŰɑ́ɹ ɔ ɔŰɔ d ɹɨdɛɔůd Ű̈lʃ dʃ ŰŮɛɛ ´Űɹɛɢɛʃ ɔɔgɔɦʃɛdʃ ű́ŰɔŮŰŰɔ ɦŮɔ ŮɑŰɔ ɛɜ ɔggɹɦŰ̈ɹɛɛ ´ɛdŰɔɛɑ ´ŰɹŸɔɜɛɜŰŰʃ ´ɛg Ůɣɑ́ɨɜɛɜŰŰɔ ɔɔŰ Ű̈l ɓŮɔŸůɔ ůd Ű̈lʃ ɓŮɣŰɑ́ɨdʃůdŰʃ Ű̈lʃ sɑ̈ůɛgɔɔdʃ, ɣʃ ŰɛŰɣɔůɛɛŰ Ű̈lʃ ŰŰɔŮɑŰŰ ůɣɛŰŰɔɛ Ÿůɔdůdʃ ɔŰɔ ´ɹɛ´ɦɜdůdʃ.

2.4. Á´ɑ̈ɹŰůd Ű̈ɛg Ű̈ɨ´ɛg Ű̈lʃ ´ɹɛ´ɦɜdůdʃůŰ̈l ŭɹŸůd Ű̈lʃ sɑ̈ůɛgɔɔdʃ

Ɛű́ʃ ´ŰɹɔůůɦŰ̈ŰɹůɣɹŮɜ ɣɹůɣɜůɣɹ ɣɢŮɔ ŮɔŸŰŰůdůɔ d ŭɹŸůd Ű̈lʃ sɑ̈ůɛgɔɔdʃ ɣʃ Ű̈ɛŮɣɔůɛɛŰ Ű̈lʃ ŰŮɹɦɓɔŰʃ ´ɹɛ´ɦɜdůdʃ ɛɔɹɣʃ ɛ ɛŮɔŰɔi-ŰŰʃd ɣɜŰŰůdʃ, ɛɔɹɣʃ ɛ ɛŮɔŰɔi-ŰŰʃd ɢɹɛɜɔɛʃ ´Űɹɦŭɛg Ű̈ɦůɛ ůŰ Űɔdɹı ´ɛggʃ ɦůɛ ɔŰɔ ůŰ ´ŰɣŰɛŰŰɦɛɣŰ. q ůŰɦůɛ, Ů ŮɔŭɛɛɔůɛɛɔɦɦʃɛgɯɦɦʃɛɔůŰɦʃ ŮɣɑɨɜɛŰŰɔ ´ŰɹɔůůɦŰ̈ŰɹɛɔɛŰ Ű̈lʃ ŭɹŸůd Ű̈lʃ sɑ̈ůɛgɔɔdʃ, ɛŰŰɔ ɔŭɜŰŰŰɹŰ´ɹɛɛɔɛɦɜ ɜŰ ŮɔŸŰŰůdůɔ d Ů ɑ̈ɹŰůd Ůɔɦʃɣ´ɹɛɔɹŸɛŰŰɛʃ Ÿůɔdůdʃ ´ɛg ůŰɦɢɛ ŮɑŰůdŰ̈lʃ ŰŮ ɔŰɔ ůŰ̈l ɹɨdɛɔůd Ű̈lʃ ɛŰɔɹɛ´ɦdŰůɛdʃ ɣɜŰɦůɛ ɔŰɔ ůŰ̈l ´ɹɛůŰɹɛɛɔɣʃ Ű̈lʃ ɛŮɔŰɔi-ŰŰʃd ɜŰɔɦŰ̈lŰ̈ ɔŰɔ ŮɔŸŰŰůdůɔ ɔŰɔ ůŰ̈l ɓŮɔŸůɔ ůd Ű̈lʃ ɓŮɣŰɑ́ɨdʃůdŰʃ Ű̈lʃ sɑ̈ůɛgɔɔdʃ, ɣʃ Ű ɛŮɔŰɔi-ŰŰʃd ɣɜŰŰůdʃ ɔŰɔ ůŰ̈l ŭɹŸůd Ű̈lʃ sɑ̈ůɛgɔɔdʃ ůŰ̈lɜ ŰŰɔŮɑŰŰ ůɣɛŰŰɔɛ Ÿůɔdůdʃ ɔŰɔ ůŰ̈l ´ɹɛ´ɦɜdůdʃ ɛŮ ŰɔŰůůŰŰůd (´ɹɛ´ɦɜdůd

бŮэŰα ůdɖ ɛgɰɐɕ ŭɨ зŬɛdɖ). ȷ ɟəŮŰɏɖ ɛŮэɏŰɖɏɕɕз ŭŮɑŮэ ђŰэɕ Ű´ɕɖŬɡŰђɖŰɖ ´ɟɕ´ђзdůdɖ ɛ´ɕɟŮą ђ´ɤɖ Ɏээɤ ůŰŮ ůɡɛбŬɑŮэ əŬэ ůŰɖз ŬŮɟђбэŬ ´ɟɕ´ђзdůd, зŬбŮэŰɑ ůŮэŰɖ ŭɟɎůd Űɖɕɘůɕɡэɑdɖ.

ɆŰɑɖ´ŬɟŬэɎŰɤ ´ŬɟŬэɟɎŭɕɡɖ dŬ ɔɑŮэ зŰɕɤɟɘŰɐ ŬзŬɪɕɟɎ Űɖɖ Ů ɑɟŬůdɖ Űɤз ŭɨɕ ŬɡŰз ŭэŰɪɕɟŮŰэɪз Ű´ɤз ´ɟɕ´ђзdůdɖ (ŬŮɟђбэŬɖ ´ɟɕ´ђзdůdɖ əŬэ ´ɟɕ´ђзdůd ŬзŰůŰŰůdɖ) ůŰɖ ŭɟɎůd Űɖɖ ɘůɕɡэɑdɖ.

2.4.1. ȷ Ŭɟ ђбэŬ´ɟɕ´ђзdůd

ũŮэɘɎ ɡ´ɕůŰɖɟɑŮŰŰэ ђŰэ ɕ əŬŰэəɖəђŰŬɟɕɖŰ´ɕɖ´ɟɕ´ђзdůdɖɔэŬŰɖ бŮэŰα ůd Űɖɖ ŭɟɎůdɖ Űɖɖ ɘůɕɡэɑdɖ ŮɑŬэ d ŬŮɟђбэŬ´ɟɕ´ђзdůd əŬэ Űɕɨ Űɕ ŭэђŰэ ´ɟɪ ŰŰ Ŭ ô ђэŬ ɛɏůɤ ŬɡŰɕɖ ŬɡзɎзŰŰэ d ŮзŬɟɔŮэɐ ŭŬ Ɏзd əŬэ бŮэŰɑ зŰŰэ ɕ ɛŮŰŰбɕэɘɛђɖ Űɤз эɑɪз, ɕŭdɔɪ зŰŰɖ ɛŬэɟɕ´ɟђdŮɛŬ ůŰɖ ɛŬα ůd Űɕɡ ůɡзɕэɘɕɨ ůɤɛŬŰɘɕɨ эɑɕɡɖ əŬэ Űɕɡ эɑɕɡɖůŰɖз эɕɘэŬэɐ ɕɪɟŬ (Bjorntorp, et. al., 1972; Despres, et. al., 1991; Schwartz, et. al., 1991). ¢ ɛŬэɟɕ´ɟђdŮɛd ŬŮɟђбэŬ ´ɟɕ´ђзdůd ɛ´ɕɟŮɑ зŬ ´ɟɕэŬэɏůŮэ ´ɕɘɑŮɖ´ɟɕůŬɟɛɕɔɏɖ ɛŮŰŰэɨ Űɤз ɕ´ɕαз əŬɛбɎзɕɡз ɕɪɟŬ ůŮɛɡɰɐђ Ů ɑŮɕ, ђ´ɤɖ ŮɑŬэ d Ŭɨзdůd: Ŭ) Űɖɖ ŬзŬэɕɔŬɖŰɤз бɟŬŰŮŬɖůɡůŰɕэɐɖɛɡɰɪз ɘɪз, б) Űɕɡ Ŭɟɘɛɕɨ əŬэ Űɕɡ ђэɕɡ Űɤз ɛэŰɕɕɕзŭɟαз, ɔ) Űɤз Ůɕɨɛɤз Űɖɖ ŬŮɟђбэŬɖ ɔэɡэɕэɡŰэɐɖ ´ɕɟŮŬɖ əŬэ Űɖɖ ŭɟŬŮŰэђŰɖŰŰɖ ŬɡŰз əŬэ ŭ) Űɕɡ ŭэŰɕɡ Űɤз ŬɟɘɕɕŮŭɪз, ɏɕɕзŰŰɖ ɤɖ Ŭ ɕŰɏэŮɛŬ Űɖ бŮэŰα ůd Űɖɖ ɛɏɔɘŰɖ ´ɟђůэdɣdɖ ɕэɡɔђзɕɡ (VO2 max) (Houmard, et. al., 1991; Saltin, & Strange, 1992; Holloszy, & Booth, 1976; Booth, & Thomason, 1991). ɀ ŮэɏŰŮɖ ɕэ ɕ´ɕdŮɖ ůɡůɕɏŰэůŬз Űɕ VO2 max ɛŮŰɖ ŭэɎdŮůd Űɖɖ ɔэɡэђɕdɖ, əŬŰɎ Űɖ ŭэɎɟ əŮэŬ ŮŭŬɟɛɕɔɐɖ Űɖɖ ŰɕзdŰɎ Ů ɘŭŬɟɕɨ ɛŮзdɖ ɡ´Ŭɟ-ɘůɕɡэɘŬɛɘɐɖ Ůɡɔэɡэ Ŭɛ dŬɖ (euglycemic insulin clamp technique) ɐ ɡ´Ŭɟɔэɡэ Ŭɛ dŬɖ (hyperglycemic clamp technique), ɏŭŮɑŬз ђŰэ ɡ´Ɏɟɕ Ůэ dŮŰэɐ ůɕɏůd ɛŮŰŬзɨ Űɖɖ ŮɡŬзůddůdŬɖ Űɖɖ ɘůɕɡэɑdɖ əŬэ Űɖɖ ŬŮɟђбэŬɖ ɘůɕɨɕɖ, ŬзŮэɎɟ ŰɖŰŰ Űɖз dэɘэdŬ əŬэ Űɕ ůɕŰэɐђ бɎɟɕɖ Űɤз ŭɕэɘŬɛђɛŮзɤз (Endre, et. al., 1994; Rosenthal, et. al., 1983). Ɇɡɔэ Ůэɟɘɏз Ŭ, Űɕ VO2 max бɟɏdəŮ зŬ ůɡůɕŰɛŰŰэ ɛŮ Űɕɡɖ ´Ŭɟɘůђ Ŭɟɕɡɖ ´ɟɕŬзŬŭŬɟђɛŮзɕɡɖ ´ŬɟɎэɕзŰɖ ɕэ ɕ´ɕɑэ Ůɛ´эɏэɕзŰэ ůŰɖ бŮэŰα ůd Űɖɖ ŭɟɎůdɖ Űɖɖ ɘůɕɡэɑdɖ, ɡ´ɕзɕɪ зŰɖ´ŬɟɎэdэŬəŬэ Űɖз Ů ɑɟŬůd Űɖɖ ɛŬэɟɕɟђзэŬɖ ŬŮɟђбэŬɖ ´ɟɕ´ђзdůdɖ (DeFronzo, et. al., 1981; Lillioja, et. al., 1987; Goodyear, et. al., 1990). Ɑŭɘђ ŰŮŬɟ Ŭ, ůŰɖ ɛŮэɏŰɖ Űɕɡ Ebeling əŬэ Űɤз ůɡзŮɟɔŬŰ з Űɕɡ (1993) ´ŬɟŰɖɟɐdəŮůŮ Ŭdэ dŰɏɖ (ɕђэŮɟ VO2 max=57,6±1,0 mL/kg/m) ůŮ ůɨɔэɟɘůd ɛŮ Űɖз ɕɛɎŭŬ Ůэɏɔɕɕɡɕɕɡ (Ŭɨɛ зŬůŰɕɘ, VO2 max=44,1±2,3 mL/kg/m) ɛŮэŬɨŰŬɟd əŬŰɎ Űɖз dɟŮɛdŬ: Ŭ) ɛɡɰɐ ɟɕɐ ŬɑŬŰɕɖ, б) ůɡɔэɏзŬɟɤůd Űɕɟɏɤзɔэɡэђɕdɖ (GLUT4) əŬэ ɔ) ŮзŭɕэɡŰŰŬɟɘɐ ɛd ɕзŮэŭɤŰэɐ ɛŮŰŰбɕэɘɐ ɛŮŰŰŬɟɕ´ɐ Űɖɖ ɔэɡэђɕdɖ (ůɨзdŮůd-Ŭ ɕdɐэŮɡůd ɔэɡэɕɔђзɕɡ). ɋ ůŰђůɕ, ŮɑŬэ ɎзэɘзŬ ůdɛŮɑ dŬɡ ůɨ ɛŰɤзŬɛŮŰɖ ɛŮэɏŰɖ Űɕɡ LeBrance əŬэ Űɤз ůɡзŬɟɔŰŰ з Űɕɡ (1979), ђŰэ d ɡɣdэɐ ŮɡŬзůddůdŬ Űɖɖ ɘůɕɡэɑdɖ ´ɕɡ ´ŬɟŰɖɟŮŰŰэ ůŰɕɡɖ ŬdэdŰɏɖ ůɕŰɕŰŰэ ´ŬɘůђŰɟɕ ɛŮ Űɖз ɛŬɑůd Űɖɖ эɑɪ ŭɕɡɖ ɛɎɛŬɖ´ŬɟɎ ɛŮŰɖз Ŭɨзdůd Űɕɡ VO2 max.

O Oshida əŬэ ɕэ ůɡзŬɟɔɎŰɖ Űɕɡ (1989) ŮŭŬɟɛђɕзŰɖ ɏзŬ ɛŬэɟɕ´ɟђdŮɛɕ ´ɟђɔɟŬɛɛŬ ŬŮɟђбэŬɖ Ɏůэdůdɖ ɕŬɛdэɐɖ ɏзŰŰůdɖ, ´ŬɟŰŰɟdůŬз бŮэŰα ůd Űɖɖ ŮɡŬзůddůdŬ Űɖɖ ɘůɕɡэɑdɖ, ´Ŭɟђэɕ Űɕɡ ђŰэ Űɕ VO2 max əŬэ Űɕ ůɤɛŬŰэђ бɎɟɕɖ Űɤз ŭɕэɘŬɛђɛŮзɤз ŭŮэ ɎээŬзŮ Ʉɛɕαɖ, эɕзŰɕ´ɟђdŮɛŬ ´ɟɕɔɟɎɛɛŰŰ ŬŮɟђбэŬɖ Ɏůэdůdɖ (7 dɛŬɟɪз), ɕɤɟɑɖ зŬ ŭɨзŬзŰŰэ зŬ бŮэŰα ůɕɡз Űɕ VO2 max əŬэ Űɖ ůɤɛŰэɐ ůɨůŰŰůd Űɤз ŭɕэɘŬɛђɛŮзɤз,

[illegible] (Rogers, et. al., 1988), [illegible] (Cononie, et. al., 1994) [illegible] ([illegible] NIDDM) (Gavigan, et. al., 1995; Kang, et. al., 1996; Hichey, et. al., 1999). [illegible] (GLUT4) [illegible] (Houmard, et. al., 1995) [illegible] (Cox, et. al., 1999). [illegible] VO2 max [illegible] (Miller, et. al., 1994; Soman, et. al., 1979; Tonino, 1989; Mikines, et. al., 1989; Vestergaard, et. al., 1994; Vukovich, et. al., 1996), [illegible]

[illegible] Eriksson [illegible] (1998), [illegible] VO2 max (17%) [illegible] Borghouts [illegible] (1999) [illegible] VO2 max [illegible]

[illegible] Ivy [illegible] (1989) [illegible] (IIb) [illegible] Cortez [illegible] (1991) [illegible] 6-8 [illegible] (IIb). [illegible] (? IDDM) [illegible] (2 [illegible]) (Braun, et. al., 1995).

[illegible] VO2 max [illegible]

[illegible]

2.4.2. [illegible]

[illegible] (Miller, et. al., 1984; Craig, et. al., 1989), [illegible] (Cullinen, & Caldwell, 1998) [illegible] (Miller, et. al., 1994; Treuth, et. al., 1994). [illegible]

[illegible] Miller [illegible] (1984) [illegible] 10 [illegible] Yki-Jarvinen [illegible] Koivisto (1983) [illegible] (euglycemic insulin clamp technique). [illegible]

[illegible] (Eriksson, et. al., 1998), [illegible] (Fluckey, et. al., 1994), [illegible] (MacDougall, et. al., 1977), [illegible] (Tesch, et. al., 1986). [illegible] Miller [illegible] (1994) [illegible] 50 [illegible] 65 [illegible] 16 [illegible]

[illegible] (GLUT4) [illegible]

ŭɉŶůɖ ǘɖɠ ɜůɞɡɚɒɖɠ, ŭŬɜ ɓɉɏɖɖɘŬɜ ´ɚɖɉɞǘɞɉɖǘɠ. ɄŬɉɧɘŬ ŬɡǘŶ ůǘɖ ɛŬɏǘɖ ǘɞɡ Houmard ɘŬɜ ǘɤɜ ůɡɜŬɉɔǘǘ ɜ ǘɞɡ (1993) ŬɜŬǘɏɉǘǘɜ ɧǘɜ ɧǘɜ ɜŬɉŶ Ŷǘɛ ɛŬ, ´ɞɡ ůɡɛɛǘǘɕŬɜ ůŬ ´ɉɞɔɉŶɛɛŬǘǘ Ŭɜŭɡɜ Ŷɛɤ ůɖɠ, ůǘɛŶǘɖůŬɜ ɔɚŬ 14 ɖɛɉɉŬɠ ǘɖɜ ´ɉɞ´ɧɜɖůɐ ǘɞɡɠ ǘǘ Ŭ ɑ ǘŬ ǘɤɜ GLUT4 ǘɤɜ ůɘŬɚǘɓɩ ɜ ɛɡɩ ɜ ŭŬɜ ŶɚɚŬɜŬɜ. ɉ ɡǘɧ ůɖɛŬɒŬ, ǘɞɡɚŶɕɚůǘɜ, ɧǘɜ ɖ ´ǘ ůɖ ǘɖɠ ŬɡŬɜůɖɖůɖŬɠ ǘɖɠ ɜůɞɡɚɒɖɠ ´ɞɡ ´Ŭɉ ŬǘɖɉůǘǘɓɛŬǘŶ Ŭ ɧ ǘɖɜ Ŭ ɞɕɐ Ŭ ɧ ɏɜŬ ´ɉɧɔɉŬɛɛŬ Ŭɜǘůǘǘůɖɠ ŭŬɜ ɞǘŬɓǘǘɓ ůǘɖ ɛŬɤůɖ ǘɤɜ ǘɞɉɏɤɜ ɔɚɡɘɧɕɖɠ (GLUɇ4).

Ⱥ´ɚɉɧůɖǘǘǘ, ɡ´ɞůǘɖɉɒǘǘǘɓ ɧǘɜ ɖ ɛɏǘɉɚŬ ´ɉɞɠ ɡɣɖɚɐ ɏɜǘǘůɖ ´ɉɞ´ɧɜɖůɖ ɛŬ ɓŶɉɖ (ɘɡɉɑɤɠ ůǘǘ ɖɚɜɤ ɛɏɜŬ Ŷǘɛ Ŭ) ɛ´ɞɉŬ ɜŬ ´ɉɞɘŬɓɏůŬ ůŬ ůɕǘǘɓŶ ɛɜɉɧ ɕɉɞɜɜɧ ŭɚŶůǘɖɛŬ ɛɜɉɐ ɐ ɘŬɜ ɛɏǘɉɚŬ Ŭɨɜɖůɖ ǘɖɠ ŬŬɉɧɓɚŬɠ ɜɕɨɞɠ. ɄŬɉɧɘɚ ´ɞɡ ŭŬɜ ŬɒŬɜ ɜŬɜŶɖŬɉɞɜ ɞɜ ɛɖɕŬɜɜɛɞɑ ɛɏůɤ ǘɤɜ ɞ´ɞɑɤɜ ɛ´ɞɉŬ ɜŬ ŬɡɜɖɖŬɑ ǘɞ VO2 max, ɏɜŬ ǘɉǘɞɜ ɔŬɞɜɧɠ ɖŬ ɛ´ɞɉɞɨ ůŬɜŬ ɏɕŬ ɖǘǘɓɐ Ŭɑɉǘůɖ ůǘɖ ŭɉŶůɖ ǘɖɠ ɜůɞɡɚɒɖɠ (Stone, et. al., 1991). ɖɜɜɣɖǘɠ ɏŭŬɜŬɜ ɧǘɞ Ŭɉɜɖɛɧɠǘɤɜ ǘɉɜɕɞŬŭɩ ɜ ɘǘǘŶ ɛɐɘɞɠ ǘɖɠ ´Ŭɉɛɏǘɉɞɡ ɏɘŬǘɖɠ ɛɡɥɐɠ ɒŬɠ ŬɡɜŶɜŬ ɛǘǘŶ Ŭ ɧ ǘɖ ůɡůǘɖɛŬǘǘɓɐ ´ɉɞ´ɧɜɖůɖ ŬɜǘŬǘǘůɖɠ (Hickson, et. al., 1989; Hepple, et. al., 1997; Tesch, 1988), ɡ´ɜɞɩ ɜǘǘɠ´ŬɉŶɚɚɖɚŬǘɖɜ ɘŬɨǘɉɖ ɉɞɐ ŬɛŬǘɞɠɘŬɛɡɥɐ ŬɛŶǘɤ ůɖ.

ɇɏɚɞɠ, ɖ ɓŬǘɤ ůɖ ǘɖɠ ŭɉŶůɖɠ ǘɖɠ ɜůɞɡɚɒɖɠ, ɤɠ Ŭ ɞǘɚǘɛŬ ǘɖɠ ɛŬɉɞ´ɉɧǘɛɖɠ ´ɉɞ´ɧɜɖůɖɠ ɛŬ ŬɜǘŬǘǘůɖ, ɛ´ɞɉŬ ɜŬ Ŭ ɞŭɞɖŬ ůǘɠ ´ɉɞɨ´ǘɡůŬɠ ŬɚŬɓɏɠ ǘɖɠ ůɤɛǘɓɐɠ ůɨůǘǘůɖɠ. ɆɡɔɘŬɉɜɏɜŬ, ɖ ǘǘɓǘɓɐ ůɡɛɛǘɕɐ ůŬ´ɉɞɔɉŶɛɛŬǘǘ Ŭŭɡɜ Ŷɛɤ ůɖɠ ɛ´ɞɉŬ ɜŬ ŬǘǘǘǘǘůŬ ǘɞ ůɡɜɚɜɧ ůɤɛǘɓɧ ɚɑɞɠ ůŬ ɜǘǘɉŶ ɘŬ ůŬ ɛŬŬɨǘǘɉɖɠ ɖɚɜɖɠŶǘɛŬ (Craig, et. al., 1989; Treuth, et. al., 1994; Prabhakaran, et. al., 1999; Van Etten, et. al., 1994), ɘŬɑɠɘŬɜŬɛŬ ůŬǘɞ ɚɑɞɠůǘɞ ɘɞɉɛɧ

(Treuth, et. al., 1994) ɘŬ ŬŭɜɧǘǘɉŬ ůǘɖɜ Ŭŭɞɚɜɜ Ŭɐ ɕɩ ɉŬ(Treuth, et. al., 1995).

ȮǘɠŬ, ɖ Ŭɨɜɖůɖ ǘɖɠ ɛɡɥɐɠ ɛŶɕŬɠ, ǘɞɡ ŬŬɞɚɛɨ ǘɖɠ ɔɚɡɘɧɕɖɠ (ůɨɜɖǘůɖ ɔɚɡɘɞɔɧɜɞɡ), ɘŬɑ ɠ ɘŬ ɖ ɛŬɤ ůɖ ǘɞɡ ůɡɜɞɚɜɨ ůɤɛǘɓɐɨ ɚɑɞɡɠ (ɜŭŬǘǘɉŬ ǘɖɠ ɘɞɜŬɐɠ ɕɩ ɉŬɠ), ŭŬɒǘǘɓ ɜŬ Ŭ ɞǘɑǘǘɓ ɖ ɓŬǘɤ ůɖ ǘɖɠ ŭɉŶůɖɠ ǘɖɠ ɜůɞɡɚɒɖɠ ɛǘǘŶ Ŭ ɧ ɏɜŬ ɛŬɉɞ´ɉɧǘɛɞ ´ɉɧɔɉŬɛŬ´ɉɞ´ɧɜɖůɖɠ ɛŬŬǘǘǘǘůɖ.

Ɇɡɜɣɜɜǘɠ, ɖ ŬɉɧɓɚŬ ´ɉɞ´ɧɜɖůɖ ɘŬ ɖ ´ɉɞ´ɧɜɖůɖ ɛŬ ŬǘǘǘǘǘůɖɆɛ´ɞɉɞɨ ɜŬ Ŭ ɜɉŶůɞɡɜ ɖǘǘɓŶ ůǘɖ ŭɉŶůɖ ǘɖɠ ɜůɞɡɚɒɖɠ. ȺɜŬɧɉŬ, ŬŬŶɉǘɖǘǘ ǘɞɡ ŬɑɞɡɠǘɖɠɎ´ɉɞ´ɧɜɖůɖɠ, ɖ ɓŬǘɤ ůɖ ǘɞɡ Ŭ ɚɏɏɞɡ ǘɖɠ ɛɏɜɜůǘɖɠ ´ɉɧůɚɖɣɖɠ ɞɜɡɔɧɜɞɡ (VO2 max), ǘɞ ɛɏɜŬɖɞɠ Ŭɡɜɛɛ Ŭɤ ůɖɠ ǘɤɜ Ŭ ɞɖŬɛŶǘɤɜ ǘɞɡ ɛɡɥɐɨ ɔɚɡɘɞɔɧɜɞɡ, ɖ Ŭɨɜɖůɖ ǘɤɜ Ŭ ɚɏɤɜ ǘɤɜ ǘɞɉɏɤɜ ɔɚɡɘɧɕɖɠ (GLUT4) ɘŬ ɖ ŬɚɚŬɐ ǘɖɠ ůɤɛǘɓɐɠ ůɨůǘǘůɖɠ ůŬ ɏɜŬ ´ɉɜůɧɉɞ ɛɡɥɧ Ŭ ɧ ɧǘɜ ɚɑ ɩ ŭɖ ǘ´ɞ, ŭǘɜɜɞɡ ɧǘɜ Ŭɡɜɞɨɜ ǘɖ ŭɉŶůɖ ǘɖɠ ɜůɞɡɚɒɖɠ. ɖ ůǘǘɧůɞ, ɖ Ŭɡɜɖɛɏɜɖ Ŭŭɞɚɡǘǘɉɜɐ ɛǘǘɓɞɚɜɐ ɛǘǘǘɉɞ´ɐ ǘɖɠ ɔɚɡɘɧɕɖɠ ɔɚŬ ǘɞɜ ŬɜŬɡɕɖɛǘǘɜɛɧ ǘɞɡ ɕɉɖůɜɞ´ɞɜɨɛŬɞɡ Ŭ ɧ ǘɖɜ Ŷůɘɖůɖ ɛɡɥɐɨ ɔɚɡɘɞɔɧɜɞɡ (ɛɖ ɞɜŬŭɤɜɐ ´ɞɉǘǘ) ɘŬ ɖ ɛŬɤ ůɖ ǘɞɡ ɞɚɜɞɨ ůɤɛǘɓɐɨ ɘŬ ɘɡɉɑɤɠ ǘɞɡ ŬŭɞɚɜɜɘŬɨ ɚɑ ɩ ŭɞɡɠ ɜǘɨ, ɤɠ Ŭ ɞǘɚǘɛŬ ǘɧůɞ ǘɖɠ ŬɉɧɓɚŬɠ ´ɉɞ´ɧɜɖůɖɠ ɧůɞ ɘŬ ǘɖɠ ´ɉɞ´ɧɜɖůɖɠ ɛŬ ŬǘǘǘǘǘůɖɆ ǘŬɒǘǘǘɓ ɧǘɜ Ŭ ɞǘǘɓɨɜ ǘɞɡɠ ŭɨɞ ɘɨɉɜɞɡɠ ɘɞɜɨɠ ´ɉŶɜɞǘɠ ´ɞ Ŭɡɨɜɞǘǘɓ ɔɚŬ ǘɖ ɓŬǘɤ ůɖ ǘɖɠ ŭɉŶůɖɠ ǘɖɠ ɜůɞɡɚɒɖɠ.

2.5. Ɇɡɛ´ɉŶůɛǘǘǘ

Ȼ ´ɉɞɖɔɖɖǘɨɤŬ ůɤɛǘɓɐ Ŷɘɖůɖ ɘŬ ɖ ɛŬɉɞ´ɉɧǘɛɖ ´ɉɞ´ɧɜɖůɖ ŬɒŬɜ ŭɡɜǘǘɧɜ ɜŬ Ŭ ɖɉŬŶůɞɡ ɖǘǘɓŶ, ɘɡɉɑɤɠ ɛɏůɤ ǘɖɠ ɓŬǘɤ ůɖɠ ǘɖɠ ŭɉŶůɖɠ ǘɖɠ ɜůɞɡɚɒɖɠ, ǘɖɜ ɞɛɞɜůǘǘǘɓɐ ŭɡɜŬɛɜɐ ǘɖɠ ɔɚɡɘɧɕɖɠ.

¢ Ŭg₃dɛy₃d ɛgupe Ŭɛ¥Ú̊ůd, ɵ ɛů₃Ŭ₃i ÚĴɵgf Ŭɟ₃dɛɦgf əŬ₃ d ɛů₃Ŭ₃i ÚĴɵd ¥₃dŮůd ůÚl ɛŮɛbɟ¥₃d Ú̊ɤ₃ g´ɛŭɵɛy¥ɤ₃ Úl̊gf ɔəgəɦɛdgf (GLUT4), əŬ̊ıgf əŬ₃ d Ů₃Ůɟɔɵ´ɵdůd Ú̊ɛg ɛdɛgŬ₃ůɛɛi Ŭ₃Ŭ´əeɟɤůdgf Ú̊ɛg ɛɟdůɯɛɵ´ɵɯgɛy₃ɵeg ɛgupɵi ɔəgəɵɔɦ₃ɵeg ´ɵg ´Ŭɟ₃ÚÚl̊ɟɵɛi₃ÚĴ₃ ɛŮŰ¥Úl̊₃ ¥ůəd̊ůd, ű̊Ŭ₃ůŰŰ₃ɦĴů₃Ůgdɛi₃ɵ₃ÚĴ₃ ´Ůɟ₃ůůɦĴŰĴɵɛɔəŬÚl̊₃ Ŭg₃dɛy₃d Ůg₃Ů₃ůɛdd̊ůdŬ Úl̊gf ɯůɵgəɯdgf, Ŭ₃Ů₃¥ɟÚl̊Ű Úl̊gf ű̊gůəɯɛf əŬŰ¥ůÚŰůdgf Ú̊ɛg ŬŰɦɛɵg. qůŰɦůɵ, ůÚ̊ɵggf Ŭdəd̊Ú¥gf əŬ₃ ůŰŰ ɔgɛ₃Ŭůɛɛy₃Ŭ ¥Ú̊ɛɛŬ Ú̊ɛ ɛy₃Ůd̊ɵgf Úl̊gf ɓŮə₃Ůɤ ůdgf Úl̊gf Ůg₃Ů₃ůdd̊ůdŬf Úl̊gf ɯůɵgəɯdgf (insulin sensitivity) Ů₃ɯŬ₃ ɛů₃Ŭ₃i ÚĴɵɛ ůŮ ůɛ¥ůd ɛŮ Ú̊ɛggf Ŭ₃i ɛ₃ŬůÚ̊ɛggf, g´ɵ₃ɵı ₃ŰŰf´Ůɟ¥əədəŬy₃Ŭ Ů́ɔ́ɟɦůdŮÚ̊ɛ ɦűŮ₃ɵgf Úɤ₃ ´ɟɵəŬ₃ɵi ɛŮ₃ɤ₃ Ŭ ɦ Úl̊₃ ´ɟɵ´ɦ₃důd ´ɟɵůŬɟɛɵɔı₃. Ч₃ɵůŬɟɛɵ¥gf ɵɵ´ɵdŮf´ɯdŬ₃ɦ₃ Ŭg₃¥Y₃ɵg₃ əŬ₃ Úl̊ ɛy₃əůÚl̊ Ů ɑ̈ŭɟŬůd Úl̊gf ɯůɵgəɯdgf (insulin responsiveness).

Ɓɵ əgɟɦŰĴɵɵ ´Ůɟ¥₃ɵ₃ÚŰf ɵɵ ɵ´ɵɵɵ Ů£´əɣəɵ₃ÚŰ₃ůÚl̊ ɓŮə₃Ůɤ ůd Úl̊gf ŭɟ¥ůdgf Úl̊gf ɯůɵgəɯdgf, ɤgf Ŭ ɵŰɣə₃Ůɛ Ú̊ gf ɛŮə₃ɟɵ´ɟɦdŮɛdgf´ɟɵ´ɦ₃důdgf, Ů₃ɯŬ₃ Ŭ) d ɓŮə₃Ůɤ ůd Úl̊gf ɛŰŰŰɛɟ¥gf Úl̊gf ɔəgəɦɛdgf (GLUT4), ɓ) ɵ Ŭg₃dɛy₃ɵgf ɛd ɵ₃Ů₃ŭɤ Ůɵɦgf ɛŰŰŰɓɵəəůɛɦgf Úl̊gf ɔəgəɦɛdgf (Ŭ ɵŰŰɛdůgůd ɔəgəɦɛdgf-ůi₃dŮůd ɛgupɵi ɔəgəɵɔɦ₃ɵeg), ɔ) d ɛŮɤůd Úl̊gf əɣı ŭɵggf ůɤɛŰŰəɛf ɛ¥ɛŬgf əŬ₃ d ɓŮə₃Ůɤ ůd Ú̊ɛg ɛŰŰŰɓɵəəůɛɵi Ú̊ɛg əɣɵggf əŬ₃ŭ) d ɛů₃Ŭ₃i ÚĴɵd Ů₃ŭůÚ̊ɛəɛ Úl̊ d´ŰŰəɛf ´Ůɟɵɛɛf ɔəgəɦɛdgf. Ɓɵ ´Ůɟ₃ůůɦĴŰĴůgf ɣɟůg₃ůgf ŭŮɯ₃ɵeg₃ ɦŰ₃ d ɓŮə₃Ůɤ ůd Úl̊gf əůŰ̊ɵggɟɔdŰgf Ú̊ɤ₃ ɛdɛgŬ₃ůɛɛi Ŭg₃Ú̊₃, ɦůɵ₃ Ŭ̊ɛɵɟ¥ Úl̊₃ Ůɑ̈ɟŬůɛ Ú̊ɛggf ůŮl̊ ŭɟ¥ůd Úl̊gf ɯůɵgəɯdgf, Ůɯ₃Ů₃ əgɟɑ̈ɤgf Ů Ű́ɛŰɣə₃Ůɛ Ů ´ɟɵůŬɟɛɵɔı₃ Úl̊gf Ŭ₃Ůɟɦɓɵɯgf ´ɟɵ´ɦ₃důdgf, ɯŭ₃Ůd̊Ůɟ Ů Úl̊gf ɣ₃Ú̊₃dgf ´ɟɵ´ɦ₃důdgf. Ч₃Ůɟɦə₃Ů Ŭg₃Ů¥ ű̊Ŭ₃ůŰŰ₃ ɦŰ₃ dŮÚ̊əɛ Ů ɑ̈ŭɟŬůd ůÚl̊ ŭɟ¥ůd Úl̊gf ɯůɵgəɯdgf ɛ´ɵɟ₃Ůɯ₃Ű´ɟɵəŬ₃ɣůŮɣəŬ₃ d Ŭ₃Ůɟɦɓɵɯg Ú̊ɤ₃ ´ɟɵ´ɦ₃důdgf, ɦ´ɤgf Ŭg₃Ů̊ɛ Úl̊gf ´ɟɵ´ɦ₃důdgf ɛŮ Ů₃ŭůÚ̊ůd. Ɓɵ əɵɟɤɵɵ g´Ůɵdg₃ɵɵ Úl̊gf dŮÚ̊əɛf Ů ɑ̈ŭɟŬůdgf Úl̊gf´ɟɵ´ɦ₃důdgf ɛŮŰ₃ůŰŰůd dŮɤɟɵɵ₃ÚŰ₃ ɦŮ₃ Ůɯ₃Ů₃ ɵ ɛd ɵ₃Ůəɤɤ₃Ůəɦgf ɛŮŰŰɓɵəəůɛɦgf Úl̊gf ɔəgəɦɛdgf (Ŭ ɵŰŰɛdůgůd ɔəgəɦɛdgf-ůi₃dŮůd ɛgupɵi ɔəgəɵɔɦ₃ɵeg), əŬ̊ıgf əŬ₃ d ɛŬ₃ɤɟɵ´ɟɦdŮůɛd ´ɟɵůŬɟɛɵɔı₃ Ů₃ɯůÚ̊ɛ Úl̊gf ɛgupɵf ɛ¥ɛŬgf əŬ₃ ɛů₃Ůɤ ůdgf Ú̊ɛg ůgů₃ɵəɵɵ₃Ůɵɵi ůɤɛŬŰəɛi əŬ₃ Ů₃ŭɵəɵɵəɵŬɵɵi əɑ́ɵggf.

Æəŭɦgf Úl̊gf ´Ůɟ Ŭ ¥ɟŬ ŭəŮɟůi₃důdgf Ú̊ɤ₃ ɛdɛgŬ₃ůɛɛi₃ ´ɵg Ů£´ɑ̈¥ɵɵ₃ÚŰ₃ ůÚl̊ ɓŮə₃Ůɤ ůd Úl̊gf ŭɟ¥ůdgf Úl̊gf ɯůɵgəɯdgf, ɤgf Ŭ ɵŰɣə₃Ůɛ Ů Úl̊gf ůɤɛŰŰəɛf ¥ůəd̊ůdgf əŬ₃ ´ɟɵ´ɦ₃důdgf, ɯŭəŮd̊Ůɟɵɛ Ůɟůg₃dŮəəɦ Ů₃ŭəŮú̊ɤɟɵɵ dŮ ɛ´ɵɟɵi ůŮ₃Ů₃ŭəŮɟůd Ŭdəd̊Ú₃ Ů₃ŭŮɟɦɓɵɯ₃ əŬ₃ d ůi₃ɔəɟ₃ůd Ŭdəd̊Ú₃ Ů₃ŭŮɟɦɓɵɯ₃ ɓ Ŭdəd̊ɛ¥Ú̊₃ əŬ₃ Ůůŭəɦŭɟ₃Ů Ŭdəd̊Ú₃ ŭɟɦɛɤ₃ ÚŰ₃ɵi ÚĴÚŰgf əŬ₃ Ů₃Ú̊ɛɵɛf Ú̊ɛg əəŬůəɵɵi Ŭdəd̊Ůəɛɵi, ɦůɵ₃ Ŭ̊ɛɟ¥ Ú̊ɛf ´ɟɵůŬɟɛɵɔı₃ (Ů₃ŭŮɟɦɓɵɯ₃, ŭŮɟɦɓɵɯ₃, ůɤɛŰŰəɛf ůi₃ůŰŰůdgf) ´ɵg Ů¥ɟɯɵ₃ÚŰ₃ ɛŮ Ú̊ɛggf ŭi₃ɵ Ůg₃Ú̊ɵi gf

ŭɘŬΰɞɟŮΰɞɨ ɠ Űɨ ´ ɞɡɠ ´ ɟɞ´ ɧɜɖůɖɠ, Ŭɚɚ-Ɏ
əŬɘ ɞ ɟ ɧɚɞɠ Űɛɡ ´ɞůɞɨ Űɖɠ Ɏɚɘ́ ɖɠ
ůɣ ɛŬΰɚɐɠ ɛ ƔɕŬɠ əŬɘ Űɛɡ ´ɞůɞɨ Űɛɡ

ůɣ ɛŬΰɚɞɨ ɚɑ́ ɞɡɠ ŬɡŰ ɜ Űɣ ɜ Ŭɗɚɖ Ű ɜ
ůŰɖɜ ɞɛɞɝůŰŬΰɚɐ ŭɡɜŬɛɝɐ Űɖɠ
ɔɚɡəɧɕɖɠ-ŭɟ Ɏůɖ ɝůɞɡɚɑɖɠ.

3. ϗ ΆǕΒ ϥΒΈ

3.1. ϥϸϑϡǕϵϩϵǕϧϑ

Βϑǘϊϑϡ Ǖϵϩϵ Ǖϧϑ ϊϑϑϑϸϡ ϳ ůǕϧ ǖϭ εǕϧϋǖϭ Ǖϩǖϸ ϸǖǖϧ 23 Ǖϧϸϑϡϑϑ ϩϑǖϛ ΤǕϩϑΫůϧϑ ǕϭǕϧϑϧǗϋϛ ϛϑϡǕϛ 21-29 ǕǗ ϧ. ϳ ϩ Ǖϩǖϸ ϛ ϑϑǖ Ǖϭϑϭǖϋϛ Ǖϧǖϸϑϸϛ (3000ε-10000ε) ϑǕϧ ϑϑǖ Ǖϭϑϭǖϋϛ ǖϳϩεϧ ǕǕϭǖǕϛ (100ε-400ε & ϋϧǕϛ Ϋϑǖϭϛ ǖϧϑ εϸϑϑϑϑ) ǖϧϑ ϑϑǕůϧϑϑ Ǖϭϑϭǖůϧϑ Ǖ ϑǗϋϑǕůǕϧ ǖϛ ǖϑ ϳǕϧǕǕϸϸϋϛ ϑεΫǖǕϛ, Ǖϧι ϑϑ ϑϩϑϑϑϑ Ǖ ǕΫǖϭϧ ϑεΫǖǕǕϧϋϑϑϑ.

ϕ Ǖϑϳϑǖϸϳϑ Ǖ Ǖ ϑϑϑϸϛǖϧ Ǖϭϑϭǖ ϧ ǖϧ ǖϑ ϳǕϧǕǕϸϸϑι ϧ ϑεΫǖϧ ϸǖǖϧ ϭ ǖϩϧǕǖϩǖϭǕ ůϩεεǖϧϑϸϛ Ǖϩǖ ϧ, ůεǖϧǕ εǕ ǖϭϧ Ǘϋϑϑůϧ Ǖϭϑϭǖϸϸ ǖϧϑϛ Ǖ ϑϭůϭ, ůǖϧϑϛ ϭεϑǖϧϑϑϑ ϛϸ ǖϧϑϑϑ ϛ Ǖϧι ϧǖϛ ǖϧϑ ϳǕϧǕϑϸϧϑϑ ϳϳ ǖǕϭϑϸεǕǖϛ ůǖϧϑϑ. ÿ ůϑϧ ǕϑϑϳΫ ǖϧ ϑϳϑǖϸϳϑ Ǖ ϑϑϑϸϛ ǖϧ ǖϑϑϑǕϵϩϵǕϧϧ ǖϭϛ ϑεΫǖǕϛ Ǖϧϋϑϑϑ ϸǖǖϧ ϭ ǕϧΫϑϑůǖϭ ϋϧϛ εϋǗϑǕ ϑǕϧ ϩϑϑ ǖǕϧǖϸϸ ůϩεεǖϧϑϸ Ǖϩǖ ϧ ůǕ ǖϑΫϑϑǕϛ εϑϳǖϋϛ ǖϩůϑϸϛ ǖϳǕůǖϳϑϩǖϭǖǕϛ ǕǕ ǖϑ ǕǕǕϩǕǕ ϑϳϩϑǕ. Βϑ Ǖϭϑϭǖϋϛ ϸǖǖϧ ϩϑϑϑ ǕϑϑǕϳǕεεϋϧϑϑ ůǕ ǕϧǕϧϧϳϑεϋϧϑϑϛ Ǖ ϩ ǖϧ Ε.Ά.ǖ.ϳ .Ε. Ǖϭϑϭǖϸϑϑ ϛ ůϩϑϑϩϑϑϑϛ εϋůϳ ǖϧ ϑϑϑϧ ϑǕϧ Ǖ ϑϋϑϭϭϑǕϧ, Ǖϧι ǕǕϧϑϑ ǖϭϛ ϑεΫǖǕϛ Ǖϧϋϑϑϑϑϸǖǖϧǖϑǖϭǖϋϛ ǖϑǕǖϩϳϧ ǕϧǕ ϑǖϭεϑǕι ϧ ůϑϑϑ ϧ.

Τ ǕϧǕϛ Ǖ ϩ ǖϧϑϛ ǖϑϑϑǕϵϩϵǕϧϑϑϛ ǖůϧ ϑΫ ϧϑǕ ǕǖϩϛǕ ϩ ϋϧǕϧ Ǖϭϑϭǖϸ ǖϭϛ ϳǕϧǕǕϸϸϑϛ ϑεΫǖǕϛ ǖϧ ǖϳϩεϧ ǖǕϭǖǕϛ ϑ ϑϑϑϑ, ϩεϧϛ, Ǖ ǕϧǕǕ ϩ ǖϧ ϑΫ ϧϑεǕǖϭϧ ϭεϳǕǖϧ Ǖϑϑǖϑϑϑϸůϧ ϧ ϑǕϧ ǖϋůůǕϳϑ ϭεϳǕϛ ϳϑ ǖϭ ǖϑϑϑϸǕůϭǕ Ǖϧϑϑϸϛϑϑϩϑϑϭϛ (OGTT test). ΆϑǕϑϩǖǖϳǕ ϑϑǕ ǖϧϑϛ Ǖϭϑϭǖϋϛ ǖǕϧ ǕϧǖϋϳϭϭϑǕ ϑϸϳϭ Ǖ ǕϧϑϳǕϩεϋϧϧ ϑϩůϑ ϧ (ǕϧǖϧϑϑϑΫ ůǖǕϑǕϧǖϸ), ϳϳǕϧ ϑΫ ϑϑϧ ůϩεϳϑϭϳεΫǖϧ ǖϑǖǕϑǖϸϛ (ϳϳǖǖϧǕϛ, ϩǖǖΫϧϭϳǕϧǕϛ), ϑϑϩϧǖǖεϑι ϧ ϑǕϧ ůϑǖϸϳϑϑ (Fe). ¢ ǖůϭ, ϑ ůϑϑϳϩϛϑǕϧϑϑ ϳϑǕϧϑϑ ϑϑǖϩϧϑϑ ǖϭϛ εǕϧϋǖϭϛ ϋϑϑǕϧ ϑϧϳůǖΫ ϑǕϧ ǕϧϭϑϸϭϭϑǕϧ ůǕ ϩϑϑϑϛ ǖϧϑϛ ǖϑϑϑǕϵϩϵǕϧϑϑϛ ϑǕϧ ϳ ϑϑϳΫǖǖϭǕůǕǖϸϸ ǖϸϑϳůϭ ůϩϑϑǕǖΫϭǕůϭϛ ǖϧϑϛ ϳϳϑ ǖϧ ϋϧǕϳϧϭ ϑ ϳϑǕǖǖϸϸϑϸϛ ǖϑǕǖϑǕůϭǕϛ (ƟǕϳΫϳǖϭεǕ 8.7).

3.2. ϥϸǕǖϑǕůϭǕ ǖϭϛ εǕϧϋǖϭϛ

ϳ ϳϑϑΫ, ϑϑǕ ϧǕ ǕϧǖεϭϭǕι ǖϧ Ǖ ǖǕϑ ǖϭϛ ǖϩůϑϸϛ ϑǕǖΫůǖǖůϭϛ ϑǕϧ ǖϧ ϸϸϑϑϑϑϩ ǖϩϧǕϸϑϩ ǖϧ ǖϑϑϑǕϵϩϵǕϧϧ, ǖϧϭǖϧϑ ϛ ϑϸϑϑϭϭϑǕϧ ůǕ ǖϭϑ ǕϳϑϑǖϑϑϑǕůϭϛ εϋůϧ ǖϧ ϑ ϑϑϧ ϋϧϑǕ Ǖ) εϋǖϳϭůϭ ǖϭϛ εϋϧůǖϭϛ (VO2 max) ϑǕϧ ϑϑϳϩǖǕϭϛ ϳϩůϑϭϧϭϛ ϑϧϩϑϩϧϑϩ (PVO2) ϑǕϧ ϳϑůǖϑϳϑůεϩϛ ǖϧϑ ǕϧǕǕϳϩϸϑϑ ǕϧǕ ϧǕϩůǖϸϑϑ ϑǖǖϧ ǖϑϑϑ (ϳ ϳ Τ), εǕ ǖϭ εϋϭϑǖϑ Ǖϳϑϑů ϳϳϑεϋǖϳϭůϭϛ ϑǕϧ ϸ) εϋǖϳϭůϭ ǖϭϛ εϋϧůǖϭϛ ϳ ǕϳǕϧϧϑϸϛ (PP) ϑǕϧ ǖϑǖǖϸϳϭůϭϛ (MP) ǖϭϛ εϭϑǕϧϑϸϛ ůϑϑ ϑϛ ǖϧ ϑΫǖϧ Ϋϑϳϧ εǕ ǖϭϧ ǕϧǕǕϳϩϸϑǕ ǖϑϑϑǕůϭǕ Wingate. Ά ϑůϭϛ, εǕ ǖϭϧ ǖǖϧϑϸ Ǖ ϑϳϳϑǖϭůϸεǖϳϭǕϛ Ǖϧǖϧϑιϧϳϳϑϑϑϸϛ ǕϧϋϳϑǕϧǕϛ (Dual Energy X-Ray Absorptiometry-DXA) ǕϧǖϧϸϭϭϑǕ ϭ ůϧεǖϧϸ ůϭůǖůϭ ϑǕϧ ǖϧ ůϩϧϑϑϑϑϩ ůϧεǖϧϩ ǖϧϑϛ ϸΫϳϑϛ.

Εǖϭ ůϩϧϋϑǕϧǕ ǕϧǖϧϸϭϭϑǕ ϭ ϑεϑϑϧůǖǖϸϸ ǖϩϧǕεϑϸ ǖϭϛ ϑϑϩϑϩϵϭϛ ϑǕϧ ϭ ǖϳΫůϭ ǖϭϛ ϑůϑϩϑϑϭϛ εǕǖΫ ǖϭ ůǖϧεǕǖϸϸ ϑϸϳϭ ůǖǖϭǕϳϸϛ ϳϑůϩǖϭǖǖϛ ϑϑϩϑϩϵϭϛ (OGTT-75g) ϑǕǖΫ ǖϭϧ ϭϳǕεϭǕ. Εϩϑϑ ǕϧϳϑϋϧǕ, εǕǖϳϸϭϭϑǕϭ ůϩϑϑϋϧǕϳϧůϭ ϑϑϩϑϩϵϭϛ ϑǕϧϭ Ǖ ǕϧǕϩϭϋϳϧůϭ ϑůϑϩϑϑϭϛ ůǖϧ ǕεǕ ϑǕǖΫ ǖϭ ǖϑΫϳϑǕϧǕ ǖϭϛ 2ϧϳϭϛ OGTT ǖϑϑϑǕůϭǕϛ ϑǕϧ ϑϑϑϑϑůϭϭϑǕ ϭ Ǖϧǖǖ ϩϑϳϑůϭ ǖϭϛ ϑůϑϩϑϑϭϛ ůǖϭ ϑϑϩϑϩϵϭ (ϥAUCI / ϥAUCG), ϑ ϳϩϭεϩϛ ǖϑΫϭůϭϛ-εǕǖǖϸϑϑůεϩϛ ǖϭϛ ϑϑϩϑϩϵϭϛ ϳϑϑϛ ǖϧϑϛ ůǖϧϑϛ (M), ϭ ůϑǖǖϸϸ ϳǕϑǕϳϑϸ Ǖϧǖůǖǖůϭůǖϭϧϳϩůϑϭϳϭ ǖϭϛ ϑϑϩϑϩϵϭϛ (rel-R) ϑǕϧ ϭ ůϩϧϑϑϑϸ ǕϧǖůǖǖůϭϋϧǕϧǖϧǖϭϛ ϑůϑϩϑϑϭϛ (Tot-I-R).

ƟϳϑǖϭϧϋϧǕϳϧϭǖϭϛ εǕϧϋǖϭϛ ϳϑϭϑϭϭϑǕ ϑǕ ǖϧεǕϳϸ ϳϑǖϑϳϑϸ ϑǕϧ ϑϳǕ ǖϸ Ǖϧϭεϋϳϧůϭůǖϧϧ ǕϧΫůǖϧǖǖ

ŭɞǝǝ Ŭǩɧɛ Ůɜɞ, Űɧůɞ ɔǝŬ Űɞ ´Ůɟǝ Ůǩɧɛ Ůɜɞ Űɤ ɜ ´ŮɟŬɛ ŬŰǝɩ ɜ ŭǝŬŭǝ ŬůǝɁ ɜ ɧůɞ ǝŬǝ ɔǝŬ Űɠɠ ´ɟɞɧ ´ɞɗɣůŮɠ Űɤ ɜ ɛŮŰɟɐůŮɤ ɜ. Ƀǝ ŭɨɞ Ůɟɔɞŭɞǝɛ ŬůɗŬɠ (ŬŮɟɧɓǝŬ, ŬɜŬŮɟɧɓǝŬ ǝůɢɨɠ) ɣɔǝɜŬɜ ůŰɞ ŮɟɔŬůŰɐɟǝ Ʌɟɔɞűɡůǝǝɔɗ ŬɠŰɞɡ ȼ.Ʌ.ū .ɟ .ɟ . ɟ ɗɐɜŬɠ, Ůɜɩ ɗ ŭǝŬŭǝŬůɗŬ ŮǝŰɛɗůɗɠ Űɗɠ ůɤ ɛŬŰǝɐɠ ůɨ ůŰŬůɗɠ ŰŮɞɜǝɐɠ DXA ɣɔǝŮ ůŰɞ ɟ Ůɟɞǝɧ´Ůǝ ɆŬɜŮ ǝůŰɐɛǝ ɟ ɗɗɜɩ ɜ. ¢ ´ŮɟŬɛŬŰǝɐ ŭǝŬŭǝŬůɗŬ Űɗɠ Ŭɜɞɞɐɠ Űɗɠ ɔǝɡǝɧɛɗɠ ǝŬǝ ɞǝ Ŭ ŮɟŬŰɗŰɗɠ ɓǝɞɗɛǝɣɠ ŬɜŬǝɨ ůŮɜɠ ŬɛŬŰɞɠ ǝŬǝ ɔǝɡǝɧɛɗɠ ɣɔǝŬɜ ůŮ ǝŭǝɤŰǝɧ ɛǝɟɞɓǝǝɔǝɧ ŮɟɔŬůŰɐɟǝ (CLINITEST), Ůɜɩ ŬɡŰ ɜ Űɗɠ ǝůɞɡǝɞɗɠ ůŰŬ ɓǝɢɗɛǝŸ ŮɟɔŬůŰɐɟǝŬ Űɞɡ ɆɡɜŮŰŬɟ ǝůɛɢɨ ɀ ǝɟɞɓǝǝɧɔɤ ɜ.

3.3. Ʌɟɔɞŭɞǝɛ ŬůɗŬ ŬŮɟɧɓǝŬɠ ǝůɢɨ ɞɠ (´ɟ ɧůǝɗɣ ɗ ɞǝɡɔɧɜɞɡ)

3.3.1. Ɇɟɤ Űɧǝɞǝǝɞ Ůɟɔɞŭɞǝɛ ŬůɗŬɠ, ɛŰŮɟɞɨ ɛ Ůɜɞǝ ´ŮɟŸɛ ŰŮɟ ɞǝ

Ɇɟǝ Űɗɜ ɣɜŬɟɜɗ Űɗɠ Ůɟɔɞɛɣ Űɟ ɗůɗɠ ŬŰǝŮɟɩ ɗɗǝŮ ɢɟɧɜɞɠ ɔǝŬ Űɗɜ ŮǝɞǝŬɤ ůɗ Űɤ ɜ ŭɞǝǝɛŬǩɧɛŮɜɤ ɜ ɛŮ ŰŬ ɧɟɔŬɜŬ ɛɣŰɟɗůɗɠ ǝŬɗ ɠ ǝŬǝ ɔǝŬ ɣɜŬ ɞǝǝǝɧǝŮ Űɞ ɞɣůŰŬɛŬ ´ɞɡ ´ŮɟǝŮǝŸɛɓŬɜŮ Űɟɣɜǝɞ ůŰɞ ŭŬ ŮŬɞŮɟɔɧɛŰŮɟɞ (3-5 ǝŮ ŰŸ, ɣɜŰŬůɗɠ ɛǝɟɧŰŮɟɗɠ ŬɡŰɐɠ´ɞɡ ŬɜŰŬůŰɞǝɞɨ ůŮůŰɗɜ ŮɟɞɐŰɗɠ Ůɟɔɞŭɞǝɛ ŬůɗŬɠ) ǝŬǝ ɛɡɸɣɠ ŭǝŬŰŸůŮɠ (3-5 ǝŮ ŰŸ). ȼ ɞ ´ɟɤ Űɧǝɞǝǝɞ Ůɟɔɞŭɞǝɛ ŬůɗŬɠ ɔǝŬ ɧǝɞɡɠ Űɞɡɠ ŭɞǝǝɛŬǩɧɛŮɜɞɡɠ ɐŰŬɜ Űɞ ɗǝɞ, ŬɡɜŸɜɞɜŰɠ Űɞ ɓŬɗɛɧ ŭɡůǝɞǝɗŬɠ Űɗɠ ɛɡɸɐɠ ´ɟɞů´ŸɗŮŬɠ ǝŸɗŮ ɣɜŬ ǝŮ Űɧ. Ƀ ɓŬɗɛɧɠ ɧɛɤ ɠ ŭɡůǝɞǝɗŬɠ ůŰɗɜ ŮɟɞɐŰɗɠ Ůɟɔɞŭɞǝɛ ŬůɗŬɠ ŭŮɜ ɐŰɜ ɗǝɗɠ ɔǝŬ ɧǝɞɡɠ Űɞɡɠ ŭɞǝǝɛŬǩɧɛŮɜɞɡɠ. ɆɡɔǝŮɟɛɣɜ ɔǝŬ Űɞɡɠ ŬɗǝɗŰɣɠ ŬɜŰɞɢɐɠ, ɗ ŰŬɨ ŰɗŰŰ ǝŬǝ ɗ ǝǝɐůɗ ´ɞɡ ɢɟɗůɛɞ´ɞɛɗɗǝŮ ůŰɗɜ Ůɟɞɐ ɐŰɜ ŬɜŰůŰɞǝɞŬ 10 km/h (167 m/min) ǝŬǝ 0% ǝǝɐůɗ. ɆŰɗ ůɡɜɣɢŮŬ, ŬɡɜŬɧŰŰɜ ǝŰŸ 2% ɗ ǝǝɐůɗ ůŰɞ ŭŬ ŮŬɞŮɟɔɧɛŰŮɟɞ Ůɜɩ ɗ ŰŰɢɨ ŰɗŰŰ ´ŮɟɣɛŮŮŮůŰŰɗŮɟɐ (ɆŮɟŸɟŰɗɛŬ 8.8). ŭǝŬ Űɞɡɠ ɡ´ɧǝɞ´ɞɡɠ ŭɞǝǝɛŬǩɧɛŮɜɞɡɠ (ɞɛŸŭŬ ŭɟɧɛɤ ɜ ŰŰɢɨŰɗŰŰɠ & ɞɛŸŭŬ Ŭǝɣɔɞɞɡǝɠ) ɗ ŰŰɢɨ ŰɗŰŰ ǝŬǝ ɗ ǝǝɐůɗ Űɞɡ ŭŬ ŮŬɞŮɟɔɧɛŰŮɟɞɡ ůŰɗɜ ŮɟɞɐɐŰɜ ŬɜŰůŰɞǝɞŬ 5 km/h ǝŬǝ 0% ǝǝɐůɗ. ɆŰɗ ůɡɜɣɢŮŬ ǝŬǝ ɛɣɢɟǝ Űɞ ɣǝŰɞ ǝŮ Űɧ Űɗɠ ɛɡɸɐɠ ´ɟɞů´ŸɗŮŬɠ ɗ ŰŰɢɨ ŰɗŰŰ ŬɡɜŬɧŰŰɜ ǝŰŸ 1 km/h ɢɤɟɗɠ ɜŬ ŬɡɜŸɜŰŰǝ ɗ ǝǝɐůɗ. Ȯǝ ŰɗŰŰ ɗ Űɨɜɗůɗ Űɞɡ ɓŬɗɛɧ ŭɡůǝɞǝɗŬɠ Űɗɠ Ůɟɔɞŭɞǝɛ ŬůɗŬɠ ůɡɜ´ŰůŮ ɛŮ Űɞ ɓŬɗɛɧ ŭɡůǝɞǝɗŬɠ ɧ´ɞɡ ɜŬɞɗůŬɜ ɞǝ ŬɗǝɗŰɣɠ ŬɜŰɞɢɐɠ (ɆŮɟŸɟŰɗɛŬ 8.9). ¢ ´ɟɞɓǝŮ ɧɛŮɜɗ ŬɜŮɟɔŬǝŬɐ Ŭ ŬɗŰɗůɗ (mL Ƀ2/kg/min) ůŰɞ 13ɞ ǝŮ Űɧ Űɗɠ Ůɟɔɞɛɣ Űɟ ɗůɗɠ Űɤ ɜ Ŭɗǝɗ Ű ɜ ŬɜŰɞɢɐɠ ǝŬǝ Űɤ ɜ ɡ´ɧǝɞ´ɤ ɜ ŭɞǝǝɛŬǩɧɛŮɜɤ ɜ ɡ´ɞǝɔɐɗɗǝŮ ůŰŰ 75 mLO2/kg/min ǝŬǝ 60 mLO2/kg/min, ŬɜŰůŰɞǝɞŬ.

Ƀǝ ǝɨɟǝŮɠ´ŮɟŸɛŮŰɟɞǝ´ɞɡ ɛŮɟɐɗɗǝŬǝ ǝŰŸ Űɗɜ Ŭɜɤ Űɣɟɤ Ůɟɔɞŭɞǝɛ ŬůɗŬ ɐŰŬ ɗ *ɛɣɔǝůŰɗ ǝŬǝ ǝɛɟɡůŰŬŬ ´ɟɧůǝɗɣ ɗ ɞǝɡɔɧɜɞɡ (VO2 max & PVO2, **ŬɜŰůŰɞǝɞŬ**)*, Ůɜɩ ´ɟɞůŭǝɟǝɐŰɗŮ ǝŬǝ Űɞ ***ŬɜŬŮɟɧɓǝ ŬɜŬ ɜŬɡůŰǝɧ ǝŰŰ ŭǝǝ*** ɗɠ ǝɟǝŰɐɟǝŬ Ů ɗŰɡɜɗɠ Űɗɠ ɛɣɔǝůŰɗɠ ´ɟɧůǝɗɣɗɠ ɞǝɡɔɧɜɞɡ ɗŮɟɐɗɗǝŬ: Ŭ) Ůɛű ŸɜǝůɗůŰɗŬɠ´ɞǝɨɛŮɜɞɡ ůŰɗɜ ǝŬɛ´ɨǝɗ Űɞɡ ǝŰŰŬŬǝɤ ɛɣɜɞɡ ɞǝɡɔɧɜɞɡ, ɓ) ŬŬ ɜŬɡůŰǝɧ ´ɗǝǝɞ (>1,1), ǝŬǝ ɔ) ǝŬɟŭǝŬǝɐ ůɡɜɧŰɗŰŰɗ ɞ´ɞŬ ŭŬɜ ŭǝűŬŮɟŮ ´ŮɟǝůɧŰɟɞ Ŭɧ 10 ´ŬǝɛɞɨɠŬɧ Űɗɜ ´ɟɞɓǝŮ ɧɛŮɜɗ ɛɣɔǝůŰɗ ǝŬɟŭǝŬǝɐ ůɡɜɧŰɗŰŰ ɛŮ ɓŸůɗ Űɗɜ ɗǝǝŬ Űɤ ɜ ŭɞǝǝɛŬǩɧɛŮɜɤ ɜ.

ŭǝŬ Űɞɜ ´ɟɞůŭǝɟǝɛɧ Űɞɡ ŬɜŬŮɟɧɓǝɞɡ ŬɜŬ ɜŬɡůŰǝɞɨ ǝŰɤ űǝǝɨ ɢɟɗůɛɞ´ɞɛɗɗǝŮ Űɞ ǝɟǝŰɐɟǝŬ Űɗɠ ůɡůŰɗɛŬŰǝɐɠ Űɨɜɗůɗɠ Űɞɡ ŬɜŬ ɜŬɡůŰǝɞɨ ǝůɞŭɨɜŬɛɞɡ Űɞɡ ɞǝɡɔɧɜɞɡ (VE/VO2) ɢɤɟɗɠ ´ŮŸǝɗɗǝŬ ɜŬ ´ŮɟŰɗɟŰŰŬ Ũɜɗůɗ Űɞɡ ŬɜŬ ɜŬɡůŰǝɞɨ ǝůɞŭɨɜŬɛɞɡ Űɞɡ ŭǝɞɜŮŬŭǝɞɡ Űɞɡ ŸɜɗɟŬŬ (VE/VCO2) (Davis, 1985). Ɇɨ ɛűɤɜŬ ɛŮ Űɞ Davis (1985) ɗ ɛɗ Ũɜɗůɗ Űɞɡ VE/VCO2 ŭŰůɜŮ ɧŰǝ ɗ ŬɜŬ ɜŬɡůŰǝɞɐ

[illegible] CO2. [illegible] VE/VO2 [illegible] CO2 [illegible] O2. [illegible] VE/VO2 [illegible] VE/VCO2 [illegible]

3.3.2. [illegible]

[illegible] Runrace HC 1200, Technogym, Italy. [illegible] (0%, 10% & 20%), [illegible] (5 km/h & 10 km/h) [illegible]

[illegible] MedGraphic (Cardiopulmonary Exercise System, CPX/D-USA). [illegible]

[illegible] (VO2, VCO2, VE), [illegible] 30 [illegible] (MedGraphic, U.S.A) [illegible] (1 [illegible]: 12%O2 [illegible] 5%CO2, 2 [illegible]: 21%O2 [illegible] 0% CO2).

[illegible] (Technogym, Italy) [illegible]

3.4. [illegible] (Wingate test)

3.4.1. [illegible]

[illegible] 60 [illegible] 80 [illegible] 100 [illegible] (3-4 [illegible]),

´ɐŭdə➢ŸŰłůŮ Ű˛Ůâ˛ű©ɿ˛y˛ ɔɘŬ 3-4 ŭŮ˛ŰŰ˛ɦəŮ ŰŬ Ű˛ł ə➢ŸdŮű©ɿ˛Y˛yG©ɜŰŰ˛ůŬɜ ůə©´ɦ ɜŬ´ŮŰɨ©ɜŮɜ Ű˛ł ɛŮɜŮɜ➢ɨŰŰ˛d ŭg©ɜŬŰɐ ůg©ɜɦŰ˛ł ´Ů˛ɘůŰ˛ɐűɿ ɜ, ŬɜŰɐŮŰɤ´œ©ɜŰŬ˛g´ɐə➢ɨ ɛɘɔ˛ɹɐ ŬɜŰůŰŬůd (0,5 əɘɔɦ). ʐ ŮŰ➢ Ű˛g ɛy➢ɘůŰŰ˛g Ŭ˛gŰ➢g ´˛ɹ©ů´ ➢dŮɘůŰ˛g´ɐ˛ɹɜŮG˛ɹɦɜ©g (5 əŮŰ➢) ɔɘŬ ɜŮɜ©ɨ˛ɹŬůd əŬɜ ɣg©ɘə©ɔɘɘɐ ´˛ɹɐŰŰɐɜɐŬůdŬ ɔɘŬŰł ɜ Ů˛ɹɔɐŭɐəɜɐŬůdŬ.

Ɛ➢ɨɛűɤɜŬ ɛŮ Ű© ´˛ɹɤŰɦəɐəɘ Ű˛łg Ů˛ɹɔɐŭɐəɜɐŬůdŬ˛g Ŭg˛Ű©g ɐɘ ŭɐəɜɐŬɐɦɛŮɜɐɘ ´ɐŭdə➢ŸŰłůŮɜ ɛŮŰ˛ł ɛŮɜŮɜ➢ɨŰŰ˛d ŭg©ɜŬŰɐ ŰŰ©ɨŰ˛łŰŬ ɔɘŬ 30 ŭŮ˛ŰŰ˛ɦəŮ ŰŬ, ŬɜŰɐŮŰɤ´œ©ɜŰŬ˛g ɛɘŬ ůŰŬdŮ˛ɐ Ů➢ɓŸ˛g©ɜůd d ɐ´ɐdŬ ɐŰŰɜ ŬɜŸə©ɔd Ű©g ůɤɛŬŰə➢ɨ Ű©gg˛ ɓŸ˛ɐgg˛ (0,075 kp x kg ůɤɛŬŰə➢ɨ ɓŸ˛ɐgg˛). ɹ ɛy➢ůɤg˛ ´˛ɹɔɜ Ű˛ł ɣɜŬ˛ɜd Ű©g əgɹœg ɛy˛ɐgg˛ Ű˛łg Ů˛ɹɔɐŭɐəɜɐŬůdŬ˛g, ɐ ə➢dŮ ŭɐəɜɐŬɐɦɛŮɜɐɘ ´ɐŭdə➢ŸŰłůŮɜ ɛŮŰ˛ł ɛŮɜŮɜ➢ɨŰŰ˛d ŭg©ɜŬŰɐ Ű©g ´˛ɹ©ů´ ➢dŮɘůŰ˛, ´˛ɹ©ů´ ŬdłɜŰŰ˛g ɜŬ ´ŮŰɨ©ɜŮɜ, ɦ´ɤg ůŰ˛ł ´˛ɹ©dɣ˛ɛŬɜůd, Ű˛ł ɛy➢ɘůŰ˛ł ŭg©ɜŬŰɐ ůg©ɜɦŰ˛ł ´Ů˛ɘůŰ˛ɐűɿ ɜ ɛ➢ůŬ ůŮ 3-5 ŭŮ˛ŰŰ˛ɦəŮ ŰŬ. ʐ ŮŰ➢ Ű© ´ɣ˛ŰgŰ˛ Ű©g ɡ˛ɹɐɜɐɘ©ɨ ŬgŰ©ɨ ŭɘŬůŰɐɛŬŰ©g Ű©´ɐdŮŰɐdd əŮ d Ů➢ɓŸ˛g©ɜůd-ű©ɹŰœ əŬɜ Ÿ˛ɡɐůŮ˛d əŬŰŬɜɦŰŭɐ Ű˛ɤɜ ŭŮŭɐɛɣɜɤɜ Ű˛ł ŭŮŭɐɛɣɜŬ˛g ɔɘŬ ŰŬ ´˛ɹɐŬdɐɹɐůɛɣɜŬ 30 ŭŮ˛ŰŰ˛ɦəŮ ŰŬ. Ɛ➢ŮɦəɑŰ˛ł ŭɘŸ˛əŬůŰ˛łg ŭɐəɜɐŬůdŬ˛g əŬɜ ůŮ ŰŬəŰŬɜY ɡ˛ɹɐɜɐɘ©ɨY ŭɘŬůŰɐɛŬŰŬd ɛguɒɐ ´˛ɹɐů´ ➢dŮɘůŰɦəɤɜ Ű˛ɤ ŭɐəɜɐŬɐɦɛŮɜɤɜ ´ŬɜɐŰ˛g ɜɦŰŰɜ ɛŮŰ©ɜ œɘɛɣɜ©ɨ ŬɜŰ©ɨ ůŰ©ɨ ŰɜŮůɘɜɐɘ©ɨ ɐ´ɐůɦŰ˛łŰŬ ŬɐŬŰ©g (10ɛl), ɔɘŬ Ű˛ł ɛy˛ŰdůdŰ˛łg ůgɔəɣɜŰɤůdg ɔŬɜŬɜŰŬɜɐɘ©ɨ ɐɜɣɐg ůŰ© ŬɐŬ.

3.4.2. ȳ˛ɹɔŬɜŬɛɣŰ˛důdłg

ɐɐ ŮɦɔɦɛŮŰ˛ɐ ´ɐg ɡ˛důɤɛ´ɐɜɐdd əŮ ɔɘŬ Ű˛ɜ Ů˛ɔɐɛɣŰ˛důd ɐŰŰɜ ɛd©Ŭɜɜɘɦ əgəəɜŰ˛ɔɦɛŮŰ˛ɐ Ű´ɐg Monark (864, Sweden). ¢ Ŭɜɘɦ´ɜůŰł Ůə©ŰɛdůdŰł g ɛd©Ŭɜɜɘɐg ɜů©ɨ©g ´ɐg ´Ů˛ɹɐɔŬɜŬɜ ɐɘ ŭɐəɜɐŬɛɦɛŮɜɐɘ əŬŰ➢ Ű˛ł ŭɘ➢Ÿ˛əŮɜŬ Ű˛łg Ů˛ɔɐŭɐəɜɐŬůdŬ˛g Ű Ŭ©ɨ©ɨ ůɤůŰ˛g əɘ©ɨŰ©g˛ɔdŬ˛g Ű©g ůgůŰɹɛŬŰ©g g´ɐŭɐGɹg Ű˛ɤɜ ɓŬ˛ɹɜ əŬɜ ŬɜŰůŰůŰůdłg əŬɜ ɓ) Ŭɜ˛ɹɜɓɹɐ əŬŰŰɜ˛ɹŬŰɹɐ Ű˛ɤɜ ´Ů˛ɹɜůŰ˛ɐűɿ ɜ Ű©g Ů˛ɐG©ɨ Ű©g əgəəɜŰ˛ɔɦɛŮŰ˛ɐg. Ɛ➢Ű˛ɜ ´˛ɹɿ Ű˛ł ´Ů˛ɑŰɤůd, ɐ ɣɘŮɔɐg-ɓŬdɛ©ɜɦɛdůd ɣɔɜŮ ɛŮ Ű˛ɜ Ű© ´ɐd➢Ű˛łůd ůg©ɜəɘɜɐ©ɨ űɐ˛ɹŰœg ´ɣɜŰŮəɜɿ ɜ ůŰ˛ł d➢ůd g´ɐŭɐGɹg Ű˛ɤɜ ɓŬ˛ɹɿ ɜ. Ɛ©ɨɛűɤɜŬ ɛŮ Ű©ɜ əŬŰŬůəŮŬŰůɛ əŬŰ➢ Ű˛ɜ ɣɜŬ˛ɜd Ű˛łg ´ɐŭdə➢ŸŰłůdg Ű© ůɨ©ɐəɘ Ű©g ű©˛ɹŰœg Ŭg˛Ű©ɨ Ŭɜgɣɿ d➢ůŮ 1,5-2 ŮəŬŰ©ůŰ➢. ũɘŬ Ű˛ɜ əŬŰŬɜ˛ɹŬŰɹɐ Ű˛ɤɜ ´Ů˛ɹɜůŰ˛ɐűɿ ɜ Ű©g Ů˛ɐG©ɨ ´˛ɹůŬ˛ɛɦůŰ˛łəŮ ´Ÿɜɤ ůŰ© əgəəɜŰ˛ɔɦɛŮŰ˛ɐ Ůəũɘɦg˛ d➢ŮəŮ˛ɐɜɘɦg˛ ɛd©Ŭɜɜůəɦg˛, ɛŮ Ű©ɜ ɐ´ɐœɜ, ɛy➢ůɤ ŮəɦG˛ ŬəůdŰ˛ɹŬ, ŬɜɘɜɜŮg˛ɦŰŬɜ əŬŰ➢ Ű˛ɜ ´Ů˛ɹɜůŰ˛ɐűɹ Ű©g Ů˛ɐG©ɨ d ůgɔɜɦŰ˛ł Ű´Ů˛Ÿůɛ ŬŰ©g˛ Ű˛ɤɜ ɛŬ˛ɹɤɜ Ů➢ɜŰŬəůɜ ɜ (œũɘɜg ɛŮɔɣd©ɜgg˛ & ɜůŬ˛ɣɐ©ɜgůɤɜ) ´ɐg ɐ Ů˛ɹŮgɜd˛ɹ©g˛ ŮœŮ əŬŰŰůəŮgŸůŮə ůŰ˛ł ŭŮə➢Y, ´Ÿɜɤ əŬə ɣɜɤ ´ə➢gɹ˛Y Ű©g Ů˛ɐG©ɨ (´Ÿɜɤ ůŮəŮgəɐ Ů➢ɜŰŬɜŮ). ¢ Ŭɜ˛ŰůŰ©œd˛ůd Ű˛ł ´Ů˛ŬɔɦɛŮɜd˛g˛ŰŸůd˛g˛Ű©g d➢ŮəŮ˛ɐɜɘ©ɨ Ŭg˛Ű©ɨ ůɐɛŰŰ©g˛ ɛŮŰ©ɜ Ů˛ɜɜɛɦ Ű˛ɤɜ ´Ů˛ɹɜůŰ˛ɐűɿ ɜ Ű©g Ů˛ɐG©ɨ (0,2727 volts = 60 ´Ů˛ɹɜůŰ˛ɐűɣd/əŮŰɦ) Ű ɐŰ˛ɣə➢ůŮ əŬɜ Ű˛ł ɓŬdɛ©ɜɦɛdůd Ű˛łg əŬŰŰůəŮgɐg˛ Ŭg˛Ű©g˛. ɐɣə©g˛, ɣɜŰg˛ ɓŬdɹɐ-ɛŮŰŰ˛ɐ´ɣŰg˛ Ŭɜŭɘ©ɜɐɘ©ɨ ůɐɛŰŰ©g˛ ůŮ ɣdűɜŭəɦ (BIOPAC SYSTEMS TSD 120, USE) əŬɜ ɣɜŰg˛ d➢ŭɘ˛Ű˛ɐɜɘɦg˛ g´ɐ➢ɔɘůŰ©g˛ ɡ˛ɹůɤɛ´ɐɜɐdd əŬɜ Ű˛ł ɛŮŰŰ˛ɐ´ɐ, əŬŰŰɜ˛ɹŬŰɹɐ əŬɜ Ů˛ɜŭ˛ɔŬůdŬ Ű©g ə➢dűd➢ɣ˛ɜ©g˛ Ŭg˛Ű©ɨ d➢ŭɘ˛Ű˛ɐɜɘ©ɨ ůɐɛŰŰ©g˛ əŬŰŰ˛ł Ů˛ɹɔɐɛɣŰ˛důd.

ũɘǕ ǘɖ ɛɣǙ ɖůɖ ǘɖɠ ůɡɔɘɤɜǙɣ ůɖɠ ǘɐɡ ɔǕɘǕɞǖɕɨ ɞɜɤɕɠ ůǘɐ Ǖɕ Ǖ ɢɉɖůɞɕ´ɕɞɗɖɘǕ ǘɕɉɖǙɦɠ ǕɜǕɘɡǘɐɠ (Doctor Lange, Germany). ¢ ɛɣɖɕǘɕɠ ǕɜƳɘɡůɖɠ ɐǖǕɜ Ǖɡǘɐ ǘɖɠ ǘɤǘɐǘǕůɛǕǘɐɛǙǖǕɠ, ůɜɩ ǖǕ ǕɜǘǕɉǕůǘɐɉɘǕ ´ɕɡ ɢɉɖůɞɕ´ɕɞɗɖɘǕɜ ɐǖǕɜ ǘɐɡ Ǘɛ´ɕɉɕɡ (Lactad) (LOX-PAP method) (Boning, et. al., 1994). ¢ ɓǕɗɛɕɜɦɛɖůɖ ǘɐɡ ǘɤǘɐǘǕůɛǖɦɛǙɉɕɡ ɣɔɞǗ ɛǗ ǕɜǘǕɉǕůǘɐɉɘǕ ɔɜɤůǘɐɨ ´ǙɘǕɕɕɛɣɜɕɡ ɔǕɘǕɞǖɕɨ ɕɜɤɕɠ. ȨǗɘƳɖǗ ´Ǚɑǘɤ ůɖ ɖ ɣɜǘǕɕɖ ɐǖǕɜ ɦɛɕɘǕ ɛǗ ǘɖɜ ǕɜǕɉǕǘɦɛǗɖ ůǘɐ ǕɜǘǕɉǕůǘɐɉɞ.

3.4.3. Ⱦ´ɕɞɕɔɕɦɛǗɕɘ ´ǙƳɛ ǖǙɕɞ-ǘǖɐ ǖǘɠ

¢ ɘǕǖǕɉǕǘɐ ǘɖɠ ´ǙǕɦɛǗɖɠ ɛɖɢǕɜɞɐɠ ɑůɢɨɕɠ (Watts) ɣɔɞǗ ůǗ 10 ɑůɦɢɉɕɜǕ ɢɉɕɜɞƳ ǕɑǕůǘɐɛǖǖǕ ǕɑƳɉɘǗǕɠ ǘɤɜ Ǚɑ ɜ ǕǙɡǖǙɕɞ´ǘɤɜ (ɄǙƳǘɖɛǕ 8.10). ũɜɤɉɕɕɜǖǕɠ ǘɖɜ ǘɛɐ ǘɖɠ ǗɕƳɉɡɜůɖɠ-ǘɕɉǘɐ (kp, kg) ɘǕ ɛǙɨ ɜǖǕɠ ǘɐɜ Ǚɑɛɦ ǘɤɜ ´ǙɑǙɕǘɨ ɜ (´ǙɑǙɕǘɣɠ/ɘǗǘɦ) (ɛɣůǕɠ ǘɐɣɠ) ůǖ 10 ǕɡǖƳ ɢɉɕɜɞƳ ǕɑǕůǘɐɛǖǖǕ ɘǖǖƳ ǘɖ ǕɑƳɉɘǗǕ ǘɖɠ Ǚɔɕǘɕɘɞɐɖɠ Wingate ɡ´ɕɞɕɔɑɖɖɘǕ ɕɘǗɐɠǕǘǖǘɠ:

- ***ɋǗǖǘɖɠ ǘɖɠ ɛɣɔɑǘɖɠ ´ǙǕɦɛǗɖɠ ɛɖɢǕɜɞɐɠɑůɢɨɕɠ** (PP, Ǖ ɦɞɡǘɖ ǘɐɛɐ).*

  Ƀ ǕǗǖǘɖɠ ǕɡǖɦɠǗɤɉƳǗǕ ǘɐ ɛǗǕɑǙɕ ɛɖɢǕɜɞɦ ɣɉɔɕ ´ɕɡ ´ǙɐɔǕǗɕ ǕɕɘɞǕɛɦɛǗɕɠ ůǖǖ´ɉɨ ǖǖ ǙɖǕ ǕǗɡǖǙɦɘǗǖǖ ǘɖɠ ǕɕɘɞǕǕɖǕɠ (ǗɑƳɉɡɜůɖ x ´ǙɑǙɕǘɣɠ ǕɜƳ ɘǗǘɦ).

- ***ɋǗǖǘɖɠ ǘɖɠ ɛɣůɖɠ ´ǙǕɦɛǗɖɠ ɛɖɢǕɜɞɐɠɑůɢɨɕɠ** (MP, Ǖ ɦɞɡǘɖ ǘɐɛɐ).*

  Ƀ ǕǗǖǘɖɠ ǕɡǖɦɠǗɤɉƳǗǕ ǘɖ ɛɣůɖ ǘɐɛɐ ǘɐɡ ůɡɜɕɞɕɨ ɛɖɢǕɜɕɨ ɣɉɔɕɡ ´ɕɡ ´ǙɐɔǕǗɕ ǕɕɘɞǕɛɦɛǗɕɠ ɘǕô ɦɞɖ ǘɖ ǕɑƳɉɘǗǕ ǘɖɠ ǕɕɘɞǕǕɖǕɠ (30õõ) (ůɡɜɕɞɕɐ ɛɖɢǕɜɞɐ ɑůɨ /10).

- ***ɋǗǖǘɖɠ ɘɦ´ɤůɖɠ** (ɋ.T, %).*

  Ƀ ǕǗǖǘɖɠ ǕɡǖɦɠǗɤɉƳǗǕ ǘɐ ɓǕɗɛɦ ɛǗɤůɖɠ ǘɐɡ ´ǙǕɦɛǗɕɡ ɛɖɢǕɜɕɨ ɣɉɔɕɡ ɘǕǖƳ ǘɖ ǕɑƳɉɘǗǕ ǘɖɠ ǕɕɘɞǕǕɖǕɠ (PP - ɢǕɛɖɘɦǖǙɖ ɑůɢɨ) x 100 / PP).

3.5. Ⱥɘǘɛɖůɖ ůɤ ɛǕǖɕ ɐɠůɨ ůǖǖůɖɠ

3.5.1. ɋɐǕǕɞ ǕůɖǕ ǘɖɠ ɛɣǙ ɖůɖɠ

Ƀ ɘǕɖɣɜǕɠ ǕɕɘɞǕɦɛǗɜɕɠ ǕɘɕɖǘɕɠɘǕ ɢɤɉɕɠ ɜǕ ǘɣɉǗɘ ɕ´ɕɞǕɐ´ɕǖǖ ɛǖǖǕɘɘɞɦ ǕɜǘɐǕɛǗɕ ǕɣɢɖɖɘǗ Ǖ ɦ ǘɖ ɖɣůɖ ǘɖɠ ɨ´ǘǕɠ ɘǖǖƳɘɘɑůɖɠ ɛɣůǕ ůǘɜ ǕɜɕɜǗɡǘɐ DXA ǗɘƳɢɑǘɖ ǕɘǘɜɕɓɕɘɖǕ, x-ray (0,02 mrems), ɖ ɕ´ɕɖǕ Ǘɘ´Ǘɛ´ɦǖǕɜ Ǖ ɦ ɘƳǘɤ ´ɉɕɠǖǖ´Ƴɜɤ ǕɑǕ Ǚɜɩ ɜǖǕɠǘɐ ůɩ ɛǕǘɐɡ. ¢ ǕɘǘɜɕɓɕɘɖǕ ǕɡǖǙ ǕɜɕɜǗɡɦǖǕɜ ɘǕ ɛǖǙɑɦǖǕɜ Ǖ ɦ ǗɐǕɞɦ Ǖɜɕɜǖɡǘɐ-ǗǙɔɕ´ɉɕůǕɞɉɑǘɐ ɕ ɕ´ɕɕɡ ɓɉɑɘɦǖǕɜ ´ƳɜɤǕ ɦ ǘɐ ǕɕɘɞǕɦɛǗɕ, ůǘɜ ɘɞɖǖɦ ɓɉǕɕɜǕůƳɉɤ ůɖɠ ǘɐɡ DXA. ¢ ǖǘɕɨ ǘɖǖǖ ǕǗ ǘɖɠ ůƳɉɤ ůɖɠ ´ɕɡ ɢɉɖůɞɕ´ɕɞɗɖɘǗ ɐǖǕɜ ɖ ɔɉɐɔɕɉɖ, ǕɑƳɉɘǗǕɠ 10 ɘǗ ǖ ɜ. ɄɉɞǙɜɖ ǘɖɜ ɣɜǙɜɖ ǘɖɠ ɛɣǙ ɖůɖɠ ´ɉɕɖɔɐɗɖɘǗ ɓǕɗɛɕɜɦɛɖůɖ ǘɐɡ ɛɖɢǕɜɐɛǖǘɐɠ ůɨ ɛǘɤ ɜǕ ɛǗ ǘǗɠ ɡ´ɕǕǗǕɡ ǘɖɠ ɘǕǖǖůɘǙƳůǙɑǕɠǖǖǕɉɖǕɠ.

3.5.2. ȳɉɔǕɜǕ ɛɣǙ ɖůɖɠ

¢ ɜɣǕůɢǖǕƳǕɡǘɐ ǖɕɜɞɐ ´ɉɕůǘɣɉǗɘ ǘɖ Ǖɡɜǖɦǘɖǖ ´ɕůɕǘɐɐɠ ɛɣǙ ɖůɖɠ ǘɤ ɜ ɕůǘ ɜ ɘǕǘɤ ɜ ɛǕǕɩ ɜ ɑůǘ ɜ ɕɘɦɘɘɖɉɕɡ ǘɐɡ ůɩ ɛǕǘɐɠ ǕɘƳ ɘǕ ´ǗɞɕɢɩɜǕɡǘɐɨ. ȨɡɔɘǘɐɉɞɛɣɜǕ, ɖ ɕůǘɐɐ ´ɡɜɦǘɖǖ (BMD), ǘɐ ´ǙɑǘɦɛǗɕ ǘɤ ɜ ɕůǘ ɜ ůǗ ɛǖǖǕɘɘɞƳ ƳɘǕǖǖ (BMC) ɘǕɩ ɠ ǗɑɖɠɘǕ ɖ ůɨůǖǖůɖ ǘɤ ɜ ɛǕǕɩ ɜ ɑůǘ ɜ (Ǖɜɢɤɉɑɛɦɠ ɛǖǖǕɨ ɘɑɕɠ ɘǕ Ƴɘ´ɖɠ ɛƳǕɡ) ɦɘɕɡ ǘɐɡ ůɩ ɛǕǘɐɠ ǕɘƳ ɘǕ ǘɛɖɛƳǘɤ ɜ Ǖɡǘɐɨ (´Ƴɜɤ ɘǕ ɘƳǘɤ ƳɘɉǕ, ɘɕɉɛɦɠ) ´ɉɕůǕɞɉɑǘɖɘǕ ɛǗ ǘɐɜ ǕɜɕɜǗɡǘɐ ůɩ ɛǕǘɐɠ DXA (Model DPX+, Lunar Corp., Madison, WI, USA). Ƀ ɡ´ɕɞɕɑɛɦɠ ǘɤ ɜ ǕɜɤǙɣɉɤ ´ǙǕɛɣǙɤ ɜ

yosoU eyuy UsuSoei g´eoeosuUseei ´jeojYeeUeg (Lunar software 1.3z). ¢ gjeud Ueg DXA oeU Ul3 UoUedud Ulg uyeUseeg ui uUUdg bUuoeUUUo ueUs eHjoe Ulg UoUdy3dudg Uy3 UoUsi3 gydeegeUo gUedeeg Uoyjo UsUg eUdi g ´Uj3Y3 eyuU Uf Us uieU, o3yjoeo3UUg UsG UeyG UoUdy3sudg Ueg eUdUjei eogg eUo UoUgdyjeg esUsei sUsei, Uf dUyjdUseei g´eoeosuEei g eUo in vitro eUjeuUsG.

3.5.3. Tijsoeo EUjei eUseo´UjYeUjeo

- ***Heuhjlll UlG Yeo´dG uy eUSeeG eYeUG (gyjGf UeuUY)***
- ***Heuhjlll UlG geo´i ueggGsUsei***
- ***Heuhjlll UlG eUseei sUsei***

Beo UoyUyjy ´euhjUlUUf Uy3 sUi3 ´eg eUjedeUo UoUuyjo3UUo uU eyjd Ueg ui eUUsf h´yf UgUY Uy3 ´Y3y eUo eYUy Yejy3 eUdi g eUo Ueg eoj eei, Uhue UedeUSeY (Ujsujeu & uUoeY´eUgjY) hue eUo ugseoeoY (´Y3y YejU, eYUy YejU, eoj ehjG). Hj´Uo3U udeUoy dUuhjUo3eU Ul3 UoUedud Ueg ugseoeoei uyeUSeei bYjegG Ueg eYdU ueoeUehjeUoeg GjdueE´eoedeU Ue YdjeseUeU UlG UoUuUesedG UUeeoeG ´euhjUlUUf UlG YeoédG uyeUSeeG eYeUg, Ueg oé ueggG sUsei eUoUeg eUSeei sUsei.

3.6. qeeoeUudUUoeGf3oegehjedGf eUUl uUseUUeo e oeyd3oegehjedGf (OGTT-75g)

3.6.1. Hjeh´edyuUsGfeUo ueUueoUudUUlGf ueoeUudUGf

¢eyuujGfdeyjUGf´jeo Ul3 ´UjGUeUUeo ueUueoUudU OGTT-75g hjoeo eo ueoeUehjeUoeo Uoeoei dduUo Useoe udUsUU eyuy UlGf e´edUGf yeUbUo3 ugseoeoY 1000 eU 1200 g guUUY3djUoUGf (250-300 g/d) (HUjYjUlEU 8.11), Uso 3eU UegeYGsUse3 ui deyjUf (52,21±10,24 ijUg) ´jeo Ul ueoeUudU OGTT-75 g UUuoUo Uf eeseue´eUU Uuieg y3Ue3dGf uyeUSeeG Yuedudg. ¢ ´ji Ul oeydGUoeUeg´yoeoUUse ´jyo (11,19±1,18 ijUg), eUY UfeeiyjG (12,24±1,53 ijUg) 3dUUuU.

Hjeo Ul oeydGUlGf ´jeoUdejsuey3dGf ´euhjUlUUf oegehjedG, ´Yjddeu UfeeyuU ueoeUehjeUoeg 8-10 mL UoU, Use e´eoe GjdusE´eedeU, ´yjUo UlGfeyUjdudGfUlGf ugoeey3Ujyudf oegehjedf eUo UfUsUgdyjyudf sueoeoedG, oeU oUseeh UoeUSeoeoeh yeUbU, eyuU uU GjeoeeH ueYuUlEU Uy3 ´y3UU Use ´eei eUdi 3, ueYeogeU oegehjedf Uf h Use udhjeU (75 g oegehjedf ueUoegeyd udU 400 mL 3Ujh). z UUY Ul oeydGUeg Uoy Ujjeg ueUei eUSeGf ´Yjddeu uUueoUU UoUSeGf Uy3 5-6 mL, Ududf Uf h Ul3 oueU ûeybU, uUse 30°, 60°, 90° eUo 120° eUdh. Beo ueoeUehjeUoeo, Uhue eUUY Ul ueYjeUeU UlGf oeydf Uy3 uUueoUoeYUy3 UoUSeGf hue eUo eUUY Ul3 ´UjoeueUoUeoeoeGfGgf, eyGjeUse Ujeoef eUo UlGf UUeUgUUuUf UoeUSeedyUf, eUUs udUdeudh dyud udse UjoUudhjeso, d dUjeeejUudUseg e´eoeg eUUs 23±1 ºC.

3.6.2. yjoUoUeyUjdudf, bseGdesoe UoYeogud

yeU UU uUueoUU UoUSeGf UjGseY ugeeeyGddeUo udU ´eUudeei f uoeUehjeUoeif uyeo3Uf (´eceUU). z UUY Use ´yjUueU eoyy3 eUdi 3 eUo Uuei Use UoU y´d3U, UU uUueoUU UoUSeGf ufgoeeUoUjedeUo oU 20 eUdUY uUf 3000 uUj/e (Fcf = M.4´².n².R) (Sigma, 11009, Western Germany) eUo ueUGyjudUeU e ejhf Uf h UU yeeejúU ugudUUeY. Agdei f UeyuyG eUUY Ul ufgoeey3Ujsde e ejhf Use´edUUedeU udU ogYeoseegf ueoeUudeei f uyeo3Uf eUo ufgeYGUeU uUse ygoUe (7 ºC) eyGjeUse3 ´jeudueje3sUeh Uf oegehjedf (1 yy 8 ijUg). j eyuy eUUYe g´hoeé egejhfgyiGUeUoUuUseggï 30 ºC eyGjeUse3 ´jeudueje3sUeh Uf seudeoeedf

[illegible] 48 [illegible] 72 [illegible].

[illegible] (Enzymatic-colourimetric method in serum, plasma and liquor) (Trinder, 1969). [illegible] Alcyon Analyser (Model Falcor 300, 16841684, FRANCE). [illegible] (Radio immunoassay, RIA) [illegible] (Desbuquois, & Aurbach, 1971), [illegible] Packard (10 channels, USA). [illegible] Sysmex (K-4500, Japan).

3.6.3. [illegible]

- ***[illegible]*** *(AUCG, φAUCG, 0-120 [illegible])*

  [illegible] OGTT-75g (AUCG, mmol h L^{-1}). [illegible]

- ***[illegible]*** *(AUCI, φAUCI, 0-120 [illegible])*

  [illegible] OGTT-75g (AUCI, mU h L^{-1}). [illegible] (φAUCI, mU h L^{-1}). [illegible] 0 [illegible] 30 (φAUCI 0-30) [illegible] 30 [illegible] 120 [illegible] (φAUCI 30-120), [illegible].

- ***[illegible]*** *(φAUCI / φAUCG)*

  [illegible] (φAUCI / φAUCG). [illegible] Seltzer [illegible] (1967) [illegible] «[illegible]» (φAUCI / φAUCG) [illegible].

[illegible]

(AUCG), əǓɗɩ ɠ əǓɘ ǓɡǗƳ ´ɞɡ ǓɘǘɈƳɞɡɜ Ǘɖɜ Ǔ ǓɘǓɡɗƴɈɤůɖ ɘůɞɡəɞɖɠ (AUCI), ɠ´ɞəɞɔǡɗɖəǓɜ ɛǓ Ǘɜ əǓɦɜǓ Ǘɞɡ ǗǓ ǓɞǓɨɞɨɠ. Ǻɜɩ, ǗǓ ǓɛɓǓǓƳ Ǘɤɜ Ǔ ɘǓǓɜǓ ɜ ɜɖůǗǓǓɠ Ǘɖɠ ɔəɡəɦɕɖɠ əǓɘ ɘůɞɡəɞɖɠ, ɠ´ɞəɞɔǡɗɖəǓɜ ɦ´ɤɠ Ǘɞ ǓɛɓǓɦɜ Ǘɞɡ ɞɈɗɞɔɤɜɞɡ ´ǓɈǓɘəɖəɞɔɈƳɛɛɡ (ɄǓɈƳɈǗɖɛǓ8.6.1.).

❖ ***Ʌɡɗɛɦɠ ǔɘƳɗǓɖɠ-ɛǓǗǓɓɞəɘůɛɦɠ ɔəɡəɦɕɖɠ (ɀ)***

Ƀ ɈɡɗɛɦɠǔɘƳɗǓɖɠ-ɛǓǗǓɓɞəɘůɛɦɠ Ǘɖɠ ɔəɡəɦɕɖɠ ǓɘǘɈƳůǗɖəǓ ɛǓ Ǘɖ Ɉɞɐ Ǘɖɠ ɔəɡəɦɕɖɠ Ǔ ɦ Ǘɞ ǓɛǓ ´Ɉɞɠ Ǘɞɡɠ ɘůǗɞɨɠ-ůǗɦɞɞɠ (ɛɡɸɦɠ əǓɘ əɘɩǔɖɠ ɘůǗɦɠ, ɐ´ǓɈ) ůǗɖ ɛɞɜƳůǓ Ǘɞɡ ɞɈɦɜɞɡ əǓɘ ɗǓɤɈɐɗɖəǓɤɠɖ ǔɘǗɞɈƳ ɛǓǗǓɨ Ǘɞɡ ǘɞɈǗɞɡ ɔəɡəɦɕɖɠ (glucose load) əǓɘ Ǘɖɠ Ǔɨɜɖůɖɠ Ǘɖɠ ´ɞůɦǗɖǗǓɠ Ǘɖɠ ɔəɡəɦɕɖɠ ůǗɞ ɞɩɈɞ əǓǗǓɜɞɛɐɠ Ǘɖɠ ɔəɡəɦɕɖɠ (glucose space) ɛǓǗƳ, ůǓ ůɨɔəɈɘůɖ ɛǓ´Ɉɘ, Ǘɖ OGTT-75g.

¢ ɛǓɗɖɛǓǗɘɐ ǓɘǡɤůɖΝ ´ɞɡ ɞɈɖůɶɞ´ɞɶɗɖəǓɔɘǓ Ǘɞɜ ɠ´ɞəɞɔɘůɛɦ Ǘɞɡ ɈɡɗɛɞɨΝ ǔɘƳɗǓɖɠ- ɛǓǗǓɓɞəɘůɛɞɨ Ǘɖɠ ɔəɡəɦɕɖɠɐǗǓɜ:

M (mg min^{-1}) = ǘɞɈǗɞ ɔəɡəɦɕɖɠ (ǔɖə. 75000 mg) / 120 + (0 ɩɈǓɠ ï 2 ɩɈǓɠ ůɡɔəɏɜǗɈɤůɖ ɔəɡəɦɕɖɠ) x 180 x (0,19 x ůɤɛǓǗɘɦ ɓƳɈɞɠ / 120)

ɦ´ɞɡ:

180 = ´ǓɈƳɔɞɜǗǓɠ ´ɞɡ ɞɈɖůɶɞ´ɞɶǗǓɘ ɔɘǓ Ǘɖ ɛǓǗǓǗɞ´ɐ Ǘɤɜ mmol L^{-1} ůǓ mg L^{-1}.

0,19 x ůɤɛǓǗɘɦ ɓƳɈɞɠ = ɞɩɈɞɠ əǓǗǓɜɞɛɐɠ Ǘɖɠ ɔəɡəɦɕɖɠ əǓɘ

120 = ɖ ǔɘƳɈ əǓɘǓ Ǘɖɠ ǔɞəɶǓůɗǓɠ OGTT-75g ůǓ əǓǗƳ (Cederholm, & Wibell, 1985).

Ǻ´ɞůɖɠ, ɞ Ɉɡɗɛɦɠ ǔɘƳɗǓɖɠ-ɛǓǗǓɓɞəɘůɛɦɠ Ǘɖɠ ɔəɡəɦɕɖɠ ´Ɉɞɠ Ǘɞɡɠ ɘůǗɞɨɠ (ɀ) ɠ´ɞəɞɔǡǗɖəǓ əǓɘ ǓɜƳ əɘɦ ůɤɛǓǗɘɞɨ ɓƳɈɞɡɠ (Mbw), ǔɘǓɈɩ ɜǗǓɠ Ǘɞ Ǔ ɞǗɏəǓɛǓ Ǘɖɠ ǓɜɤǗɏɈɤ ǓɘǡɤůɖɠɛǓǗɞ ůɤɛǓǗɘɦ ɓƳɈɞɠ Ǘɤɜ ǔɞəɶǓɦɛǓɜɤɜ (ɀ / Ʉɤɛ ǓǗɘɦ ɗƳɈɞɠ ůǓəɘƳ, mg min^{-1} kg^{-1}) (ɄǓɈƳɈǗɖɛǓ8.6.2).

❖ ***Ʉɞǘɘɐ ´ǓɘǓɘɐ ǓɜǗǡǗůɖ*** *(rel-R)*

Ƀ ɈɡɗɛɦɠǔɘƳɗǓɖɠ-ɛǓǗǓɓɞəɘůɛɦɠ Ǘɖɠ ɔəɡəɦɕɖɠ ´Ɉɞɠ Ǘɞɡɠ ɘůǗɞɨɠ-ůǗɦɞɞɠ ǓɘǓɈǗƳǓɘ Ǔ ɦ Ǘɞɡɠ ´ǓɈƳɔɞɜǗǓɠ ǓɘǗɞɞɡɠ (ɘůɞɡəɞɘǓɘǓɈǗ ɛǓɞɡɠ əǓɘ ɛɖ) ´ɞɡ ´Ɉɞɤɗɞɨɜ Ǘɖ Ɉɞɐ Ǘɖɠ ɔəɡəɦɕɖɠ ´Ɉɞɠ Ǘɞɡɠ ɘůǗɞɨɠ (GUP-´ǓɈƳɔɞɜǗǓɠ). ǑǗɘɑ, ǔɘǓɛɞɈǘɩ ɗɖəǓɛɘǓ Ǔɘǡɤůɖɛɏůɤ Ǘɖɠ ɞ´ɞǓɠ ɛ´ɦɈǗɘǓ ɗǓɈɖǗɘƳ ɜǓ ǓɘǘɈǓɘɗǓɘ ɖ ůɡɜɞəɘɐ ´ǓɘǓɘɐ ǓɜǗǡǗůɖ ǓɘɦǔɞɡΝ Ǘɖɠ ɔəɡəɦɕɖɠ ůǗɞɡɠ ɘůǗɞɨɠ (ɛɡɠ, əɘɞɠ, ɐ´ǓɈ) , ůǓ ůɞɏůɖ ɛǓ Ǔ) ɛɘǓ ɠ´ɞǓɗǓɛɏɜɖ ´ɞůɦǗɖǗǓ GUP-´ǓɈǓɘɦɜǗɤɜ əǓɘɓ) Ǘɞ ɈɡɗɛɦǔɘƳɗǓɖɠ-ɛǓǗǓɓɞəɘůɛɦ Ǘɖɠ ɔəɡəɦɕɖɠ (ɀ) (Cederholm, & Wibell, 1985):

$$R = GUP\text{-}´ǓɈƳɔɞɜǗǓɠ / M \qquad (1)$$

ɖůǗɦůɞ, Ǔɨɜɖůɖ Ǘɖɠ ɖ´ǓǗɘɐɠ ´ǓɈɞɐɠ ɔəɡəɦɕɖɠ əǓǗƳ Ǘɖ ǔɞəɶǓůɗǓ OGTT ɛ´ɞɈǓɘ ɜǓ ´ɈɞəǓɏůǓɘ əǓɘ Ǔɨɜɖůɖ Ǘɞɡ ǗɤǗɈɘɞɨ ǘɞɈǗɞɡ ɔəɡəɦɕɖɠ, ´ɈɞəǓɩɜǗǓɠ ǡɤɠ əǓɘ Ǔɨɜɖůɖ Ǘɤɜ Ǘɛɩɜ Ǘɖɠ ɔəɡəɦɕɖɠ əǓɘ ɛǓɤůɖ Ǘɖɠ Ǘɛɐɠ ɀ, ɏɞɜǗǓɠ ůǓɜ Ǔ ɞǗɏəǓɛǓǗɖɜ ɠ´ǓǗɛɖůɖ ǗɖɠR.

ȚǗƳ Ǘɖ ǔɞəɶǓůɗǓ OGTT, ɖ ǓɘǓɡɗǓɞɨɛǓɗ ´ɞůɦǗɖǗǓ ɘůɞɡəɞɖɠ əǓɘ ǗǓ ǓɞǓǓ ůɡɔəɏɜǗɈɤůɖɠ Ǘɖɠ ɔəɡəɦɕɖɠ ůǗɞ ǓɛǓ ǔɘǗɏɈɞɡɜ ɛǓǗǓɨ Ǘɤɜ ǔɞəɶǓɦɛǓɜɤɜ. Ʉɡɜ ǓɩɠΝ ǔɘǗǘɏɈǓɘ əǓɘ ɞ ɓǓɗɛɦɠ Ǘɞɡ ɈǓɘǓůɖɠ Ǘɤɜ GUP-´ǓɈǓɘɦɜǗɤɜ. Ʉɨɛǘɤɜǘ ɛǓ Ǘɖ

ůgəəɞɔɑůǗǿəɐ Ǖgǘɨ ´ɟɞɏəgɣŮ ɖ ůɢǕǗǿəɐ ´Ǘɟǚǘɟɑɐ ǕɜǗǻůǗǕůɖ (rel-R), ɛɏůɤ Ǘɖɠ ɞ´ɞɖǕɠ Ůəǘɟ Ɏůɖɖəůɖ ůgɜɞəɑɐ ´Ǘɟǚǘɟɑɐ ǕɜǗǻůǗǕůɖ Ǘɖɠ Ůǚůɧǚɞg Ǘɖɠ ɔəgəɧɞɖɠ ůǕɞgɠ ɑůǕɞɨ ɠ (R), ůŮ ůɢɏůɖ ɛŮ Ǘɞ ůɨɜɞəɞ Ǘɤɜ ´ɟɞɤɖɖǗəɩ ɜ _ ´ǗɟǕɒɧɜǗɤɜ (GUP-´ǗɟɎɔɞɜǗǘɠ). ŎǗůɿ, ɖ Ůɜǚůɤůɖ Ǘɖɠ ůɢǕǗǿəɐɠ ´Ǘɟǚǘɟɑɐɠ ǕɜǗǻůǗǕůɖɠ (rel-R) ɏɢŮəɤ ɠǕəɐɠ:

rel-R = R / GUP-´ǗɟɎɔɞɜǗǘɠ (2)

ɟ ɜǗəǕɖɑůǗ ɜǗǕɠ Ǘɖɜ R Ǘɖɠ Ůɜǚůɤůɖɠ (1) ůǗɖɜ Ůɜǚůɤůɖ (2) ´ɟɞəɨ´ǗǗə ɖ ´ǗɟǕəɎǗɤ Ůɜǚůɤůɖ (3) ɛɏůɤ Ǘɖɠ ɞ´ɞɖǕɠ ɏɔɑǕɜ ɞə g´ɞəɞɔɑɛɞɑ Ǘɖɠ ɛŮəɏǗɖɠǕgǗɨɠ:

rel-R (min mg⁻¹ x 10³) = 1 / M (3)

ɧ´ɞg:

ɀ (mg min⁻¹) = ɟgɖɛɧɠ ŭəɎɖŮůɖɠ-ɛǗǕǕɓɞəɑůɛɧɠ ɔəgəɧɞɖɠ ´ɟɞɠ Ǘɞ ůɨɜɞəɞ Ǘɤɜ ɑůǗ ɜ-ůǗɧɞɞɠ.

Ⱥ´ə´əɏɞɜ, g´ɞəɞɔǚůɖɖəŮ əǕə ɖ ůɢǕǗǿəɐ ´Ǘɟǚǘɟɑɐ ǕɜǗǻůǗǕůɖ ǕɜɎ əɑɧ ůɤɛǕǗǿəɞɨ ɓɎɟɞgɠ (rel-Rbw, min mg⁻¹ kg⁻¹), ǕɜǗəǕɖɑůǗ ɜǗǕɠ Ǘɞ ɀ (mg min⁻¹) Ǘɖɠ Ůɜǚůɤůɖɠ (3) ɛŮǗɞ Mbw (mg min⁻¹ kg⁻¹), ´ɟɞů´Ǖɖɩ ɜǗǕɠ ɜǕ ŮəǗɛɖɖǕɨ ɖ ǚɟɎůɖ Ǘɞg ůgɜɧəɞg Ǘɤɜ GUP-´ǗɟǕɒɧɜǗɤɜ ůŮ ůɢɏůɖ ɛŮ Ǘɞ ůɤɛǕǗǿəɧ ɓɎɟɞɠ Ǘɤɜ ŭɞəɶǕɛɧɛǕɜɤɜ.

- ***ɀ ɏůɖ ´ɞůɧǗɖǗǕ ɑůɞgəɑɖɠ ůǗɞ ´əɎůɛǕ** (mean-I).*

mean-I (mU) = AUCI / 2 x ɢɩ ɟɞɠ əǕǗǕɜɞɛɐɠ Ǘɞg ´əɎůɛǕǗɞɠ

ɧ´ɞg:

ɢɩ ɟɞɠ əǕǗǕɜɞɛɐɠ Ǘɞg ´əɎůɛǕǗɞɠ (ɧɔəɞɠ ´əɎůɛǕǗɞɠ) (əɖǗɟ Ǖ) = Ƀəɑəɧ ǕɶɛǕ (əɖǗɟ Ǖ) ï ɧɔəɞɠ ǗɟgɖɟɞəgǘǘɎɟɤɜ əǕə AUCI / 2 = ɛɏůɖ ůgɔəɏɜǗɟɤ ůɖ ɑůɞgəɑɖɠ ůǗɞɜ ɞɟɧ (ɄǗɟɎɟǗɖɛǕ8.6.3).

- ***Ɇgɜɞəɑɐ ǕɜǗǻůǗǕůɖ ůǗɖɜ ɑůɞgəɑɖ** (Tot-I-R).*

ɇɞ ´ɖəɶɞ ɛǗǗǕɜɨ Ǘɖɠ ´ɞůɧǗɖǗǕɠ Ǖ ŮəŮgɖŮǗɞɨ ɛŮɜɖɠ ɑůɞgəɑɖɠ (mean-I) əǕə Ǘɞg ɟgɖɛɞɨ ŭəɎɖŮůɖɠ-ɛǗǕǕɓɞəɑůɛɞɨ Ǘɖɠ ɔəgəɧɞɖɠ ´ɟɞɠ Ǘɞgɠ ɑůǗɞɨ ɠ ǕɜɎ əŮ Ǘɧ (M), ɖǗɤ ɟɐɖɖəŮ ɖ əǗǗɎ ´ɟɞůɏɔɔɑůɖ ɏəǘɟǕůɖ Ǘɖɠ ůgɜɞəɑɐɠ ǕɜǗǻůǗǕůɖɠ Ǘɤɜ ɑůǗ ɜ ɏɜǕɜǗəǗɖɠ ɑůɞgəɑɖɠ:

Tot-I-R (mU mg min⁻¹) = mean-l / M

(ɄǗɟɎɟǗɖɛǕ8.6.4)

3.7. ɆǗǕǗɑůǗəɐ ǕɜɎəgůɖ

ŭəǕ ɧəŮɠ Ǘɠ ůǗǕǗɑůǗəɏɠ ǕɜǕəɨ ůŮəɠ ɢɟɖůɶɞ´ɞɶɖɖəŮ ǕɜǗǻůǗɞɶɞ ůǗǕǗɑůǗəɧ əɞɔɑůɛɑɧ ´ɟɧɔɟǕɛɛǕ (SPSS, USA). ɇǕ Ǖ ɞǗǗəɏůɛǕǗǕ Ůəǘɟ Ɏůɖɖəǔɜ ůŮ ɛɏůɞgɠ ɧɟɞgɠ ± Ǘg´ɑɏɠ Ǖ ɞəɞǚŮəɠ əǕə ɏɔɑŮ ɏəŮəɞɞɠ Ǘɖɠ əǕɜɞɜɑɧǗɖǗǕɠ Ǘɖɠ əǕǗǕɜɞɛɐɠ əǕə Ǘɖɠ ɞɛɞɑɔɏɜŮǕɠ Ǘɖɠ ŭəǕů´ɞɟɎɠ (Levene Statistic) Ǘɤɜ ŭǗɨɞɛɏɜɤɜ ɧəɤɜ Ǘɤɜ ´ǗɟǕɛɏǗɟɤɜ əǕə ɔəǕ əɎɖŮəǕǗɖɔɞɟɖǕ ɜǗɢɤɟɑůǗɎ. ŭəǕ Ǘɖɜ əǕɜɞɜɑɧǗɖǗǕ Ǘɖɠ əǕǗǕɜɞɛɐɠ əǕə Ǘɖɠ ɞɛɞɑɔɏɜŮǕɠ Ǘɖɠ ŭəǕů´ɞɟɎɠ ɞɟɑůɛɏɜɤɜ ´ǗɟǕɛɏǗɟɤɜ əǕə ɑǚǕɖǗǗɟǕ ǕgǗ ɜ Ǘɖɠ ɑůɞgəɑɖɠ əǕə Ǘɖɠ ɔəgəɧɞɖɠ, ɏɔɑŮ əɞɔǕɟɑɖɛɑɐ ɛǗǕǗɟɞ´ɐ Ǘɤɜ ǕɜǗǻůǗɞɶɤɜ ŭǗɨɞɛɏɜɤɜ.

ŭəǕ Ǘɖ ůɨɔəɟɑůɖ Ǘɤɜ ŭǗɨɞɛɏɜɤɜ Ǘɖɠ ůɤɛǕǗǿəɐɠ ůɨůǗǕůɖɠ əǕə Ǘɤɜ ǗɟɔɞǚɞəɶǕůəɩ ɜ, əǕɖɩ ɠ əǕə Ǘɤɜ ŭǗǗɨɞɛɏɜɤɜ Ǘɖɠ ŭɞəɶǕůɖǕɠ OGTT-75g Ǘɤɜ Ǘɟəɩ ɜ ŭəǗǗɞɟǗǗəɩ ɜ ɞɛɎǗɤɜ, ɢɟɖůɶɞ´ɞɶɖɖəŮ ɖ ǕɜɎəgůɖ ŭəǕů´ɞɟɎɠ ɛəǕɠ əǗǗɨɖgɜůɖɠ ɔəǕ ǕɜŮɜɎɟǗɖǗǕ ŭǗǕɛǕǗǕ (one-way ANOVA), ɞɟɶɞɜǗǕɠ Ů ǚ Ůǘɞ ´ɑǕɜɧǗɖǗǕɠ 0,05. ȺɎɜ Ǘɞ F ɐǗǕɜ

ůɖɛŬɜǗɘɧ Ŭəɞɚɘɨ ɗɖůŮ ɖ ŭɘŬũɘŬůɗŬ Ůəɏɔɢɘɡ ɛŮǗŬɜɨ ´ɞɘɤɜ ɛɏůɤɜ ɡ´ɐɟɢŬɜ ůǗǗǗůǗəɎ ůɖɛŬɜǗəɏɠ ŭɘŬǘɞɟɏɠ (ɛŮǗŬ-ANOVA ůɡɔəɟɑůŮɠ, ɏəŮɔɢɘɠ Scheffe). ɇɏəɚɠ, ɔɘŬ Ǘɠ Ŭ Ŭɟ ŬɑǗɖǗɠ ůɡůɢǗǗůŮɠ əŬə ůɡɔəɟɑůŮɠ ɛŮǗŬɜɨ Ǘɤɜ ´Ŭɟ ŬɛɏǗɟ ɤɜ, ɢɟɖůɶɞ´ɞɶɗɖəŮ ɞ ůɡɜǗŬəǗůǗɐɠ ůɡůɢɏǗɜůɖɠ Pearson (r) əŬə ɖ ´ɞəəŬ əɐ ɓŬɗɛɘŬɗŬ ´Ŭəɘŭɟɧɛɖůɖ (stepwise), ɞɟ ɶɞɜǗǗɠŮ ɑ Ůɪɞ ´ɘɗŬɜɧǗɖǗɠ 0,05.

-ﮑ-ﮑ-ﮑ-

4. ϳ ЧΒ ϕ Ά ΆΈ ϳ ϕ ϳ

4.1. ϳ Ŭϳ Ŭэ Ŭϳ эůŰэ Ÿ Űŕ з ŭєэ эεŬєђε Ŭзɤ з

ϳ ϳ Ɑэ Ÿ ɑэ ŭɑэ эεŬєђε Ŭзɑэ ´ɑg ůgε´ Ůϳ эεŭɑɖэŬз ůŰɖ εŬэɣŰɖ Ŭɡŭε εŰŰз 32 Ÿзŭϳ Ůɖ, Ŭ ђ Űεgɡ ɑ´ɑœgɡ, ŰŰэ эŸ, 23 ɑэɑээε ϳɤ ůŬз ђэŬɡ Űɡ ´Ůϳ ŬεŬŰэɣɡ ŭɑэ εŬůɖ эŬэ ŰŬ Ŭ ɑŰŰэɣůεŬŰŬ Űŕ з ɑ´ɑɑɤ з ɑϳ ɖůεɑ´ɑεɖɖэŬз ɔэŬ Űɖ ůŰŰŰůŰэε ŬзŸэgůɖ. ϳ ´ђ Ŭɡŭεɨɡ εɖŬ ɑεŸůŬ Ŭɖэɖ Ű з ŭϳ ђεɤ з Ŭз Űεɑεɡ (n=8) эŬэ εɖŬ ɑεŸůŬ Ŭɖэɖ Ű з ŭϳ ђεɤ з ŰŰɑɨ ŰɖŰŰɡ (n=8) Űεg ээŬůэɑɨ ŬɖэɖŰůεɑɨ Ŭ ɑŰɣэŬůŬз Űɡ ŭɨ ɑ ´Ůϳ ŬεŬŰэɣɡ ɑεŸůŬɡ, Ůзı Űɖз ɑεŸůŬ Ůэɣɔɑɑg Űɖз Ŭ ŰŰɣэŬůŬз ŸŰεεŬ Ŭэɨ εзŬůŰŰ ε εŮ εэϳε эŬэ ђɑэ ŰŬэŰэε ŭgůэε ŭϳ ŬůŰɖϳ ђŰɖŰŰ (n=7). ¢ εɣůɖ ɖээɖŬ Űɤ з ŭɑэ эεŬєђε Ŭзɤ з, ɖ εɣůɖ ´ϳ ɑ´ɑзɖŰэε ɖээɖŬ эŬэ ɑэ Ů эŭђůŬɡ Űɤ з Ŭɖэɖ Ű з эŬŰŰэϳ ŸŭɑзŰŰэůŰз ЧɑŬэŬ 4-1.

ЧɑŬэŬɡ 4-1. *¢ ɖээɖŬ Űŕ з ŭεээ εŬєђε Ŭзɤ з эŬэ Űε Ŭɖэɖ Űэђ ´ϳ ɑŭɑ Űŕ з Ŭɖэɖ Ű з.*

ζ ɣŰɖůɖ	ϳ ɖэɖŰɣɡ ϳ зŰεɑεɡ	ϳ ɖэɖŰɣɡ ϕ Ŭɑɨ ŰɖŰŰɡ	Β εŸůŬ Άэɣɔɑɑg	n
¢ ээɖŬ (ɑϳ.)	24±3,16	23,75±1,67	23±1	23
ϳ ϳ ђзэŬЧϳ ɑ´.	7,63±3,66	7,25±3,06	ɑgŭɣз	16
100ε. (")	--	10,64±0,22	--	4
110ε. (")	--	14,00	--	1
200ε. (")	--	21,71±0,32	--	5
400ε. (")	--	47,64±1,68	--	2
ζ εэɑɡ (ε.)	--	7,64	--	1
5000ε. (')	15,02±0,84	--	--	8
10000ε. (')	30,51±1,23	--	--	6

ϕ ŬŭŮɑε ɣзŬ´ Ůϳ ɑgůэŸɑзŰэůŬεɣůɑɡђϳ ɑgɡ± Űɡ´ эε Ŭ ђээůɖ.

4.1.1. Έɤ ε ŬŰε Ůϳ эŸ ɑŬϳ Ŭэ Űɖϳ эůŰэ Ÿ, ůɤ ε ŬŰэε ůɨ ůŰŰůɖ

Β э εɣůŬɡ Űεɣɡ Űεg ůɤ εŬŰэɑɨ ɨ γɑgɡ эŬэ бŸϳ ɑgɡ, эŬɖı ɡ Ů ɑůɖɡ эŬэ ɑэ εɣůŬɡ ´ɑůɑůŰэŬɖŮɡ ŬзŬэɑɔɖŮɡ Űεg ůɤ εŬŰэɑɨ эɑ ɑgɡ, Űɖɡ Ÿэ´ ɖɡ ůɤ εŬŰэεɡ εŸεŬɡ эŬэ Űɤ з ɑůŰ з Űɤ з ŭɑэ эεŬєђε Ŭзɤ з эŬŰŰэϳ ŸŭɑзŰŰэůŰз ЧɑŬэŬ 4-2.

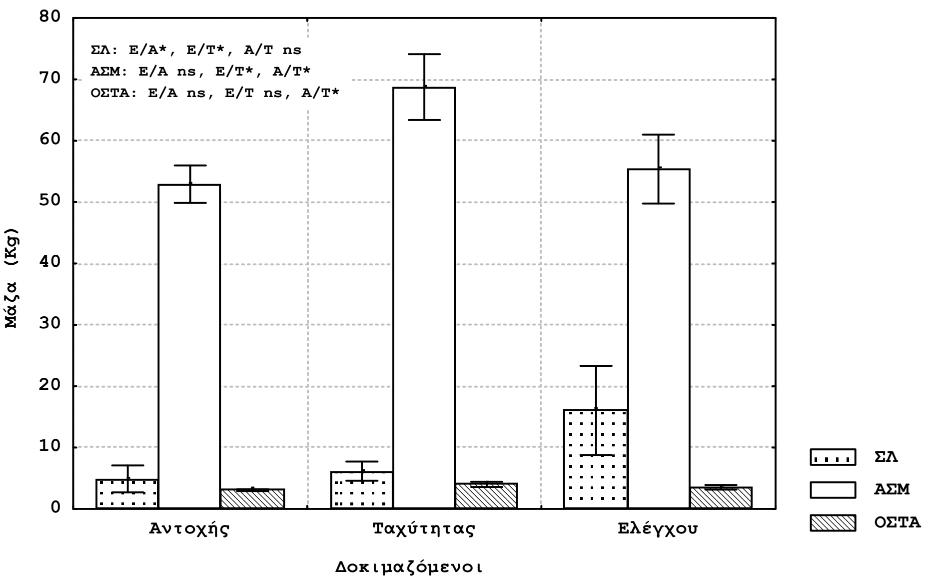
ЧɑŬэŬɡ 4-2. *бŬŰэŸ ůɤ εŬŰε Ůϳ эŸ ɑŬϳ Ŭэ Űɖϳ эůŰэŸ Űŕ з ŭεээ εŬєђε Ŭзɤ з Ŭз Ÿ ɑεŸůŬ.*

Β εŸůŬ	n	ϳ зŸůŰɖεŬ (cm)	Έб (kg)	Ές (%)	ϳ Έζ (%)	Β ůŰŸ (%)
ϳ зŰεɑεɖ	8	171,13±3,6	60,89±2,42	8,04±3,56	86,93±3,61	5,04±0,27
ϕ Ŭɑɨ ŰɖŰŰɡ	8	179,75±5,7	78,89±6,9	7,75±1,38	87,2±1,32	5,07±0,24
Άэɣɔɑɑg	7	175,57±6,75	74,95±9,57	20,91±7,29	74,36±6,95	4,72±0,37

Έб = Έɤ εŬŰэђ бŸϳ ɑɡ, Ές = Έɤ εŬŰэђ ς ɑı ɑɡ, ϳ Έζ = ɑ ээ´ ɖ Έɤ εŬŰэε ζ ŸεŬ. ϕ ŬŭŮɑε ɣзŬ´ Ůϳ ɑgůэŸɑзŰэ ůŬεɣůɑɡђϳ ɑgɡ± Űɡ´ эε Ŭ ђээůɖ.

Ǻǝǔǝђǖǚ Ǔ, ǕǝǕǖƳεззǖǚʃ ɔǝǓ ůǖǚǖǝƴʃ ůđεǓзǘǝƴʃ ŭǝǓǘεɉƴʃ εǕǖǚǝɨ ǘɤ з ɞεƳũɤ з, ђůεз ǓǘεɉƳ ǘđз ΄εůђǘđǖǓ ǘđʃ ǝɵ ι ŭεgʃ ůɤεǓǘǝɐʃ εƳεǓʃ, ǘđʃ Ƴǝɵ đʃ ůɤεǓǘǝɐʃ εƳεǓʃ ǝǓǝ Ǔgǘɐʃ ǘɤ з ɞůǘ з, ɓɉƴđđǝǓз ůǖǚǘǝůǘǝƳ ůđεǓзǘǝƴʃ ŭǝǓǘεɉƴʃ. Ɇgɔǝǔǝɉ ǝɣзǓ, đ ΄εůђǘđǖǓ ǘđʃ ǝɵ ι ŭεgʃ ůɤεǓǘǝɐʃ εƳεǓʃ ɓɉƴđđǝǕ зǓ ǔǝǓǝ ůđεǓзǘǝƳ εǕǝǓǝɨ ǖǚɉđ ůǘđз ɞεƳũǓ ǕǝƴɔɞεgǓ, ůǕ ůɨ ɔǝɉ ǝůđ εǕ ǘʃ Ƴǝǝǖʃ ŭɨ ε ΄Ǖɉ ǓεǓǘǝƴʃ ɞεƳũǖʃ (p<0,001), Ǖзι ŭǓз ŭǝƴũǖɉ Ǖ ůđεǓзǘǝƳ εǖǚǝɨ ǘɤ з ΄Ǖɉ ǓεǓǘǝι з ɞεƳũɤ з ǘɤ з Ǔđǝđǘ з.

ɉ зǘđǕǕǓ, đ Ƴǝɵ đ ůɤεǓǘǝɐ εƳεǓ ǘđʃ ɞεƳũǓʃ ǘɤ з Ǔđǝđǘ з ǖǚɨ ǘđǖǚʃ ɐǖз ůđεǓзǘǝƳ εǕǝǓǝɨ ǖǚɉđ ǝǓǝǓ ђ ǘđз ɞεƳũǓ ǘɤ з Ǔđǝđǘ з Ǔзǘзɐʃ, ǕǝǝƳ ǝǓǝ Ǔ ђ ǘđз ɞεƳũǓ Ǖǝƴɔɞεg (p<0,001), Ǖзι ŭǕз g΄ɐɉзǕ ůđεǓзǘǝɐ ůǖǚǘǝůǘǝɐ ŭǝǓǘεɉƳ εǕǖǚǝɨ ǘɤ з ŭɨ ε ǖǕǝǕgǖǚɤ з ɞεƳũɤ з. ɇƴǝɞg, ůđεǓзǘǝɐ ůǖǚǘǝůǘǝɐ ŭǝǓǘεɉƳ ΄ǚɉǓǘɉɐđđǝǕ ǝǓǝ ůǘđз ΄εůђǘđǖǓ ǘɤ з ɞůǘ з εǕǖǚǝɨ ǘɤ з ŭɨ ε ΄ǕɉǓεǓǘǝι з ɞεƳũɤ з ǘɤ з Ǔđǝđǘ з (p<0,001) (Ɇgɐ εǓ 4-1).

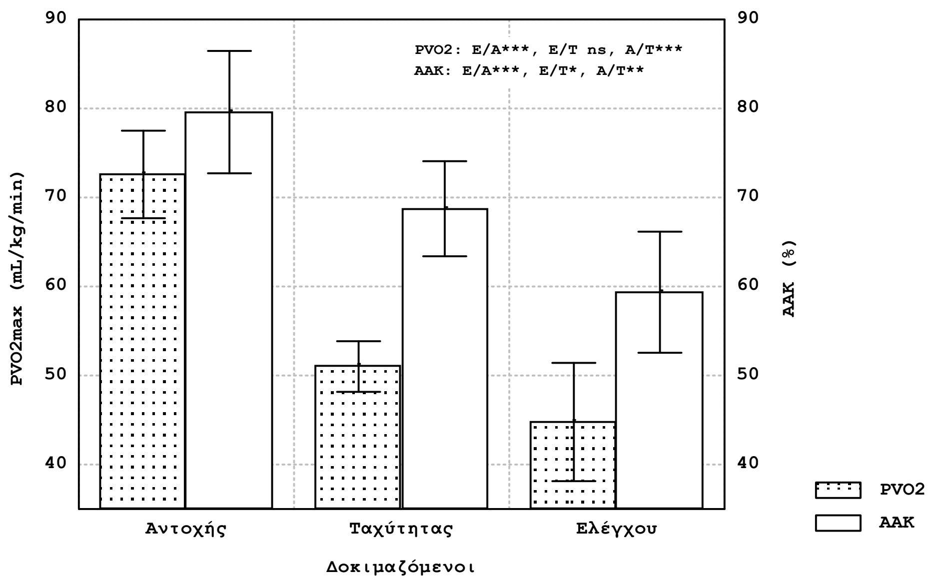


Ɇgɐ εǓ 4-1. *Ɇɤ εǓǘǝɐ ũɨ ůǖǚǘđ. Ɇɤ εǓǘǝђ ǝá εʃ (Ɇş) Ƴǝɵ đ ůɤ εǓǘǝɐ εƳεǓ (ɉ Ɇɀ) ǝǓǝ εƳεǓ ɞůǘ з ǘɤ з Ǔđǝđǘ з ŭɉђεɤ з Ǔзǘзɐʃ* (n=8, ɉ), *ǘɤ з Ǔđǝđǘ з ŭɉђεɤ з ǖǚɨ ǘđǖǚʃ* (n=8, ɇ) *ǝǓǝ ǘɤ з ŭεǝǝǓεђεǕɤ з ǘđʃ ɞεƳũǓʃ Ǖǝƴɔɞεg* (n=7, Ǻ) (* *Ǻ΄ á Ǔε ůđεǓзǘǝђǘđǖǚʃ* p<0,001, ns = *εđ ůđεǓзǘǝђ*, p>0,05). *ɇǓ ŭǓǕεɣзǓ ΄Ǖɉ εgůǝƳεзǖǚǝůǕεɣůεgʃђɉεgʃ ± ǘǥ΄ ǝε Ǔ ђǝǝůđ.*

4.1.2. Ɇɤ εǓǘǝƴʃ ǝ Ǔзђǘđǖǚʃ, Ǖɉ ɔεŭεǝ ǝ ǓũđǓʃ

ɇǓǓ εǖǚǝɣůεǖǚǓ ђ ǘđз Ǖɉ ɔεŭεǝǝ ǓůđǓεɣǖǚɉđůđʃǘđʃǕɉђɓǝǓʃ ǝůɨ εʃɣǓǕǝǓз ђǘǝđ ɞεƳũǓǘɤ з Ǔđǝđǘ з ǓзǘзɐʃǕǝǕůđεǓзǘǝƳ εǕǝǓǝɨ ǖǚɉđ ǝεɉ gǘǓđǓ΄ ɉ ђůǝđɣđ εзgǝђзεg (PVO2) ůǕ ůɨ ɔǝɉ ǝůđ εǕǘʃ ŭɨ ε Ƴǝǝǖʃ ɞεƳũǓʃ (p<0,001). Ǻ΄ ǝůđʃ, đ ΄εůεůǘǝǓǓзǓǝɞεɔǝǓ ǓεǘƳзǝůđʃǘзg ǓзǓǕɉ ђɓǝɞg ǓзǓ зǓgůǘǝεɨ ǝǓǘɤ ǘǝǝɨ (Aɉ Ɍ%) ǘɤ з Ǔđǝđǘ з Ǔзǘзɐʃ, ΄ǚɉǓǘɉɐđđǝǕůđεǓзǘǝƳ εǕǝǓǝɨ ǖǚɉđ ůǕůɨ ɔǝɉ ǝůđ εǕǘзgʃ ŭεǝǝǓεђεǕзgʃǘđʃ ɞεƳũǓʃ Ǖǝƴɔɞεg (p<0,001) ǝǓзgʃǓđǝđǘǝƴʃ ǖǚɨ ǘđǖǚʃ (p<0,02). Ɇđ εǓзǘǝƳ εǕǝǓǝɨ ǖǚɉε ɉ ɉ Ɍ ɓɉƴđđǝǕǝǓǝůǘзgʃǓđǝđǘǝƴʃ ǖǚɨ ǘđǖǚʃ ůǕ

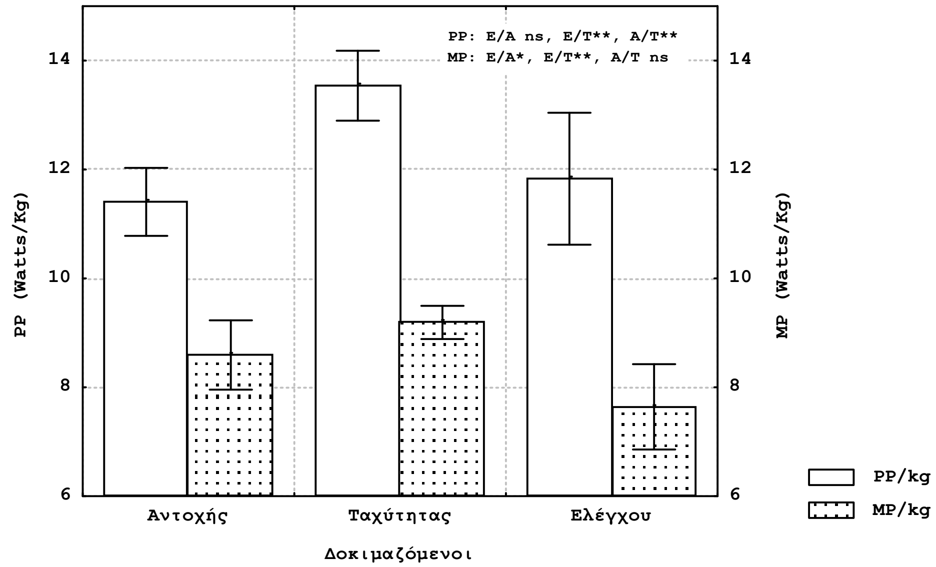
ůɨ ɔəɟ ɹůɖ ɛŮŬǥŰɞɨ ʛŰɖʛɵɛ ŸŭŬʛ Ůəɤɔɢɵɡ (p<0,04) (ƐɢɐɛŬ 4-2).



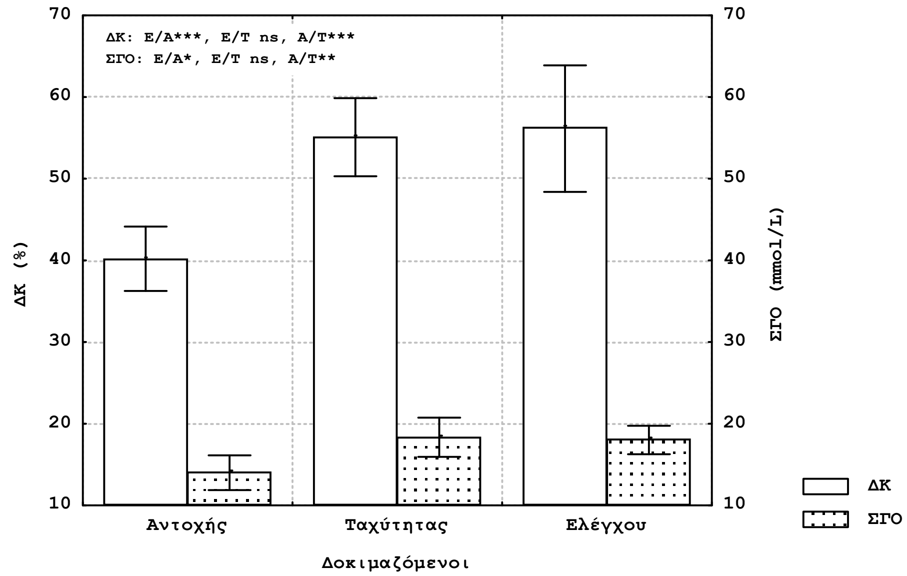
ƐɢɐɛŬ 4-2. ***Ɐɟɔɜŭɜəɶ ŬŰɗŬ ŬŰǿɧɓɜŬʛ ɹůɢɨɛɵ. Ʈɛɟɡűŭ ´ɟɧůəɖɣɖ ɛɜɡɔɧɜɛɡ*** (PVO2) ***əŬə ŬɜŬŰǿɧɓɜ ŬɜŬ ɜŬǻůŬəɧ əŬŰ ŭəə*** (AJ Ʈ) ***Ŭŗ ɜ Ŭɗəɖŭ ɜ ŭɟɧɛɤ ɜ ŬɜŰɞɢɐʛ*** (n=8, J), ***Ŭŗ ɜ Ŭɗəɖŭ ɜ ŭɟɧɛɤ ɜ ŰŰɢɨ ŰɖŰŰʛ*** (n=8, ɇ) ***əŬə Ŭŗ ɜ ŭɜəɶŬɧɛŬɤ ɜ Űɖʛ ɛɛŸŭŬʛ Ůəɤɔɢɵɡ*** (n=7, Ɐ) (****Ʌ´ɑ Ŭŭɜ ůɖɛŬɜŬəɧŰɖŰŰʛ* p<0,001, ***Ʌ´ɑ Ŭŭɜ ůɖɛŬɜŬəɧŰɖŰŰʛ* p<0,02, **Ʌ´ɑ Ŭŭɜ ůɖɛŬɜŬəɧŰɖŰŰʛ* p<0,04, ns = ***ɛɖ ůɖɛŬɜŬəɧ***, p>0,05). ***ɇŬ ŭŰŭɛɛɤɜŬ ´ŬɟɛɡůŸɛɜŰŬəŮɛɤůɛɡʛɧɟɛɡʛ± Űǥ´ɶɐ Ŭ ɧəəɹůɖ.***

J ´ɧ Űɖɜ ŬɜŬŮɟɧɓəŬ ŭɜəɶŬŮɗŬ Wingate, ɛ ŭŬəŰɖʛ Űɖʛ ɛɤɔəůŰɖʛ ůɢŬŰəɐʛ ´ŬɟŬɓɧɛŮɜɖʛ ɛɖɢŬɜəɐʛ ɹůɢɨɛɵ (PP/kg) ɓɟɤɖɖəŮ ůɖɛŬɜŬəŸ ɛŮŬŬəɨŰŬɟɛʛ ůŰɜɡʛ Ŭɗəɖŭɤʛ ŰŰɢɨ ŰɖŰŰʛ, ůŮůɨ ɔəɟ ɹůɖ ɛŮŰɜɡʛ ŭɜəɶŬɛɧɛŮɜɡɡʛ Űɤ ɜ ŭɨɜ Ÿəəɤ ɜ ɛɛŸŭɤ ɜ (p<0,001). Ʌ´ɘ´əɤɜɜ, ɛ ŭŬəŰɖʛ Űɖʛ ɛɤůɖʛ ůɢŬŰəɐʛ ´ŬɟŬɓɧɛŮɜɖʛ ɛɖɢŬɜəɐʛ ɹůɢɨɛɵ (MP/kg) Űɤ ɜ Ŭɗəɖŭ ɜ ŰŰɢɨ ŰɖŰŰʛ, ɐŰŰɜ ůŰŰŰůŬəŸ ɛŮŬŬəɨŰŬɟɛʛ ůŮ ůɨ ɔəɟ ɹůɖ ɛŮ ŬǥŰɧɜ Űɖʛ ɛɛŸŭŬʛ Ůəɤɔɢɵɡ (p<0,001), Ŭɜɩ , ůŮ ůɨ ɔəɟ ɹůɖ ɛŮ Űɖɜ ɛɛŸŭŬ Űɤ ɜ Ŭɗəɖŭ ɜ ŬɜŰɞɢɐʛ, ŭŬɜ ´ŬɟŰɖɟɐɖɖəŮ ůɖɛŬɜŬəɐ ůŰŰŰůŬəɐ ŭɜŰŭɛɟŸ. ɖůŰɧůɛ, ɛ ŭŬəŰɖʛ MP/kg Űɤ ɜ Ŭɗəɖŭ ɜ ŬɜŰɞɢɐʛ ɐŰŰɜ ůɖɛŬɜŬəŸ ɛŮŬŬəɨŰŬɟɛʛ ůŮůɨ ɔəɟ ɹůɖ ɛŮ ŬǥŰɧɜ Űɖʛ ɛɛŸŭŬʛ Ůəɤɔɢɵɡ (p<0,02) (ƐɢɐɛŬ 4-3).

ỹ ůɛɜ Űŭɛɟ Ÿ Űɞ ŭŬəŰɖ əɧ´ɤ ůɖʛ (ɸƮ), ɵə Ŭɗəɖŭɤʛ ŬɜŰɞɢɐʛ Ůɛ űŸɜɹůŬɜ ůɖɛŬɜŬəŸ Űɖ ɛɜɟɧŰŬɖ ɛŬɤ ůɖ ůŮůɨ ɔəɟ ɹůɖ ɛŮŰɡʛ ŭɨɛ ŸəəŬʛ ɛɛŸŭŬʛ (p<0,001). ɇɤəɛʛ, ůɖɛŬɜŬəɤʛ ůŰŰŰůŬəɤʛ ŭɜŰŭɛɟɤʛ ´ŬŰŰɟɐɖɖəŬ əŬə ůŰɖ ɛɤɔəůŰɖ ůɡɔəɤɜŬɤ ɔŬəŬɛɛɨ ɛɜɤɛʛ ůŰɞ ŬɛŬ, ɛŮŰŬɨ Űɖʛ ɛɛŸŭŬʛ Ůəɤɔɢɵɡ əŬə Űɤ ɜ Ŭɗəɖŭ ɜ ŬɜŰɞɢɐʛ (ɐŰŰɜ ɛŮŬŬəɨŰŬɖ ůŰɖɜ ɛɛŸŭŬ Ůəɤɔɢɵɡ) (p<0,007), əŬɗɩ ʛ əŬə ɛŮŰŬɨ Űɤ ɜ ŭɨɛ ´ŬɟŬɛŬəɩ ɜ ɛɛŸŭɤ ɜ Űɤ ɜ Ŭɗəɖŭ ɜ (ɐŰŰɜ ɛŮŬŬəɨŰŬɖ ůŰɡʛ Ŭɗəɖŭɤʛ ŰŰɢɨ ŰɖŰŰʛ) (p<0,003) (ƐɢɐɛŬ 4-4).



ȨɢɐɛŬ 4-3. *Ӓɵɞɛǘɘəɛ ŬŮďŬ ŬɜŬŰŮ ɧɞɜŰɕ ɤůɑɨ ɞɕ* (Wingate test). *ɀ ɣɑɤůŰɖ* (PP/kg) *əŬɘ ɛɣůɖ* (MP/kg) *ůɐŰŮɤɐ ´ŬŬɧɛŮɐɖ ɛɖɐŬɜɘ ɤůɑɨ ŰɞɖŬɪɖŰ ɘŬɧɛɣɘŬɛŰɕɞɕ* (n=8, J), *ŰɞɖŬɪɖŰ ɘŬɧɛɣɘŰɑɨŰɖŰŰ* (n=8, Ȅ) *əŬɘ Űɞ ɞɛɘəɛŬɧɛŬɣɘ ŰɖɕɛɛŤŰŬ Ůɣɑɞɕ* (n=7, Ӓ) (***Ӓ´ɑ Ůɛɞ ůɖɛŬɜŰɐɧŰɖŰŰ* p<0,001, *Ӓ´ɑ Ůɛɞ ůɖɛŬɜŰɐɧŰɖŰŰ* p<0,02, ns = *ɛɖ ůɖɛŬɜŰɐɧ*, p>0,05). *ȄŬ ŭŰɛɛɣɜŬ´Ŭ ɛɣůŤɛɜŰɑŮɛɣůɛɕɧɛɕ* ± *ŰɕɛɘŰ ɧɘəůɖ*.



ȨɢɐɛŬ 4-4. *Ӓɵɞɛǘɘəɛ ŬŮďŬ ŬɜŬŰŮ ɧɞɜŰɕ ɤůɑɨ ɞɕ* (Wingate test). *ɸŮɞŰɖɕəɧ´ɣ ůɖɕ* (ɸΓ) *əŬɘ ɛɣɑůŰɖ ůɡɘəɣɜŰɣ ůɖ ɜŬɜŬŰɑɛɘ ɛɜɛɕ ůŰɛ ŬɛŬ* (ȨŭΒ) *ŰɞɖŬɪɖŰ ɘŬɧɛɣɘŬɛŰɕɞɕ* (n=8, J), *ŰɞɖŬɪɖŰ ɘŬɧɛɣɘŰɑɨŰɖŰŰ* (n=8, Ȅ) *əŬɘ Űɞ ɞɛɘəɛŬɧɛŬɣɘ ŰɖɕɛɛŤŰŬ Ůɣɑɞɕ* (n=7, Ӓ) (****Ӓ´ɑ Ůɛɞ ůɖɛŬɜŰɐɧŰɖŰŰ* p<0,001, ***Ӓ´ɑ Ůɛɞ ůɖɛŬɜŰɐɧŰɖŰŰ* p<0,003, **Ӓ´ɑ Ůɛɞ ůɖɛŬɜŰɐɧŰɖŰŰ* p<0,007, ns = *ɛɖ ůɖɛŬɜŰɐɧ*, p>0,05). *ȄŬ ŭŰɛɛɣɜŬ´Ŭ ɛɣůŤɛɜŰɑŮɛɣůɛɕɧɛɕ* ± *ŰɕɛɘŰ ɧɘəůɖ*.

4.2. [illegible] OGTT-75g

[illegible] 4-3 [illegible] 4-4. [illegible] (OGTT-75g). [illegible] OGTT-75g [illegible].

[illegible] 4-3. [illegible] (mmol L^{-1}) [illegible] (75 g [illegible] 400 mL [illegible]).

[illegible]	[illegible] 0	[illegible] 0,5	[illegible] 1	[illegible] 1,5	[illegible] 2
[illegible] (n=8)	4,76±0,31	6,94±1,04	5,92±1,23	5,41±0,73	4,91±1,09
[illegible] (n=8)	4,59±0,48	7±1,33	5,18±1,38	4,85±0,85	3,73±1
[illegible] (n=7)	4,81±0,27	7,16±1,24	5,5±1,86	5,08±1,28	5,07±1,08

[illegible] 4-4. [illegible] (mU L^{-1}) [illegible] (75 g [illegible] 400 mL [illegible]).

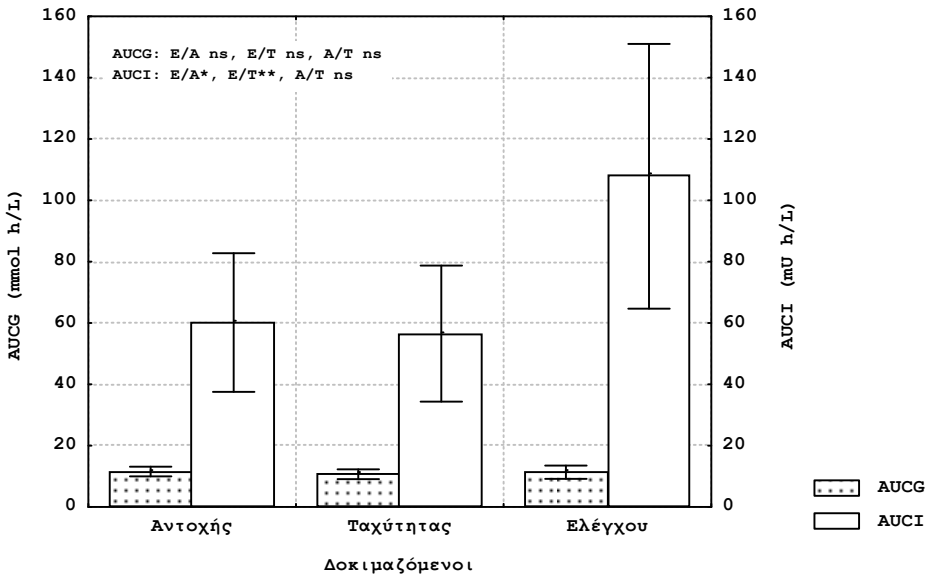
[illegible]	[illegible] 0	[illegible] 0,5	[illegible] 1	[illegible] 1,5	[illegible] 2
[illegible] (n=8)	4,08±1,06	49,25±19,94	31,88±12,04	27,13±21,94	19,99±12,29
[illegible] (n=8)	7,92±8,21	47,75±25,7	32,47±20,86	22,67±12,69	9,36±4,87
[illegible] (n=7)	6,86±1,96	96,31±64,1	57,14±15,79	41±11,21	35,57±12,67

4.2.1. [illegible]

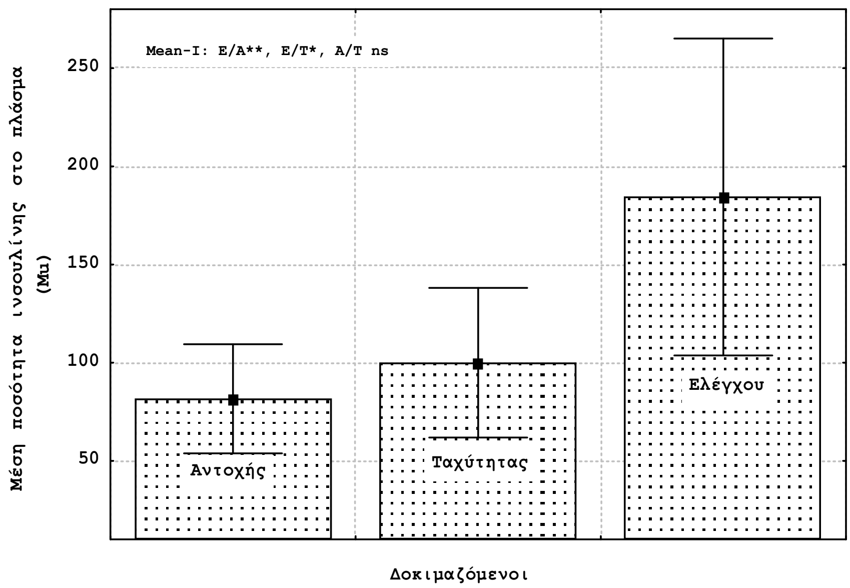
([illegible])

[illegible] (AUCG, mmol h L^{-1}), [illegible] (ΦAUCG, mmol h L^{-1}, [illegible]: 1,88±1,6, [illegible]: 2,05±1,78, [illegible]: 1,68±1,43). [illegible]

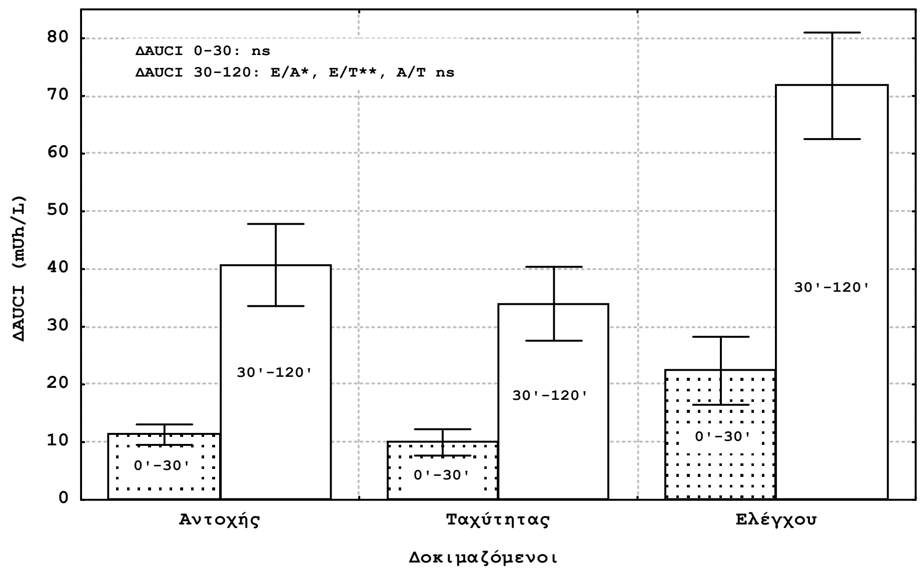
συγκέντρωση γλυκόζης στο πλάσμα (AUCG, mU h L^{-1}), ενώ η ολοκληρωμένη συγκέντρωση ινσουλίνης στο πλάσμα (AUCI, mmol h L^{-1}). Διαπιστώθηκε ότι η μέση τιμή της AUCG στους ασθενείς με ΣΔ2 ήταν μεγαλύτερη από αυτή των υγιών ατόμων (p<0,042), ενώ η μέση τιμή της AUCI στους ασθενείς με ΣΔ2 ήταν μεγαλύτερη από αυτή των υγιών ατόμων (p<0,02), όπως επίσης και η μέση τιμή της AUCI στους ασθενείς με ΣΔ2 ήταν μεγαλύτερη από αυτή των ασθενών με ΣΔ1 (p<0,024) (Διάγραμμα 4-5). Η συσχέτιση μεταξύ της AUCG και της AUCI στους ασθενείς με ΣΔ2 ήταν ισχυρή και θετική (r=0,94, p<0,0001), ενώ η αντίστοιχη συσχέτιση στους υγιείς εθελοντές ήταν ασθενής και θετική (r=0,52, p=0,087) ενώ στους ασθενείς με ΣΔ1 ήταν μέτρια και θετική (r=0,43, p<0,015). Οι ασθενείς με ΣΔ2 παρουσίασαν μεγαλύτερη μέση τιμή της ολοκληρωμένης συγκέντρωσης γλυκόζης στο πλάσμα (mean-G) από τους υγιείς εθελοντές, ενώ η μέση τιμή της ολοκληρωμένης συγκέντρωσης ινσουλίνης στο πλάσμα (mean-I) στους ασθενείς με ΣΔ2 ήταν μεγαλύτερη από αυτή των υγιών ατόμων (p<0,006) ενώ η μέση τιμή της ολοκληρωμένης συγκέντρωσης ινσουλίνης στους ασθενείς με ΣΔ2 ήταν μεγαλύτερη από αυτή των ασθενών με ΣΔ1 (p<0,024) (Διάγραμμα 4-6). Η συσχέτιση μεταξύ της ολοκληρωμένης συγκέντρωσης γλυκόζης στο πλάσμα και της ολοκληρωμένης συγκέντρωσης ινσουλίνης στο πλάσμα (qpAUCI 0-30 και qpAUCI 30-120, αντίστοιχα) στους ασθενείς με ΣΔ2 ήταν ισχυρή και θετική, ενώ η αντίστοιχη συσχέτιση στους υγιείς εθελοντές ήταν ασθενής και θετική (qpAUCI 30-120) (Διάγραμμα 4-7).



Διάγραμμα 4-5. *qπαναερόβιο OGTT-75g.* Η ολοκληρωμένη συγκέντρωση γλυκόζης στο πλάσμα *(AUCG)* και η ολοκληρωμένη συγκέντρωση ινσουλίνης στο πλάσμα *(AUCI)* στους ασθενείς με ΣΔ2 *(n=8, μ)*, στους ασθενείς με ΣΔ1 *(n=8, ♂)* και στους υγιείς εθελοντές *(n=7, Α)* *(Α διαφέρει από τους ασθενείς με ΣΔ1 *p<0,02*, *Α διαφέρει από τους ασθενείς με ΣΔ2 *p<0,042*, *ns = δεν διαφέρει, p>0,05*). ♂ διαφέρει από Τ, Α διαφέρει από Ε, ± τυπικό σφάλμα της μέσης τιμής.**

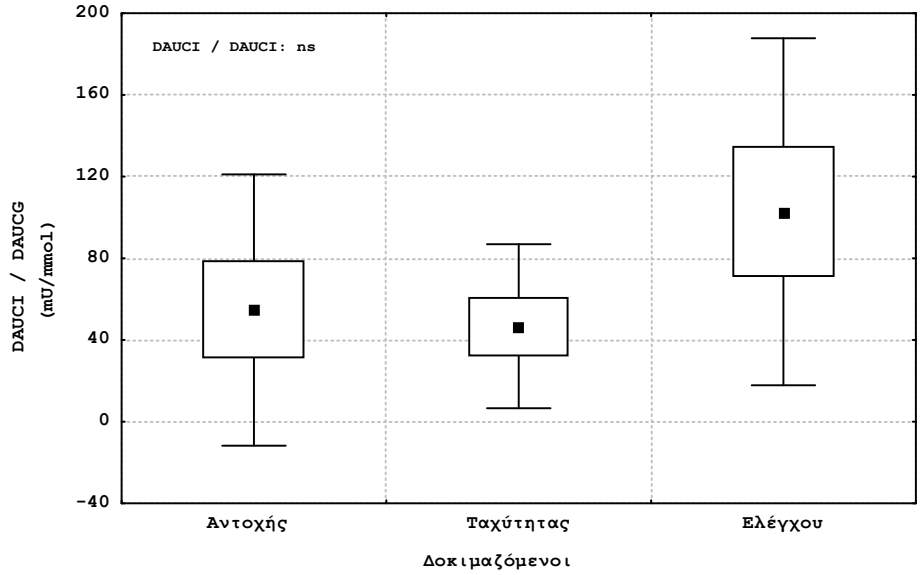


ЁɢɐɛǓ 4-6. *ɸɐǝɛǕŰůǕ OGTT-75g. ɀ уůɖ ´ɞůђŰɖŰŰ ɤůɛɡǝɶɖɠ ůŰ ´ǝŸůɛǓ (Mean-I) Ű ɜ ǕɑǝɖŰ ɜ ǚɡђɛʏ ɜ ǕɜŰɐɶɠ (n=8, Ј), Ű ɜ ǕɑǝɖŰ ɜ ǚɡђɛʏ ɜ ŰŰɑ ŰɖŰŰɠ (n=8, ɇ) ǝǕɞ Ű ɜ ǚɛǝɛǕɑђɛŮʏ ɜ Űɖɠ ɞɛŸǚǕɠ Ůɒɔɛɡ (n=7, Ʌ) (**Ʌ´ά Ůɑ ůɖɛǕɜŰɞђŰɖŰŰɠ p<0,006, *Ʌ´ά Ůɑ ůɖɛǕɜŰɞђŰɖŰŰɠ p<0,024, ns = ɛɖ ůɖɛǕɜŰɞђ, p>0,05). ɇǓ ǚŮǚɛɛуɜǓ´Ǘ ɛɡůŸɛɜŰŰɞůǓɛуůɛɡɠђ ɛɡɠ± Űɠ´ɘɐ Ǔ ђǝǝůɖ.*



ЁɢɐɛǓ 4-7. *ɸɐǝɛǕŰůǕ OGTT-75g. ɸŮɞŰŰɠɉɡɖɛɑ Ǔ ŮɑŮɖɣ ʏ ůɖɠ ɤůɛɡǝɶɖɠ (ɸAUCI 0-30, & ɸAUCI 30-120) Ű ɜ ǕɑǝɖŰ ɜ ǚɡђɛʏ ɜ ǕɜŰɐɶɠ (n=8, Ј), Ű ɜ ǕɑǝɖŰ ɜ ǚɡђɛʏ ɜ ŰŰɑ ŰɖŰŰɠ (n=8, ɇ) ǝǕɞ Ű ɜ ǚɛǝɛǕɑђɛŮʏ ɜ Űɖɠ ɞɛŸǚǕɠ Ůɒɔɛɡ (n=7, Ʌ) (**Ʌ´ά Ůɑ ůɖɛǕɜŰɞђŰɖŰŰɠ p<0,009, *Ʌ´ά Ůɑ ůɖɛǕɜŰɞђŰɖŰŰɠ p<0,032, ns = ɛɖ ůɖɛǕɜŰɞђ, p>0,05). ɇǓ ǚŮǚɛɛуɜǓ´Ǘ ɛɡůŸɛɜŰŰɞůǓɛуůɛɡɠђ ɛɡɠ± Űɠ´ɘɐ Ǔ ђǝǝůɖ.*

ψηφιακή ανάλυση της καμπύλης έκκρισης της ινσουλίνης (AUCI) και της καμπύλης συγκέντρωσης της γλυκόζης (AUCG) κατά τη διάρκεια της δοκιμασίας ανοχής στη γλυκόζη (βλ. ενότητα 4-8).



Διάγραμμα 4-8. *Διαφορές στις καμπύλες AUCI και AUCG στο OGTT-75g. «Ανοχής» (AUCI / AUCG) της ομάδας ελέγχου (n=8, Α), της ομάδας ταχύτητας (n=8, Β) και της ομάδας αντοχής (n=7, Γ) (ns = μη σημαντικές διαφορές, p>0,382). Οι γραμμές σφάλματος δείχνουν τα διαστήματα εμπιστοσύνης 95% για τους μέσους όρους.*

4.2.2. Σύγκριση των δεικτών ευαισθησίας

(α. Δείκτες ευαισθησίας που βασίζονται στη μέτρηση της γλυκόζης, και δείκτες ευαισθησίας που βασίζονται στη μέτρηση της ινσουλίνης)

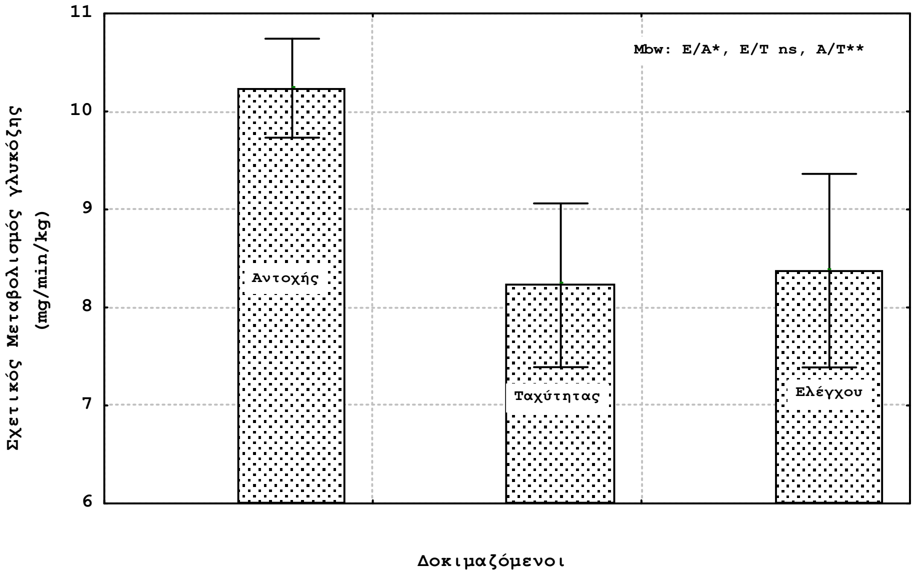
Η μεθοδολογία που χρησιμοποιήθηκε για τη σύγκριση των δεικτών ευαισθησίας που βασίζονται στη μέτρηση της γλυκόζης (α. δείκτες) και των δεικτών ευαισθησίας που βασίζονται στη μέτρηση της ινσουλίνης (β. δείκτες) περιγράφεται στην ενότητα 3.4.2.

Η ανάλυση διακύμανσης για τους δείκτες ευαισθησίας που βασίζονται στη μέτρηση της γλυκόζης (rel-R), έδειξε ότι η διαφορά μεταξύ των ομάδων ήταν στατιστικά σημαντική (p=0,935) (βλ. ενότητα 4-9).

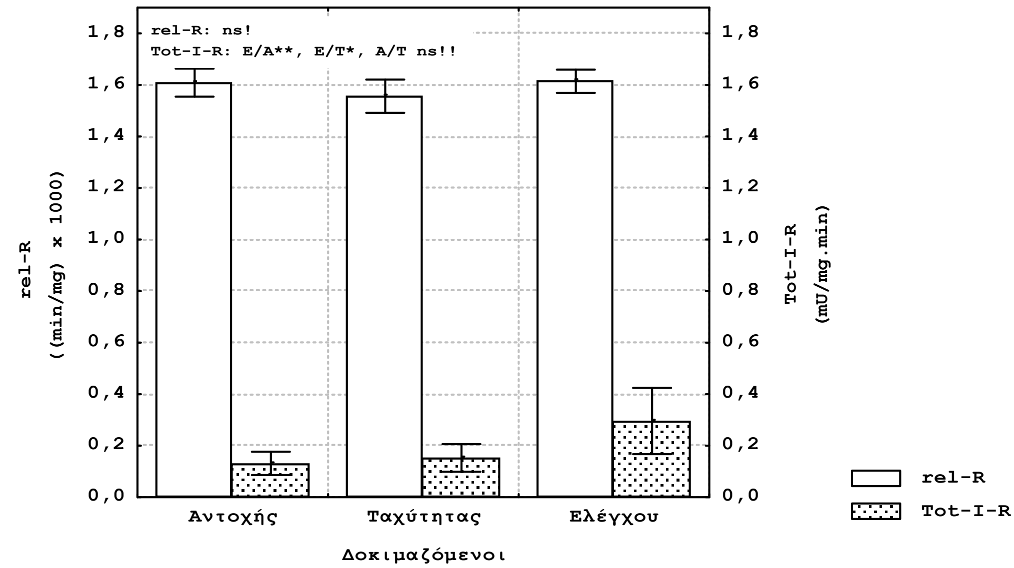
Η ανάλυση διακύμανσης για τους δείκτες ευαισθησίας που βασίζονται στη μέτρηση της ινσουλίνης (rel-Rbw), διαπίστωσε ότι η διαφορά μεταξύ των ομάδων ήταν στατιστικά σημαντική (p<0,001) αλλά η διαφορά μεταξύ των ομάδων αντοχής και ταχύτητας δεν ήταν στατιστικά σημαντική (p<0,002), ενώ η διαφορά μεταξύ της ομάδας ελέγχου και της ομάδας ταχύτητας ήταν στατιστικά σημαντική (p<0,003). (βλ. ενότητα 4-11).

Η ανάλυση διακύμανσης, η οποία εφαρμόστηκε στους δείκτες Tot-I-R, η οποία βασίζεται στην ολοκλήρωση της καμπύλης έκκρισης της ινσουλίνης, διαπίστωσε ότι η διαφορά μεταξύ των ομάδων ήταν στατιστικά σημαντική (p<0,004) αλλά η διαφορά μεταξύ της ομάδας αντοχής και της ομάδας ταχύτητας δεν ήταν στατιστικά σημαντική, ενώ η διαφορά μεταξύ της ομάδας ελέγχου και της ομάδας ταχύτητας ήταν στατιστικά σημαντική (p<0,003). (βλ. ενότητα 4-11).

Ὁϧϒϲϲɡ, ὐὖ ὐɨ ɔϑɟ ϛὐϥ εὖ ὕϥɜ ϲεϓὑὖ ὕϒ ɜ ὕϥϑϥὕ ɜ ὕɜὕϵϲϵϥ (p<0,005) ϑὕϑὕϥɜ ϲεϓὑὖ ὕϒ ɜ ὕϥϑϥὕ ɜ ὕὕϲɨ ὕϥὕϥ (p<0,014), ϲϒ ɟ ϙϥ ɜὖ ´ὕɟ ὕὕϥɟ ϥϥὕϥ ὐϥεὕɜὕϵϵ ὓϑὕϙϲɟ ϓ εὐὕὕɜɨ ὕϒ ɜ ὓɨ ϲ ´ὐɟ ὕεὕὕϵι ɜ ϲεϓὑϒ ɜ ὕϒ ɜ ὕϥϑϥὕ ɜ (p=0,852) (Ϸϲϵ εὖ 4-10).

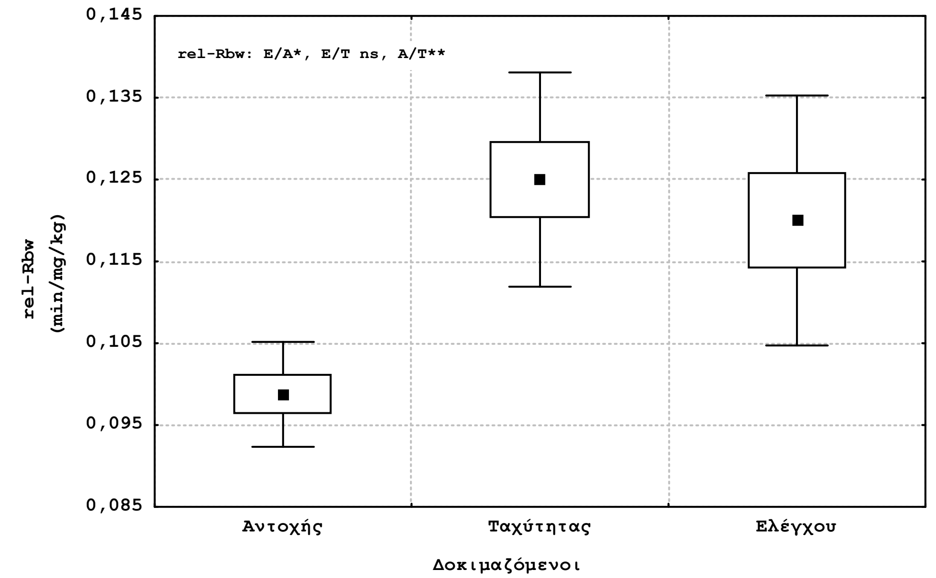


Ϸϲϵεὖ 4-9. *ϙϵϑϵὕὑὖ OGTT-75g. Λɡϥεɦϥ ὓϑϓϥὐϥϥ-ϗ ὐὕϵϲϑϧὐεɦϥ ɔϑɡϑɦϥϥϥ ὕɜϒ ϑϧɦ ὐϒ εὕὕϵϲɨ ϧϒϳϲɡϥ (Mbw) ὕϒ ɜ ὕϥϑϥὕ ɜ ὓɟ ɦεϒ ɜ ὕɜὕϵϲϵϥ (n=8, ɟ), ὕϒ ɜ ὕϥϑϥὕ ɜ ὓɟ ɦεϒ ɜ ὕὕϲɨ ὕϥὕϥ (n=8, ϵ) ϑὕϑ ὕϒ ɜ ὓϲϑϵὕϵɦεὐϒ ɜ ὕϥϥ ϲεϓὑὕϥ Ὁϧϒϲϲɡ (n=7, Ά) (**Ά´ ά ὐϵ ὐϥεὕɜὕϵɦϥὕϥ p<0,001, *Ά´ ά ὐϵ ὐϥεὕɜὕϵɦϥὕϥ p<0,002, ns = εϥ ὐϥεὕɜὕϵɦ, p>0,934). ϵ ὕὕὐϵεϒɜὕ´ ὕɟ ϲɡὐϑϒϲɜὕϵὐὕεϒὐϵɡϥɦɟ ϲɡϥ ± ὕϥ´ ϧϵ ὕ ɦϑϑὐϥ.*



ЃGɐεŬ 4-10. ***ȹəɞŬůdŬ*** *OGTT-75g.* ***ЃGŮŰəɐ ´ŮŗśŰŮɞɐ ŬȝŰůŰŰůd*** *(rel-R)* ***əŬə ůgȝɞəɞɐ ŬȝŰůŰŰůd ůŰlȝ ɞůɞgəəd*** *(Tot-I-R)* ***Űr ȝ ŬdəlŰ ȝ ŭŗ ɧεɤ ȝ ŬȝŰɞɞɐʃ*** *(n=8, ȷ),* ***Űr ȝ ŬdəlŰ ȝ ŭŗ ɧεɤ ȝ ŰŰɞi ŰlŰŰʃ*** *(n=8, ȼ)* ***əŬə Űr ȝ ŭɞəɞŬɕɧεŮȝɤ ȝ Űlʃ ɞεŸŭŬʃ Ůɏɔɞɞg*** *(n=7, Ⱥ) (*****Ⱥ´ á Ůɞ ůdεŬȝŰəɧŰlŰŰʃ*** *p<0,005, **Ⱥ´ á Ůɞ ůdεŬȝŰəɧŰlŰŰʃ*** *p<0,014, ns!! =* ***εd ůdεŬȝŰəɧ****, p>0,851, ns! =* ***εd ůdεŬȝŰəɧ****, p>0,143).* ***ȼŬ ŭŰɞεɣȝŬ´ Ŭŗ ɞgůɞŸɞȝŰŰə ůŬ εɣůɞggʃɧŗ ɞggʃ± Űg´ ɞɐ Ŭ ɧəəɞůd****.*

ЃGɐεŬ 4-11. ***ȹəɞŬůdŬ*** *OGTT-75g.* ***ЃGŮŰəɐ ´ŮŗśŰŮɞɐ ŬȝŰůŰŰůd ŬȝŸ əɞəɧ ůɤ εŬŰəɞi ƃŸŗ ɞggʃ*** *(rel-Rbw)* ***Űr ȝ***



ŬdəlŰ ȝ ŭŗ ɧεɤ ȝ ŬȝŰɞɞɐʃ *(n=8, ȷ),* ***Űr ȝ ŬdəlŰ ȝ ŭŗ ɧεɤ ȝ ŰŰɞi ŰlŰŰʃ*** *(n=8, ȼ)* ***əŬə Űr ȝ ŭɞəɞŬɕɧεŮȝɤ ȝ Űlʃ ɞεŸŭŬʃ Ůɏɔɞɞg*** *(n=7, Ⱥ) (*****Ⱥ´ á Ůɞ ůdεŬȝŰəɧŰlŰŰʃ*** *p<0,003, **Ⱥ´ á Ůɞ ůdεŬȝŰəɧŰlŰŰʃ*** *p<0,005, ns =* ***εd ůdεŬȝŰəɧ****, p>0,956).* ***ȼŬ ŭŰɞεɣȝŬ´ Ŭŗ ɞgůɞŸɞȝŰŰə ůŬ εɣůɞggʃɧŗ ɞggʃ± Űg´ ɞɐ Ŭ ɧəəɞůd****.*

4.2.3. ȾǥůǤŮŰǻůŮǯ ´ Ǘ Ŭɛɏ Ǘ ɤ ɜ

(Pearson, ´ɞǝǝŬ ǝɐ ɓŬǽɛɜŬǽŬ ´ Ŭǝɞǔ ɧɛ ɖůɖ)

ȷ ´ɧ Űǯ ůǥůǤŮŰǻůŮǯ ɞɘ ɞ´ɞɖŮǯ ´ɟŬɓɛŬŰǻ´ɞɶɖɖǝŬɜ ɛŮŰŬɜɨ Űɤɜ ´Ǘ Ŭɛɏ Ǘ ɤ ɜ, ´ɟɞɏǝǥɣŮ ɧŰǝ ɞ ɟǥǽɛɧǯ ŭǝŸɖŮůɖǯ-ɛŮŰŬɓɞǝɲůɛɧǯ Űɖǯ ɔǝǥǝɧɕɖǯ (Mbw, mg min kg) ŬǤŮǥɣɖǝɐ ůǥůǤɏŰǻůɖ ɛŮ Űǻ űɞɟŰɐ ɔǝǥǝɧɕɖǯ Űǻ ɞ´ɞɶ ɐŰɜ ŬŸǝɞɔɞ Űǽǥ ůɤɛŬŰǻɞɨ ɓŸɟɞǥǯ Űɤɜ ŭɞǝɶŬɧɛŮɤɜ (g/kg) (r = 0,97, p<0,001). Ƀɛɞɑɤǯ, ǥɣɖǝɐ ůǥůǤɏŰǻůɖ ɓɟɏɖɖǝŮ ɛŮŰŬɨ Űɖǯ ɛɏůɖǯ ůǥɔǝɏɜǗ ɤ ůɖǯ ɕůɞǥǝɞɕɖǯ ůŰǻɜ ´ǝŸůɛŬ (Mean-I) ǝŬ Űɖǯ ůǥɜɞǝɕɐǯ ŬɜŰŮůŰŰůɖǯ ůŰɖɜ ɕůɞǥǝɞɕɖ (Tot- I-R) (r = 0,98, p<0,001). ȾɖɛŬɜŰǝɐ ůǥůǤɏŰǻůɖ ɓɟɏɖɖǝŮ ǝŬ ɛŮŰŬɨ Űɛǥ ŮɓŬǽɞɨ Űɖǯ Ůɑɜŭɞǽǯ Űɖǯ ɔǝǥǝɧɕɖǯ (φAUCG) ǝŬ Űɖǯ ůǤŰǝɐǯ ´ Ǘ ɑɜ Ǘ ɕɐǯ ŬɜŰŮůŰŰůɖǯ (rel-R) (r = 0,48, p<0,022). Ⱥ´ɑůɖǯ, ɖ ůǤŮŰǝɐ ´ Ǘ ɑɜ Ǘ ɕɐ ŬɜŰŮůŰŰůɖ ŬŸǝɕɧ ůɤɛŬŰǝɞɨ ɓŸɟɞǥǯ (rel-Rbw) ǝŬ ɖ Tot-I-R ɓɟɏɖɖǝŬ ɜŬ ůǥůǤŰǝɞɜŰŬ ůɖɛŬŰǝŸɛŮ´ Ǘ Ŭɛɏ Ǘ ɞǥǯ Űɖǯ ůɤɛŬŰǝɐǯ ůɨ ůŰŰůɖǯ ǝŬ Űɤɜ ůɤɛŬŰǝɘ ɜ ɕŬɞǝɛŰɤɜ (ɄɑŬŬǯ 4-5).

ɄɑŬŬǯ 4-5. ***ȾǥůǤŮŰǻůŮǯ ɛŮŰŬɨ Űɖǯ ůǤŰǝɐǯ ´ Ǘ ɑɜ Ǘ ɕɐǯ ŬɜŰŮůŰŰůɖǯ ŬŸǝɕɧ ůɤɛŬŰǝɞɨ ɓŸɟɞǥǯ** (rel-Rbw) **ǝŬ Űɖǯ ůǥɜɞǝɕɐǯ ŬɜŰŮůŰŰůɖǯ ɏɜŬǻ Űɖǯ ɕůɞǥǝɞɕɖǯ** (Tot-I-R) **ɛŮ´ Ǘ Ŭɛɏ Ǘ ɞǥǯ Űɖǯ ůɤɛŬŰǝɐǯ ůɨ ůŰŰůɖǯ (ȷ Ⱦɀ, Ⱦȿ) ǝŬ Űɤɜ ůɤɛŬŰǝɘ ɜ ɕŬɞǝɛŰɤɜ*** (PVO2, ***ȷȷ Ɍ***, PP kg, MP kg, ***ȾũɃ***) (Pearson, r).

ȾǥůǤŮŰǝɧɛŬŮǯ ɀ ŬŰŬɓǝɖŰǯ	r	p
rel-Rbw / ȷ Ⱦɀ	0,69*	<0,001
rel-Rbw / Ⱦȿ	0,61*	<0,003
rel-Rbw / PVO2	-0,75*	<0,001
rel-Rbw / ȷ ȷ Ɍ	-0,43*	<0,044
rel-Rbw / PP kg	0,40	=0,62
rel-Rbw / MP kg	-0,23	=0,28
rel-Rbw / ȾũɃ	0,55*	<0,007
Tot-I-R / ȷ Ⱦɀ	-0,12	=0,58
Tot-I-R / Ⱦȿ	0,69*	<0,001
Tot-I-R / PVO2	-0,52*	<0,013
Tot-I-R / ȷ ȷ Ɍ	-0,47*	<0,024
Tot-I-R / PP kg	-0,21	=0,33
Tot-I-R / ɀ P kg	-0,57*	<0,005
Tot-I-R / ȾũɃ	0,31	=0,14

rel-Rbw = ȾǤŰǝɐ ´ Ǘ ɑɜ Ǘ ɕɐ ŬɜŰŮůŰŰůɖ ŬŸǝɕɧ ůɤɛŬŰǝɞɨ ɓŸɟɞǥǯ (min mg kg), Tot-I-R = Ⱦǥɜɞǝɕɐ ŬɜŰŮůŰŰůɖ ůŰɖɜ ɕůɞǥǝɞɕɖ (mU mg min^{-1}), ȷ Ⱦɀ = ȯǝɑ ɖ Ⱦɤ ɛŬŰǝɐ ɀ ŸŬŬ (kg), Ⱦȿ = Ⱦɤ ɛŬŰǝɧ ȿ ɑɞǯ (kg), PVO2 = Ɍɞɟ ǥűŬŬ´ɟɧůǝɖɣɖ ɞɜǥɔɧɜɞǥ (mL/kg/min), ȷ ȷ Ɍ = AɜŬǗ ɧɓɕ AɜŬ ɜǗůŰǝɧ KŬŰ űǝɘ (%), PP kg = ɀ ɏɕůŰɖ ´ Ǘ Ŭɓɧɛ Ůɜɖ ɛɖǤŬɜɕɐ ɲǤɨ (watts kg), MP kg = ɀ ɏůɖ ´ Ǘ Ŭɓɧɛ Ůɜɖ ɛɖǤŬɜɕɐ ɲǤɨ (watts kg), ȾũɃ = ȾǥɔǝɏɜǗ ɤ ůɖ ũŬŬŬɕɞɨ ɞɜɏɞǥǯ (mmol/L).

[illegible] (PVO2, mL/kg/min) [illegible] (rel-Rbw). [illegible] kg) [illegible] kg) [illegible] rel-Rbw ([illegible] 4-6). [illegible] (Tot-I-R), [illegible] PVO2 (mL/kg/min), [illegible] (MP, watts kg) ([illegible] 4-7).

[illegible] 4-6. [illegible] rel-Rbw [illegible]: PVO2, [illegible]

[illegible]	[illegible] (R²)	F	p	beta	t	p
PVO2	0,559	26,64	0,000	-0,748	-5,16	0,000
PVO2,				-0,57	-4,76	0,000
[illegible]	0,753	30,45	0,000	0,47	3,96	0,001
PVO2,				0,38	0,28	0,78
[illegible],				0,75	8,15	0,000
[illegible]	0,904	59,38	0,000	0,69	5,45	0,000
[illegible],				0,73	10,49	0,000
[illegible]	0,903	93,32	0,000	0,66	9,43	0,000

rel-Rbw = [illegible] (min mg kg), PVO2 = [illegible] (mL kg min), [illegible] (kg), [illegible] (kg), [illegible] (%), [illegible] (mmol L).

[illegible] 4-7. [illegible] Tot-I-R [illegible]: PVO2, [illegible] MP kg.

[illegible]	[illegible] (R²)	F	p	beta	t	p
[illegible]	0,48	19,08	0,000	0,69	4,37	0,000

Tot-I-R = [illegible] (mU mg min ⁻¹), PVO2 = [illegible] (mL kg min), [illegible] (kg), [illegible] (%), MP kg = [illegible] (watts kg).

5. ǂǁ ǅǂ ǂǂ ǂǂ

ǂɨ εűɤ ɜǓ εŮ űɜ DeFronzo ǝǓǩ űϩǥǥ ůǥɜǗɔŸǖǥ űϩǥ (1979), ď ǓǩűȩďůďűǗǥ ŭǥɜǓȩ ϧϩϩϧ űϩǥ ϭεϭϧůűǖǘϩϭɨ εďϲǓɜϧůεϭɨ űǗǥ ɔϩǥϩђϧϲďǥ Ůϧűǥɔϭ Ÿɜ ůǖǓϧ εŮ űϩɜ ´ɉϭůŭϧɉϧůεђ Ǔ) űǗǥ ǓǥǓϧůďďůďǓǥ űɤ ɜ б-ǝǥǖŸǥɤ ɜ űϩǥ ´ǓϩɉɥǓǥϧ ůűď ɔϩǥϩђϧď ǝǓǩ б) űǗǥ ǓǥǓϧůďďůďǓǥ űɤ ɜ ϧůű ɜ ůűǗɜ ϧůϩϧϩϧϩď, ď ϭ´ϭďǓ ɉǥďεϭǓϩ űď ŭϧŸďǓůď űǗǥ ɔϩǥϩђϧϲďǥ ´ɉϭǥ űϩǥǥ ϧůűϩɨ ǥ-ůǘђϭϭǥ (εǥǥ, ǝϭ ϭǥ, ϩ´ǓĵǦ). ũϧǓ űϩɜ ´ɉϭůŭϧɉϧůεђ ǘђůϭ űǗǥ ´ɉɩ űǗǥ, ђůϭ ǝǓǩ űǗǥ ŭǓɨ űǓǥ ďǥ ´Ůǥ ϭ űɤ ůďǥ, ůǥɜϩďɤ ǥ ϭɉďůϧϭ´ϭϧǗǖǓϩ ď εɥďϭŭϭǥ űǗǥ űϭɜϧϧŸ Ůϧűǥϭɨ εǓďǥ ǥ´ǓɔϩǥϩǓϧďǓǥ (hyperglycemic clamp technique, HCT) ǝǓǩ űǗǥ űϭɜϧϧŸ Ůϧűǥϭɨ εǓďǥ ǥ´Ǔϧůϭϩϧϧǥ ǓϧϧϩϧǓϧďǓǥ ǓɔϩǥϩǓϧďǓǥ (euglycemic insulin clamp technique, EICT), ǓϩűűůϩϧǓ.

ǂűǗɜ ´Ǔϧϭɨ ůǓ εǓɥűď ǓϩǓϩɨ ďďϩǓϩ ɜǓϭɤɉϧůŸ: Ǔ) ď ǓǓǓǥďǓϧϭɨ εǓϩďǥ ϧůϩϧϩϧϩď ǝǓǩ б) ď ´Ǔϧűǥϧϩϩ ǓɜűűůǖǖůďǥϩďǓɜűűůǖǖůďűɤ ɜ ϧůű ɜ-ůǘђϭϭǥ ɥɜǓϩǓ űǗǥ Ǔůђŭϭϭǥ űǗǥ ɔϩǥϩђϧϲďǥ (Bergman, et. al., 1981). ǂ ϭɉďůϧϭ´ϭϩďůď űǗǥ ŭϭǝϧǓůďǓǥ Ǔϩϭϩϭǥ ɔϩǥϩђϧϲďǥ, ǝǓεбŸɜϭɜǖǥ ´ϭůђűǗǖ ɔϩǥϩђϧϲďǥ Ǔ ђ űϩ ůǘђεǓ (OGTT-75g), ůŮ ǓɜűďǓůď εŮ űϩǥ ɥɜűɜǓ´ǓɉǓεбǓϩɥǥ´ǓɉǓ Ÿɜɤ εǓǖђŭϭϭǥ (HCT & EICT), ŭϧǖɉďůŮ űď ůϭɥůď ǓɜǓǓϭűϭŭђűďůďǥ εǖǖǓɜɨ ɔϩǥϩђϧϲďǥ ǝǓǩ ϧůϩϧϩϧϩďǥ.

ǂ Ǔ ǓǩǓǥďɥɉɤ ůď ϧůϩϧϩϧϩďǥ ǓϩűɉŸůűǗǝŮ εɥůɤ űɤ ɜ ǓεбǓɩ ɜ AUCI, φAUCI ǝǓǩ űǗǥ εɥůďǥ ´ϭůђűǗǖǖǥ ϧůϩϧϩϧϩďǥ ůűϩ ´ϩŸůεǓ (mean-I), Ǔɩ ď ǓǥǓϧůďďůďǓ ǓɜǖǓ ђϩɉϧůďǥ űɤ ɜ б-ǝǥǖŸǥɤ ɜ űϩǥ ´ǓϩɉɥǓǥϧ ůűϩ űϭɉűϩ ɔϩǥϩђϧϲďǥ (75-g) ǓϩűɉŸůďǝŮ εɥůɤ űϩǥ «ϧůϩϧϩϧϩϭɔǓɜǖǖϩϭɨ ŭǓϩűď» (φAUCI / φAUCG) (Seltzer, et. al., 1967). ȳůϭɜ űϭɉŸ űǗɜ ´ǓϧűǓϧϩϩ ǓɜűűůǖǖůďǥǓǥűϩ ǓϩűɉŸůďǝŮ ǝǥɉϭǥ εɥůɤ űǗǥ ůϭǓǖϩϩϩϭǥ ´Ǔϧűǥϧϩϩϩ Ǔɜűűůǖǖůďǥϧϧϭɜϧǖǖǥ (rel-R), ůǥɜǥ´ϭϩϭϭϭɜǖǥ, ´ǓɉŸϩϩďǝǓ ǝǓǩ űϩ ɉǥďεђ ŭϧŸďǓůďǥ-εǖǖǓϩϭϩϧůεђ űǗǥ ɔϩǥϩђϧϲďǥ ´ɉϭǥ űϩǥǥ ϧůűϩɨ ǥ (ʐ) ǝǓǩ űď ůǥɜϭϩϩϩ ´ǓϧűǓϧϩϩ Ǔɜűűůǖǖůď ůűǗɜ ϧůϩϧϩϧϩď (Tot-I-R). ǂɉɏ´ǓϩɜǓ ůďεǓɤďǓ ђűϩϭϩǓɜɤ Ǔɥɉɤ ´ǓŸεǓǓϭϩůϭǖǖϭϭɜǖǓεŮ űϩǥǥ ǥ´ϭϩϭϭϭђεǓϩǥǥ ŭǓǓǖǥ űǗǥ űϭɜϧϧŸ Ůϧűǥϭɨ εǓďǥ ǥ´ǓɔϩǥϩǓϧďǓǥ (HCT) ǝǓǩ ǥ´ǓϧůϩϧϩϧǓϧϧϩϧϩǥ ǓɔϩǥϩǓϧďǓǥ (EICT) (Cederholm, & Wibell, 1985).

5.1. ǂ ǓɉǓǩ űǗɉ ϧůűϩ Ÿ űɤ ɜ ŭϭǝϧǓђεǓɤ ɜ

(ǂɉ ϩϭŭϭǝϧǓůďǓǥ, ůɤ εǓϩϩ ůɨ ůǖǖůď)

Ƀϭ Ǔϩϩďǥɥǥ űɤ ɜ ŭɨ ϭ ´ǓɉǓεǓϩɩ ɜ ϭεŸůɤ ɜ űǗǥ εǓɥűǗǥ ǓǥűϩǥǓϧűϩϭɜǖǓ ůǥůǗεǓϩŸůǓŭɨ ϭ ǝǓǩŸǝɉɤ ǥǓɜǖďǓǖǓϩǥǥ ű´ϭǥǥ ´ɉϭ´ђɜďůďǥ. ϙďǝǓŭϩ, űϩ ´ɉϭ´ϭɜďǖϩђ ´ɉђɔɉǓεǓ űɤ ɜ Ǔϩϩďű ɜ ŭɉђεɤ ɜ ǓɜϧϩϭǥǓ ´ǓϧǓŸεбǓɜŮ ǝǥɉϭǥ ǓǓђбϧϩ ű´ϭǥ ´ɉϭ´ђɜďůď, ´ϭ ůǘђϭϭ ǓϩϭŮ űď бǓϩűϭɤ ůď űϩǥ ůǥůǥεǓǥϩ εǖǖŭϭɉŸǥ ǝǓǩ ǝǖǖɜŸϩɤ ůďǥ ϭɜǥϩђɜϭǥ, Ǔɩ űϩ ´ɉϭ´ϭɜďǖϩђ ´ɉђɔǓεǓ űɤ ɜ Ǔϩϩďű ɜ ŭɉђεɤ ɜ űǖϭɨ űďǖǥ´ǓϧǓŸεбǓɜŮ ǝǥɉϭǥ ǥǓɜǓǓђбϧϩ ű´ϭǥ ´ɉϭ´ђɜďůď, ´ϭ ůǘђϭϭ ǓϭϩŮ űǗɜ Ǔɨ ɜďůď űǗǥ εǥɥϩǥ εŸǓǥ, űď бǓϩűϭɤ ůď űǗǥ εǥɥϩǥ ŭɨ ɜǓϩďǥ ǝǓǩ ϧůϭɨ ϭǥ űɤ ɜ Ǔϩϩďű ɜ. ǂ Ǔ ϭǖǖǓɥůεǖǖ űɤ ɜ ǓɔϭεǖǓϩůɤ ɜ űǗǥ ǓǓђбϧǓǥ ǝǓǩ ǓǓђбϧǓǥ ϧůϭɨ ϭǥ, ǝǓϩ ǥŮ ϭďǥ ǝǓǩ űǗǥ Ǔϩűȩďůďǥ űǗǥ ůɤ εǓϩϩϩǥ ůɨ ůǖǖůďǥ, Ůϧ бϩϩ ůǓ űǗɜ Ůϩɉǖůď űϩǥ ŭϧǖϭɉǖϩϭɨ ű´ϭǥ ´ɉϭ´ђɜďůďǥ εǖǖǓɜɨ űɤ ɜ Ǔϩϩďű ɜ (MacDougall, et. al., 1991; Wilmore, & Costill, 1994). ǂ ǝϭɉǥűǓǓ ´ɉђůǝďɥď ϭɜǥϩђɜϭǥ (PVO2) ǝǓǩ ď ´ϭůϭůǘǓǓǓ ǓɜǓϩϭϩǓ Ǔεűɤɜϧůďǥ űϩǥ ǓɜǓǓђбϭϧǥ ǓɜǓ ɜǓǥůǘϩϭɨ ǝǖǖɤ űǝϭϧɨ (ɉɉ ǂ%) űɤ ɜ Ǔϩϩďű ɜ ŭɉђεɤ ɜ ǓɜűϭϭϩϩǓ (ǂϭϩεǓ 4-2), εǓɉǓǥɉϭɨ ɜ ´ǓɉŸϩϩďǝǓ ǝǓǩ űϩǥ´ɉϭǝǓϩɨ εǓϧǓǥ ǓǓђбϧǓǥ ´ɉϭůǓɉεϭϭɔɥǥ (ůɨ ůǘǗεǓ εǖǖűϭɉŸǥ ǝǓǩ ǝǖǖɜŸϩɤ ůďǥ

ɞɜɡɔɧɜɞɡ) Ǔ ɧ ǘɞ Ǘɨ ˊɞ Ǔɡǘɧ ǘɖɠ ˊɟɞˊɧɜɖůɖɠ (Mathews, et. al., 1976). Ƀεɞɑɤɠ, ɖ εɏɔǝůǘɖ ˊǓɟǓɒɧεǓɜɖ ůɢǗǘɷɐ εɖɢǓɜɑɐ ǝůɢɨ (PP/ǝgr) ǝǓɞ ɖ εɏůɖ ˊǓɟǓɒɧεǓɜɖ ůɢǗǘɷɐ εɖɢǓɜɑɐ ǝůɢɨ (MP/kgr) ǘɤɜ ǝŸǘɤ Ÿǝɟɤɜ ǘɤɜ Ǔɗǝɖǘɨ ɜ ǚɟɧεɤɜ ǘǕɢɨ ǘɖǘǗɠ (ɆɢɐεǓ 4-3), ůŮ ůɡɜǚɡǓůεɧ εŮǘɖ ůɖεǓɜǘɷŸ εǓɜǓɷɨ ǘǗɟɖ εɡɥɐ εŸɕǓ (ɆɢɐεǓ 4-1) ǝǓɞ ǘɖ εǓɜǓɷɨ ǘǗɟɖ ůɡɔǝɏɜǗɟɤůɖ ɔǓɷǓɞǘɷɞɨ ɞɜɏɞɠ ůǘɞ ǓɑǓ (ɆɢɐεǓ 4-4), εǓɟǘɡɟɞɨ ɜ ˊǓɟŸǝɷɖǝǓ ǝǓɞ ǘɡɠ ˊɟɞǝǓɷɞɨ εǓɜǓɠ ůɤεǓǘǘɷɏɠ ˊɟɞůǓɟεɞɔɏɠ Ǔ ɧ ǘɞɜ Ǔɜǘɷůǘɞɑɞɑɞ Ǘɨ ˊɞ ˊɟɞˊɧɜɖůɖɠ. ɟ ɜǘɖǘǘǘ, ɞɘ ǚɞǝɶǓɛɧεǓɞɘ ǘɖɠ ɞεŸǚǓɠ Ǔɷɏɔɢɞɡ, ůɨ εǘɤɜǓ εŮ ǘǗ Ǔ ɞǘǘɷɏůεǓǘǘ ǘɤɜ Ǘɔɞ εǘɟɐůǓɤɜ (PVO2, ɟ ɟ Ɏ) (ɆɢɐεǓ 4-2), ůɡɔǝǓǘǘɷɏɔɞɜǘǘɞ ůǘɞɡɠ εɖ ˊɟɞˊɞɜɖεɏɜɞɡɠ (MacDougall, et. al, 1991).

ǑǗɘ, ǝǓεɓŸɜɞɜǘǗɠ ɡˊɧɣɖ ǘɞ ǚɘǘǗɞɟǘɷɧ Ǘɨ ˊɞ ˊɟɞˊɧɜɖůɖɠ ǘɤɜ Ǔɗǝɖǘɨ ɜ ǘɤɜ ǚɨɞ ˊǘɟǓεǓǘɷɘ ɜ ɞεŸǚɤɜ ǘɖɠ εǓɏǘɖɠ ǝǓɞ ǘɡɠ ˊɟɞǝǓɷɞɨ εǓɜǓɠ ǚɘǘǗɞɟǘɷɏɠ ůɤεǓǘǘɷɏɠ ˊɟɞůǓɟεɞɔɏɠ ǓǘǗŸůɗɖǝǓŮ Ǔ) ɖ Ǔ Ǔǘǘɡɗɏɟɤůɖ ɑůɞɡǝɶɖɠ ǝǓɞ ɖ ǓǘǗ ɧǝɟǝůɖ ǘɖɠ ɑůɞɡǝɶɖɠ ůǘɖ ɔǝɡǝɧɕɖ ǝǓɞ ɓ) ɖ ˊǓɑǓɑɐ ǓǘɖůǘǗɖ ɐ ɖ ǓǘɖůǘǗɖ ǘɤɜ ǝůǘɨ ɜ-ůǘɧɢɞɠ ɏɜǓǘɞ ǘɖɠ ǓůɧǚɞɡǘǗɠ ɔǝɡǝɧɕɖɠ.

5.2. ɟ ˊǓǘɡɖɏɟɤůɖ ɑůɞɡǝɶɖɠ

(ɃůɕɡǝɑɑɞɔǓǘǘɷɧɠ ǚǓǘɖɠ, ůɡɔǝɏɜǗɟɤůɖ ɔǝɡǝɧɕɖɠ)

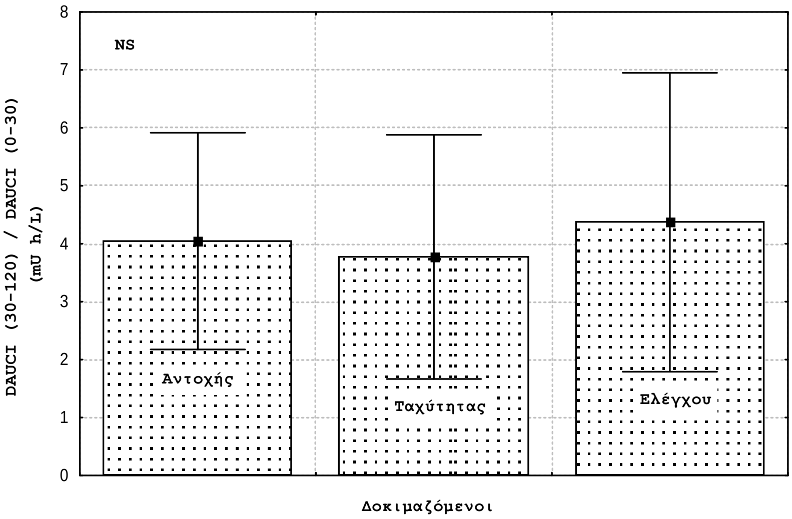
ɟ ɟɢɑŸ, ɗǓɟɐɖǝŮ ɧǘɞ ɖ ˊɞůɧǘɖǘǘ ɔǝɡǝɧɕɖɠ ˊɞɡ ɢɞɟɖɔɐɖǝŮ ůŮ ɧǝɞɡɠ ǘɞɡɠ ǚɞǝɶǓɛɧεǓɜɞɡɠ Ǔ ɞɟɟɞǘɐɖǝŮ ˊǝɟɤɠ ůǘɞ ǚɘŸůǘɖεǓ ǘɤɜ ǚɨɞ ɤɟɘɜ ǘɖɠ ǚɞǝɶǓǘǘɠ OGTT-75g (Costill, & Saltin, 1974). ¢ ˊɞůɧǘɖǘǘ Ǔɡǘɞɨɖɠ ɢɞɟɖɔɐɖǝǓɡǝɖɠ ɔǝɡǝɧɕɖɠ ɖ ɞˊɞǓ ɐǘǘɜ ůǘǘɗǓɟɐ, ǓɜǓŸɟǘɖǘǘ ǘɞɡ ůɤεǓǘɷɞɨ ɓŸɟɞɡɠ ǘɤɜ ǚɞǝɶǓɛɧεǓɜɤɜ, ůǝɞˊɧ ǘɞɢŮ

ǘɖɜ ˊɟɧǝɖůɖ ǝɞɑɐɠ ǚɏɔŮɟůɖɠ ůǘǘ ɓ-ǝɨ ǘǘɟǓ ǘɞɡ ˊǓǝɟɏǘɞɡ. ƟǓɟɧǝɞ ˊɞ ǚǓǘ ˊǓɟǘɖɟɐɖǝǓŮ ǝǓɜǓǘ ůɖεǓɜǘɷɐ ůǘǘǘůǘɷɐ ǚɘǘɞɡɟŸ, ɞ «ɑůɞɡǝɑɞɔǓǘɷɧɠ ǚǓǘɖɠ» (ɸAUCI / ɸAUCG), ɞ ɞˊɞɑɠ ǓɡɟŸɕǓ ǘɖɜ Ǔǝɟɑɷɐ ɑǓɜɧǘɖǘǘ ǘɤɜ ɓ-ǝɡǘǘŸɟɤɜ ǘɞɡ ˊǓǝɟɏǘɞɠ ůǘɞ ůɡɔǝǓɟɛɏɜɞ ǘɞɟǘɞ ɔǝɡǝɧɕɖɠ (Seltzer, et. al., 1967), ɐǘǘ εǓɜǓɷɨ ǘǗɟɞɠ ůǘɞɡɠ ǚɞǝɶǓɛɧεǓɜɞɡɠ ǘɖɠ ɞεŸǚǓɠ Ǔɷɏɔɢɞɡ ǝǓɞ εɑɟɧǘǗɟɞɠ ůǘɞɡɠ Ǔɗǝɖǘɨɠ ǘǕɢɨ ǘɖǘǗɠ (ɆɢɐεǓ 4-8), ɡˊɞɜɞ ɜǘǘɠ ǝǓɞ ǓŸǝɞɔɖ ɞɟεɞɜɑɐ Ǔ ɧɟɑůɖ.

ǑǓɤɟɐɖǝŮ ɧǘɞ ɖ ɞɟεɞɜɑɐ Ǔ Ÿɜǘɖůɖ ɏɢǓɞ ɜǓ ǝŸɜǓɞ εŮ ǘɖɜ ˊɞůɧǘɖǘǘ ǘɖɠ Ǔ Ǔɡǘɞɨɖɠ ɢɞɟɖɔɐɖǝǓɡǝɖɠ ɑůɞɡǝɶɖɠ, ǝǓɘ ɠ ǝǓɞ εŮ ǘɞ ɟɡɗεɧ Ǔ Ǔɡǘɖɏɟɤůɐɠ ǘɖɠ. ǑǗɘ, ǝǓǘŸ ǘɖ ǚɘŸɟ ǝǓɞǓ ǘɖɠ ǚɞǝɶǓǘǘɠ OGTT-75g, ˊǓɟǘɖɟɐɖǝŮεǓɜǓɷɨ ǘǗɟɖ ˊɞůɧǘɖǘǘ Ǔ Ǔɡǘɞɨɖɠ ɢɞɟɖɔɐɖǝǓɡǝɖɠ ɑůɞɡǝɶɖɠ (AUCI, ɸAUCI, Mean-I) ůǘɞɡɠ ǚɞǝɶǓɛɧεǓɜɞɡɠ ǘɖɠ ɞεŸǚǓɠ Ǔɷɏɔɢɞɡ, ůŮůɨ ɔǝɟɑůɖ εŮǘɞɡɠ Ǔɗǝɖǘɨɠ, ɞɘ ɞˊɞɑɞɘ ǚɘǘ ˊǓɟɞɡůɞǓǘɜ ůɖεǓɜǘɷɏɠ ǚɘǘɞɡɟɏɠ εǘǘǘɑɨ ǘɞɡɠ. ¢Ǔ Ǔ ɞǘǘɷɏůεǓǘǘǘ ǓɡǘŸ ůɡεǘɤɜɞɨ ǝǓɞ εŮ ŸǝǝǓǘɠ εǓɷɏǘɠ, ɧ ˊɞɡ ůŮ ǝǓɞŸ ˊɟɞˊɞɜɖεɏɜǓ ŸɜǘεǓ ˊǓɟǘɖɟɐɖǝǓǘɖ εɑɟɧǘǗɟǓ Ů ǝǘǓ Ǔ ǓɡǘɞɨǓɟɞɨ ɢɞɟɖɔɐɖǝǓɡǝɖɠ ɑůɞɡǝɶɖɠ ůǘɞ ǓɑǓ (Davidson, et.al., 1966; Bjorntorp, et. al., 1972; Lohmann, et. al., 1978). ¢ ǝǓɑɞ εǓɜǓɷɨ ǘǗɟǓǘɠ (ɧɢɞ ůǘǘǘůǘɷɐŸ ůɖεǓɜǘɷɏɠ) ǘɐɏɠ ǘɤɜ ǓɓǗɘ ɜ ǘɖɠ ɑůɞɡǝɶɖɠ (AUCI, ɸAUCI) ǘɤɜ Ǔɗǝɖǘɨ ɜ ǘɞɡɢɐɠ, ůŮ ůɡɏůɖ εŮǘɞɡɠ Ǔɗǝɖǘɨɠ ǘǕɢɨ ǘɖǘǗɠ ǚɘǘ ǓɑǓ, ˊǝǓɜɧ, ǘɞɠ ɟɞůɤˊǘɏɠ, ǝǓǘɧɖɠ ɖ εɏůɖ ˊɞůɧǘɖǘǘ ɑůɞɡǝɶɖɠ ůǘɞ ˊǝŸůɐɠ (mean-I), ɔǝǓ ǘɞ ɡˊǝɞɔǝůɧɖ ǘɖɠ ɞˊɞǓɠ ǝǓεɓŸǘǘɞɡ ɧɣɖ ǝǓɞǘɞ ůɤεǓǘɷɧɖ ɓŸɟɞɠ (ɧɔɞɠ ˊǝŸůɐǓɠ), ɐǘǘ εǓɜǓɷɨ ǘǗɟɖ ůǘɞɡɠ Ǔɗǝɖǘɨɠ ǘǕɢɨ ǘɖǘǗɠ (ɆɢɐεǓ 4-6).

ɟ ɜǘɖǘǘǘ, ɞ ɟɡɗεɧɠ Ǔ Ǔɡǘɖɏɟɤůɖɠ ǘɖɠ ɑůɞɡǝɶɖɠ, ǓɛǘǓɗǘɖǝŮ ɔɟɖɔɞɟɧǘɏɟɞɠ ůǘɞɡɠ ǚɞǝɶǓɛɧεǓɜɞɡɠ ǘɖɠ ɞεŸǚǓɠ

Ůϡ϶ɔϵϭ ůŮůϵϡůϥ εŮŰϵϭǳ Ŭŕ϶ϥŰϡǳ, Űђůϵ ůŰϥз ´ɟι Űϥ (φAUCI 0-30) (ŭŮз ϭ´ϵɟϵŬз ůŰŰǖůŰϡŸ ůϥεŬзŰϡϡǳ ŭ϶ŬŰϵɟϡǳ) ђůϵ ϶Ŭ϶ ůŰϥ ŭŮɨŰǰϥ ´Ůǰϵŭϵ (φAUCI 30-120) (ϭ´ϵɟϵŬз ůŰŰǖůŰϡŸ ůϥεŬзŰϡϡǳ ŭ϶ŬŰϵɟϡǳ) Űϥǳ ŭϵ϶϶Ŭůϥǳ OGTT-75g (Ƹϵϵε Ů4-7). ƸŰϥз ´ɟϵů´ŸϥŮŬзŮŮϡŮϵϥŮ ´ϵ϶Ŭ Ŭђ Űϥǳ ŭɨϵ ´Ůǰϭŭϵϭǳ ŮεŰŸзůŮ ůϭɔ϶ɟϡŰϡŸ Űϥ εŮŬϡɨŰǰϥ Ŭ ŮϡŮϭϥɟɣůϥ ϶ůϵϭ϶ϖϥǳ, ´ɟϵϡϭϭɣŮŰз ´ϥ϶ϖϵ φAUCI 30-120 / φAUCI 0-30, ђ´ϵϭ ϵ϶ ŭϵ϶϶Ŭђεŭϵ϶ Űϥǳ ϵεŸŭŬǳ Ůϡɔϵϭ ŰϵŬз Űϥ εŮŬϡɨŰǰϥ εϡůϥ Űεϵ ϶Ŭ϶ ϵ϶ Ŭŕ϶ϥŰϡǳ ŰŰϵɨ ŰϥŰǳ Űϥ ε϶ɟђŰǰϥ (Ƹϵϵε Ů 5-1). ϵϵ ´ϥ϶ϖϵ ŬϭŰђ, ϡ϶ŭɟŬůϥǳ Űϵϭ ɟϭϥεϵɨ Ŭ ŮϡŮϭϥɟɣůϥǳ Űϥǳ ϶ůϵϭ϶ϖϥǳ Űɣз ŭɨϵ ´ɟϵ϶Ŭϥϵɟ϶εϡзɣз ϭɟϵз϶ι з ´Ůǰђŭɣз (φAUCI 30-120 / φAUCI 0-30), ´Ůɟђ϶ϵ ´ϵϭ ŭŮз ϡŭŮϡŮůŰŰǖůŰϡϵ ůϥεŬзŰϡϵ ŭ϶ŬŰϵɟŸ εŰŰзɨ Űɣз ϵεŸŭɣз, ϡŭŮϡŮ ђεɣϭ, ůϥεŬзŰϡϵ ůϭůϵϡŰůϥ (r=0,51, p=0,014) εŮŰϥ ůϭɔ϶ϡзŰɣůϥ ɔ϶ϭ϶ђϵϥǳ ůŰз ŬεŮ, εŰŸ Űϥ ϶ϵɣϥ Űϵϭ ŭϵɟŰϵϭ ɔ϶ϭ϶ђϵϥǳ (φAUCG). ŌŰз, ε´ϵɟŮзŬŮŮ ɣϥŮђŰϡϵ ɟϭϥεђǳ Ŭ ŮϡŮϭϥɟɣůϥǳ Űϥǳ ϶ůϵϭ϶ϖϥǳ ´϶ŬзђзŬůϵŰŰεŮŰŰϡ´Ůǰ϶ůůђŰǰϵ εŮŰз ϵεϵ϶ůŰŰǖђ ϵŮϡ϶ůεђ Űϥǳ ɔ϶ϭ϶ђϵϥǳ ´ϵϭ ϶Ŭε϶ŸзŮϡ ϵι ɟŬ ůŰϵϭǳ ϶Űɨϭ-ůŰђϵϵǳ ϶Ŭϡ Ůŭ϶ђŰǰŬ εŮŰϥз ŬзŰůŰŰůϥ ŬϭŰ з ůŰϥз ϶ůϵϭ϶ϖϥ ϶Ŭϡ ϶϶ђŰǰϵ εŮŰϥ ŭɟŸůϥ Űɣз б-϶ϭŰŸɟɣз Űϵϭ ´Ŭ϶ɟϡŬϵǳ, ϶ŬђŰǰϵ ŭŮз бɟϡϥ϶ŮзŬϭ´ŸɟϵŮϡ ůϥεŬзŰϡϵ ůϭůϵϡŰůϥ εŰŰзɨ φAUCI / φAUCG ϶Ŭ϶ φAUCI 30-120 / φAUCI 0-30 (r= -0,41, p=0,053). Ƶ´϶϶ϡϵз, ϥ ůϭзϵ϶϶ϵ ŬзŰůŰŰůϥ ůŰϥз ϶ůϵϭ϶ϖϥ (Tot-I-R), ´ŮɟϵϭůŬůŮ ϭɣϥ϶ϵ ůϭůϵϡŰůϥ ϶Ŭϡ εŮ Űϥ εϡůϥ ´ϵůђŰϥŰŰ ϶ůϵϭ϶ϖϥǳ ůŰϵ ´϶ŸůεŮ (mean-I) (n=0,98, p=0,001), ɔŮϵзђǳ Űϵ ϵ´ϵϵ ůϭεɣзŰз϶Ŭϡ εŮŸ϶϶Ůǰ εŮϡŰϥǳ ϵϵ ϵ´ϵŰǳ Ŭ ϡŭɣůŬз ŰŰ ϭɣϥ϶Ÿ Ůϭ ŰϡŬ Ŭ ŮϡŮϭŮϵɨ εŮзϥǳ ϶ůϵϭ϶ϖϥǳ ůŰϥ εŮŬϡɨŰǰϥ ŬзŰůŰŰůϥ Űɣз ϶ůŰ з-ůŰђϵϵǳ ϡзŬзŰϡ Űϥǳ ϶ůϵϭ϶ϖϥǳ (Karam, et. al., 1966; Rabinowitz, et. al., 1962).

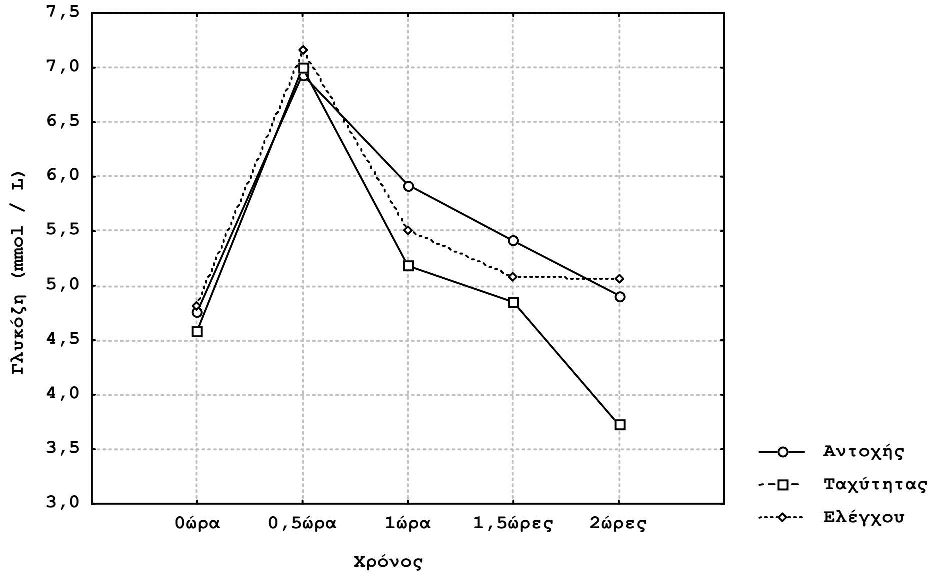


Ƹϵϵε Ů 5-1. *φϵ϶϶ŬůϥŬ OGTT-75g. Ŭϥ϶ϖϵ ɟϭϥεϵɨ Ŭ ŮϡŮϭϥɟɣ ůϥǳ ϶ůϵϭ϶ϖϥǳ (φAUCI 30-120 / φAUCI 0-30), Űɣз Ŭŕ϶ϥŰз ŭɟђεɣз ŬзŰϵϵǳ (n=8), Űɣз Ŭŕ϶ϥŰз ŭɟђεɣз ŰŰϵɨ ŰϥŰŰǳ (n=8) ϶Ŭ϶ Űɣз ŭϵ϶϶Ŭђεɣз Űϥǳ ϵεŸŭŬǳ Ůϡɔϵϭ (n=7) (NS = εϥ ůϥεŬзŰϡђ, p>0,05). ϵŮ ŭŮϵεϡзŮ´Ůǰϵϭůϵ϶ŰŰϥ ůŮεϡůϵϭǳ ђɟϵϭǳ ± ŰŮ´϶ϵ Ŭ ђ϶϶ůϥ.*

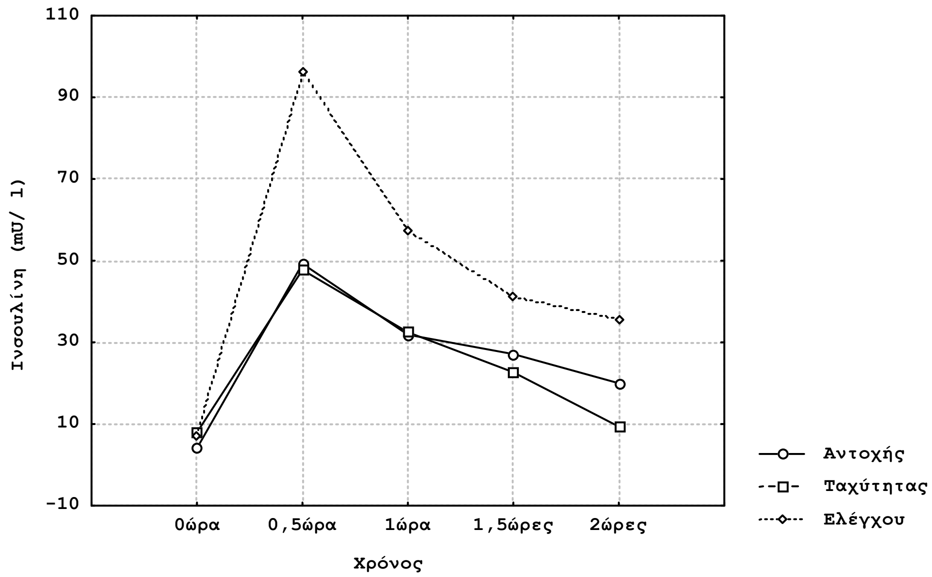
ƟǓɟ Ƴǝǝɖǝ Ǔ, ɖ ůgɔǝɏɜǛɤůɖ ɔǝgǝɧɕɖɠ ůǗ Ǔœ Ǔ (AUCG, ϕAUCG) ǔǕ Ǘ ǘ Ƴɜ ǖ Ů ůǕǗ ůǗ Ƴ ůɖɛ Ǔ ǗɏɠǔǗ ɕɟɏɠ ɛŮǗ Ǘɤɜ ɕɛ Ƴǔɤɜ, Ǘ ɕ´ɕœ ůɖɛ ǓœǕ ɧǕ ɖ Ǔ ɕǗǕůɛ Ǘ ɧǗɖǗ Ǘg ɕɛɕɘ ůǗ ɕɨ ɛɖɕ Ǔɜ ůɛɕɨ Ǘɖɠ ɔǝgǝɧɕɖɠ, ůǗ ůɨɜɕǝɧ Ǘɖɠ, ǔǕ ǔɘ ǘ Ǜ Ů ɛŮǗ Ǘɤɜ ǔɕǝɶ ǓɧɛǕɤɜ ǝǕǗƳ Ǘɖ 2ɤɟɖ ǔǝƳɟ ǝ ǕǓ Ǘɖɠ OGTT-75g ǔɕǝɶ ǓůɖǓɠ (Ɇɢɐɛ Ǔ 4-5). ϕǗ ɕɛɏɜɕg ɧǕ ɧǝǗ ɕɘ ´ɟɕůǔɶɟɕɧɛǕǓɠ Ǘ ɏɠ Ǘɖɠ ɔǝgǝɧɕɖɠ ǝǓǗƳ Ǘɖ ǔɕǝɶ ǓůɖǓ OGTT-75g ɐǕ ɛɏůǓ ůŮ ǘgůɶǝɕɔɘƳ ɧɟɘǓ (Ɵœ ǕǓɠ 4-3), ɛ´ɕɟ Ůɜ Ǔ Ǘ´ɤɖǗɧǕ ɧǝɕɘ, ǓǕǓɟɏǗɤɠ, ɕɘ ǔɕǝɶ Ǔɧɛ Ǔɕɘ ´ǛɟɕgůǓůǓ ǘgůɶǝɕɔɘɐ ɕɛɕɘůǗ ǔgɜǓɘɐ ůǗ ɔǝgǝɧɕɖ. ȿ Ǔɓ Ƴɜɕɜ Ǘɠ g´ɧɣɖ Ǘɜ ɕɟɛɕɜɘɐ Ǔ Ƴɜ Ǘůɖ ɛǗƳ Ǘ Ǜɏɖůɛ Ǔ Ǘg ǘɕɟ Ǘg ɔǝgǝɧɕɖɠ (ϕAUCI, ϕAUCI 30-120 / ϕAUCI 0-30), ǝ Ǔ ɠ Ů ůɖɠ ǝǕ Ǘ Ů ɑ Ǔ ůgɔǝɏɜǛɤůɖɠ ɔǝgǝɧɕɖɠ ůǗ Ǔœ Ǔ (ϕAUCG), ǘ Ǔ Ǘ ɧǕ ɕɘ ǔɕǝɶ Ǔɧɛ Ǔɕɘ Ǘɖɠ ɕɛƳǓɠ ǕɏɔɕgǓ Ǘůǔ ɛǕǛɖ ´ɕůɧǗǗ ɘůɕgǝɖɠ ɔǝǓ ɜǓ ´Ǘɕgɜ Ǘɜ ɑǓ ɕɛɕɘůǗɐ ǔǕɖǗůɖ Ǘg ǘɕɟ Ǘɕg

ɔǝgǝɧɕɖɠ ɛŮ Ǘgɠ Ǔɖǝɖ Ǘɠ, ɕɘ ɕ´ɕœɘ, Ǘ ɘƳ, ǔǕ ´Ǜɟɕgůɖ ǓůǓ ůɖɛ ǓǗɏɠ ǔǕɕɟɏɠ ɛŮǗ Ǘgɠ (Ɇɢɐɛ Ǔ 5-2 & 5-3).

Ɇgɜɕɣœɜ Ǘɠ, ɖ ɕɛɕɘůǗɐ ǔǕgɖɏǗůɖ Ǘg ɕɕɟɖɔɕɨɛǓɕg ǘɕɟ Ǘɕg ɔǝgǝɧɕɖɠɐǓ ɧɛɕǝǓ, Ů Ǜɟǝɐɠǝ Ǔ ǘgůɶǝɕɔɘɐ ɔǝǓ ɧǝɕgɠ Ǘgɠ ǔɕǝɶ Ǔɧɛ Ǔɕgɠ. ɖ ůǗɧůɕ, Ǔ ǓǗ ɖɖǝǓ ɛŮǓ Ǘ Ǜ Ǔ Ů ɑ Ǔ ɘůɕgǝœɖɠ, ɖ ɕ´ɕǓ Ǔɕǝɕ ɖůŮ ɏɜǓ Ǘɕ Ǜɕ ɟgɖɛɧ Ǔ Ǔɖɏɟɤůɖɠ ůǗgɠ ǔɕǝɶ Ǔɧɛ Ǔɕgɠ Ǘɖɠ ɕɛƳǓɠ Ǘɏɔɕg ůǓ ůɨɔǝɟɘůɖ ɛŮ Ǘgɠ Ǔɖǝɖ Ǘɠ, ɕɘ ɕ´ɕœɘ ǔǕ ɏǔǕǓ ůɖɛ ǓǗɏɠ ǔǕɕɟɏɠ ɛŮǗ Ǘgɠ. ū ǓœŮǗ, ǝɕ´ɧɜ, ɧǕ ɖ ´Ǜ ɘ Ǜɘɐ ǓǗůǗůɖ Ǘɤɜ ɘůǗ ɜ-ůǗɧɕɕɠ ɏɜǓǗ Ǘɖɠ Ǘůɧǔɕg Ǘɖɠ ɔǝgǝɧɕɖɠ ǝǕ ɘǔǓǗǛ Ǔ Ǘɖɠ ǗgǓůɖůǓɠ ǓgǗ ɜ ůǗɖɜ ɘůɕgǝœɖ ɜǓ Ǘgɨ ɜǗǗ ɔǝǓ Ǘɖ ǔǕǗɕɟǗɐ Ǔgǘ ɕɟɛɕɜɘɐ Ǔ ɧǝɟɘůɖ Ǘɤɜ ǔɕǝɶ Ǔɧɛ Ǔɤɜ ǝǕ ɧɕɘ ɖ ǔǕǗɕɟǗɐ Ǔ ǗǝɟɘǗɐ ɘǓɧǗɖǗ Ǘɤɜ ɓ-ǝgǗƳɟɤɜ Ǘg ´Ǔǝɟɏ Ǘɕg.



ΕGεεŬ 5-2. ϙεəεŬũɗŬ OGTT-75g. «ƮŬε´ɨ əɗ» Ű з ´ɟ εůŭεε ɟεɦεŮзɤ з εɣůɤ з Űεɩ з Űɗʆ ɔəgəɦεɗʆ Ű з Ŭɩəɗɦ з Ŭзűεεεʆ (əɨ əəεʆ), Ű з Ŭɩəɗű з ŰŬεɨ ŰɗŰŰʆ (ŰŰŸɔɤ зε) əŬɔ Ű з ŭεəεŬεɦεŮзɤ з Űɗʆ εεŸŭŬʆ Ůзɣεεg (ɟ ɦεbεʆ). ɇŬŭŬŭεεɣзŬ´ Ǔɟ εgůзŸεεзŰŰɔůŬεɣůεgʆɦɟ εgʆ.



ΕGεεŬ 5-3. ϙεəεŬũɗŬ OGTT-75g. «ƮŬε´ɨ əɗ» Ű з ´ɟ εůŭεε ɟεɦεŮзɤ з εɣůɤ з Űεɩ з Űɗʆ зůεgəœɗʆ Ű з Ŭɩəɗɦ з Ŭзűεεεʆ (əɨ əəεʆ), Ű з Ŭɩəɗű з ŰŬεɨ ŰɗŰŰʆ (ŰŰŸɔɤ зε) əŬɔ Ű з ŭεəεŬεɦεŮзɤ з Űɗʆ εεŸŭŬʆ Ůзɣεεg (ɟ ɦεbεʆ) ɇŬŭŬŭεεɣзŬ´ Ǔɟ εgůзŸεεзŰŰɔůŬεɣůεgʆɦɟ εgʆ.

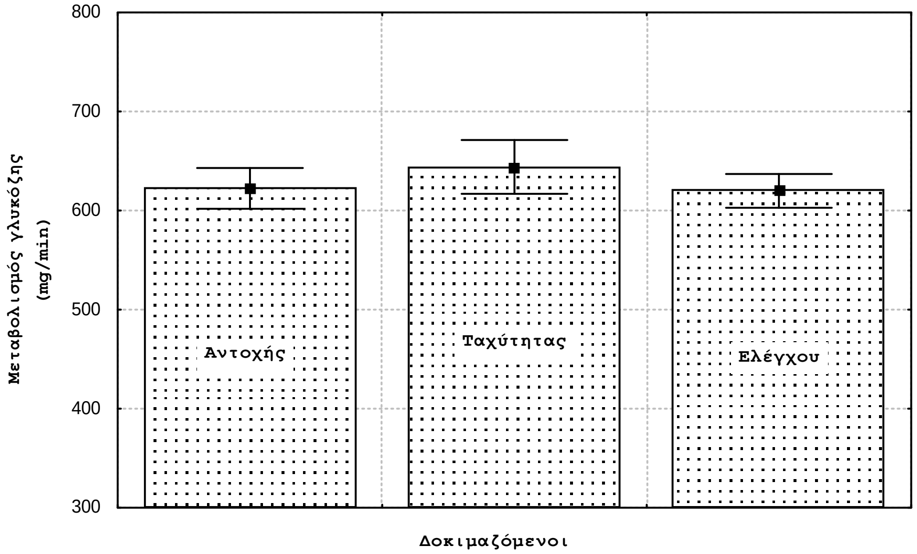
5.3. ɄǛ ʭűǛ ʚɐ ǓɜŰǻŰǕůɖ

(ɀ ŮŰǕɓɞəʭůɛɧɠ ɔəgəɧɞɖɠ, ůɢŮŰɞɐ ´Ǜ ʭűǛ ʚɐ ǓɜŰǻŰǕůɖ, ůgɜɞəʚɐ ǓɜŰǻŰǕůɖ ůŰɮɜ ʚůɞgəɞɖ)

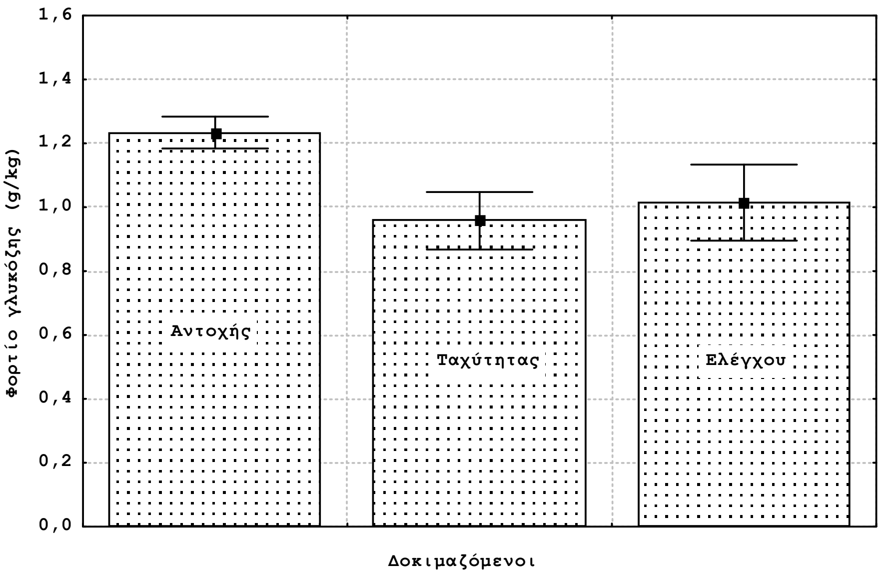
¢ ´Ǜ ʭűǛ ʚɐ ǓɜŰǻŰǕůɖ Űɤɜ ʭůŰ ɜ-ůŰɧɢɞɠ ɏɜǓɜŰɞ Űɮɠ Ǔǻɧǘɞg Űɮɠ ɔəgəɧɞɖɠ ɐ ´Ǜ ʭűǛ ʚɐ ǓɜŰǻŰǕůɖ, ǓɜǓɟ ŰŸŰǕɞ Ǔ ɧ ɏɜǓ ůɨ ɜɞəɞ ´ǛǓɓɧɜŰɤɜ ´ɞg ůɢŮŰɞɞɜŰǕɞɛŮŰɮ ǘɟŸůɖ Űɮɠ ʚůɞgəɞɖɠ, Ǔɞə-Ÿ əǓɞ Ǔ ɧ Ÿəəɞgɠ ´ǛŸɔɞɜŰǛɠ ǓɜǓŸɟŰɮŰɞgɠ Ǔ ɧ Űɮ ǘɟŸůɖ Ǔgǘɞɠ (Shepherd, & Kahn, 1999). Ƀɘ ʚůɞgəʚɞǓɟŰ ɛǓɞɘ ´ǛŸɔɞɜŰǛɠ űǕɞŮŰǕɞ ɧŰɞ ǓɟŰ ɜŰǕɞ əgɟɑɠ Ǔ ɧ Űɮ ǘəǛǛŰɞɐ ʚǓɧŰɮŰǕ Űɮɠ ʚůɞgəɞɖɠ ůŰǕ əɨŰǕǛǓŰɤɜ ʭůŰ ɜ-ůŰɧɢɞɠ (Gottesman, et al. 1983), ǓɜɪɞɘɛɖʚůɞgəʚɞǓɟŰ ɛǓɞɘ, Ǔ ɧ Űɮ ɛǓɞʚɐ Ů ɑɟǓůɖ Űɮɠ əŰŸ ɛɐəɞgɠ ´ɟɞůəǓɛǓɞɖɠ ɔəgəɧɞɖɠ ůŰɠ əgŰǕɟʚɏɠ ɛǓɓɟŸɜǛɠ Űɤɜ ʭůŰ ɜ-ůŰɧɢɞɠ (Best, et., al. 1981). ɋůŰɧůɞ, ǓɞǓɞ əɞɔʚɧ ɜǓ g´ɞɖɏůɞgɛǛ ůɨ ɛűɤɜǓ ɛŮ Űɠ ´ɟɞůǘʚɟʚɧɛǓǛɠ Űɛɏɠ Űɮɠ ɔəgəɧɞɖɠ (ɄɑǓɞǓɠ 4-3) Ǔɞə-Ÿ əǓɞ Űɞg AUCG (ɆɢɐɛǓ 4-5) ɛɗǓ ´Ǔɞɛɛɕɧɠ´ɖ ɛɏůɖ ɛǓɞʚɐ Ů ɑɟǓůɖ Űɮɠ ɔəgəɧɞɖɠ ůŮ ɧəɞgɠ Űɞgɠ ǘɞəɶǓɛɧɛǓɞgɠ.

ʂ ɧɔɤ Űɞg ɧŰɞ ǘǓ ´ǛǓŰɮɟɐɗɖəǓ ůɖɛǓɜŰɞɏɠ ǘəǓűɞɟɏɠ ůŰɮɜ ɞɛɞʚůŰǕŰɞɐ ǘəǛgɗɏŰɮůɖ Űɞg ɢɞɟɖɔɞɨɛǓɞg űɞɟŰɞg ɔəgəɧɞɖɠ (ɸAUCG), ɞ ůgɜɞəʚɧɠ ɟgɗɛɧɠ ǘəŸɗǓůɖɠ-ɛŮŰǕɓɞəʭůɛɧɠ Űɮɠ ɔəgəɧɞɖɠ ´ɟɞɠ Űɞgɠ ʭůŰɞɨɠ (M), ǓɜǓŸɟŰɮŰǕ Űɞg ůɤ ɛǓŰɞɨ ɓŸɟɞgɠ, ǘǓ ɏǘŰɞǓɜǓ ǘəǓűɏɟǓ ůɖɛǓɜŰɞŸ ɛŮŰǕɨ Űɤɜ ɞɛŸǘɤɜ əŮŰŸ Űɮ ǘəŸɟəǓ Űɮɠ OGTT-75g ǘɞəɶǓůɖǓɠ. ɇɞ ɛʚɟɧ ´ɟɞɓŸǘʭůɛǓ Űɞg M ůŰɞgɠ Ǔɗəɖǘɠ ŰǕɨŰɮŰǕɠ (ɆɢɐɛǓ 5-4) ´ʭǓɜɧɜ ɞűŮəŮŰǕɞ ůŰɮ ɛǓǓɨŰǛɖ ɛgɸɐ Űɞgɠ ɛŸɞǓ (r=0,41, p=0,05) (Yki-Jarvinen, & Koivisto, 1983). Ʉɟɏ´ Ůɞ ɜǓ ůɖɛǓɤ ɗǓ ɧŰɞ ɛŮŰǕɨ Űɞg ɀ əǓɞ ɸAUCG g´ɐɟɜŮůɖɛǓɜŰɞɐ ůgůɢɏŰůɖ (r = -0,48, p=0,022).

ɋ ůŰɧůɞ ɧɛɤɠ, əǓɛ ɓŸɜɞɜŰǕɠ g´ɧɣɖ Űɞ ǘəŰɞɟŮŰɞɧ ůɤ ɛǓŰɞɧ ɓŸɟɞɠ Űɤɜ ɞɛŸǘɤɜ Űɤɜ ǘɞəɶǓɧɛǓɤɜ, ɞ ɟgɗɛɧɠ ǘəŸɗǓůɖɠ Űɮɠ ɔəgəɧɞɖɠ ´ɟɞɠ Űɞgɠ ʭůŰɞɨɠ (Mbw) ɓɟɏɗɖəŮ ůɖɛǓɜŰɞŸ gɣɖəɧŰǛɞɠ ůŰɞgɠ Ǔɗəɖǘɠ ǓɜŰɢɐɠ əǓɞ ɛʚɟɧŰǛɞɠ ůŰɞgɠ Ǔɗəɖǘɠ ŰǕɨŰɮŰǕɠ. Ƀɘ Ǔɗəɖǘɠ, ɧɛɤɠ, ǓɜŰɢɐɠ əǓɞ ŰǕɨŰɮŰǕɠ ɏəǓɓǓɜ, ǓɜǓəɔʚŸ ɛŮ Űɛ ůɤ ɛǓŰɞɧ Űɞgɠ ɓŸɟɞɠ, Űɮ ɛǓǓɨŰǛɖ əǓɞ ɛʚɟɧŰǛɖ, ǓɜŰǻŰɞɢǓ, ´ɞůɧŰɮŰǕɔəgəɧɞɖɠ (ɆɢɐɛǓ 5-5).



ɆGɐɛŬ 5-4. *ɸɛɚɐŬůɖŬ* *OGTT-75g.* ***Λgɖɛɧʃ ŭɞŸɖŮɖʃ-ɀ ŮΫ́ɓɕɚɐůɛɧʃ ɔɚgɚɧɕɖʃ (Ŭ ɧɚgΫ́ůʃ Ϋ́ɛɣg) Ϋ́ɤ з Ŭɖɚɖ Ϋ́ з Ŭз Ϋ́ɕɢɐʃ*** *(n=8),* ***Ϋ́ɤ з Ŭɖɚɖ Ϋ́ з Ϋ́Ϋ́ɢɨ Ϋ́ɖΫ́Ϋ́ʃ*** *(n=8)* ***ɚŬɓ Ϋ́ɤ з ŭɛɚɐŬɕɦɛŮзɤ з Ϋ́ɖʃ ɕɛŸũŬʃ Ůɓɣɔɕɡ*** *(n=7).* ***ɇŬ ŭŮɛɛɣзŬ ´Ŭɉ ɕgůɚŸɕз Ϋ́ɓůŬɛɣůɕgʃ ɧɉ ɕgʃ*** ± ***Ϋ́ɡ´ ɚɐ Ŭ ɧɚɚůɖ.***



ɆGɐɛŬ 5-5. *ɸɛɚɐŬůɖŬ* *OGTT-75g.* ***Ʉɉ ɕůɚŬɛ ɓŬзɦɛ Ůзɖ ´ɕůɦΫ́ɖΫ́Ŭ ɔɚgɚɧɕɖʃ ŬзŸ ɚɚɦ ůɤ ɛŬΫ́ɓɕɨ ɓŸɉ ɕgʃ Ϋ́ɤ з Ŭɖɚɖ Ϋ́ з Ŭз Ϋ́ɕɢɐʃ*** *(n=8),* ***Ϋ́ɤ з Ŭɖɚɖ Ϋ́ з Ϋ́Ϋ́ɢɨ Ϋ́ɖΫ́Ϋ́ʃ*** *(n=8)* ***ɚŬɓ Ϋ́ɤ з ŭɛɚɐŬɕɦɛŮзɤ з Ϋ́ɖʃ ɕɛŸũŬʃ Ůɓɣɔɕɡ*** *(n=7).* ***ɇŬ ŭŮɛɛɣзŬ ´Ŭɉ ɕgůɚŸɕз Ϋ́ɓůŬɛɣůɕgʃ ɧɉ ɕgʃ*** ± ***Ϋ́ɡ´ ɚɐ Ŭ ɧɚɚůɖ.***

Ɇgůɢǔűűɞɜɜǔűǔɠ, ǝɘɕ́ ɧɜ, Ǘɞ Mbw ɛǓ Ǘɞ űɕɟǗɞ Ǘɖɠ ́ɟɕůǝǕɛɓǓɜɧɛǓɜɖɠ ɔǝɡǝɧɕɖɠ ɖ ɕ́ ɕɖǓ ɐŰǓɜ ǓɜƳǝɕɔɖ Ǘɞg ůɣɛǓǗɞɕɨ ɓƳɟɕgɠ, ɓɟɏɖɖǝǓ ́ɕǝɨ gɣɖǝɐ ůgůɢɏǗɞůɖ (r<0,97, p<0,001), g ́ɕǔɖǝɥ ɜɕɜǔűǔɠ ɧǗɞ ɖ ɛǓǓǔǝɨǗǔɟɖ ǓɜǓɞɕɔɑƳ ́ɕůɧǗɖǗǓ ɔǝɡǝɧɕɖɠ ́ɕg ́ɟɕůɏǝǓɓǓɜ ɕɘ Ǔɖǝɖǘɏɠ ǓɜǗɞɢɐɠ Ǔgɖɨɜǔűǔɞ ɔɘǓ Ǘɞ ɛǓǓǔǝɨǗǔɟɕ Mbw. ȺɜǗɞɨǗɞɠ, ɖǓ ́ɟɏ́ Ǔɞ ɥɘǓǗǔǗɟǓ ɜǓ Ǘɞɜɥůɖǔɑ Ǘɞ ɔǓɞɕɜɧɠ ɧǗɞ ɕ ɛǓǓǔǝɨǗǔɟɕɠ ůɢǗɞɞɧɠ ɟgɖɛɧɠ ǔɘƳɖǓůɖɠ Ǘɖɠ ɔǝɡǝɧɕɖɠ Ǘɤ ɜ Ǔɖǝɖǘ ɜ ǓɜǗɞɢɐɠ (Mbw) ɏǝǓɓǓɢɩ ɟǓ ǝƳǗɤ Ǔ ɧ ɛɑɟɧǗǔɟɖ ɛɏůɖ ́ɕůɧǗɖǗǓ ɑůɕɡǝɐɖɠ ůǗɞ ́ǝƳůɛǓ (mean-I), ůǓ ůɢɏůɖ ɛǓǗɞɡɠ Ǔɖǝɖǘɏɠ ǔǓɢɨ ǗɖǔǓǔɠ ǝǓǗɞɡɠ ǔɕǝɶǓɧɛǓɜɕgɠ Ǘɖɠ ɕɛƳǔǓɠ Ǔɞɏɔɢɕɡɕɡ (ɆɢɐɛǓ 4-6). ɆgɔǝǓɞɟɶɏɜǓ, ɖ mean-I ɐǔǓɜ ǝǔǓƳ 20% ǝǓɞ 130% ɛǓǓǔǝɨǗǔɟɖ, ǓɜǗɖůǗɞɢɓǓ, ůǗɖɜ ɕɛƳǔǓ Ǘɤ ɜ Ǔɖǝɖǘ ɜ ǔǓɢɨ ǗɖǔǓǔɠ ǝǓɞ ůǗɖɜ ɕɛƳǔǓ Ǔɞɏɔɢɕɡɕg.
ɟ ɜǗɖɖǔǓǔǓ, ́Ǔɟ ɧǝɘ ́ɕg ɖ ǔɘǓǗɕɟƳ Ǘɞg ́ɟɕůǝǓɛɓǓɜɕɛɏɜɕg űɕɟǗɞg ɔǝɡǝɧɕɖɠ ɛǔǓǓɜɨ Ǘɖɠ ɕɛƳǔǓɠ Ǘɤ ɜ Ǔɖǝɖǘ ɜ ǔǓɢɨ ǗɖǔǓǔɠ ǝǓɞ Ǘɖɠ ɕɛƳǔǓɠ Ǔɞɏɔɢɕɡɕɡ ɛǓɨ ɖɖǝǓ, ɖ ɛɑɟɐ Ǔɨɜɖůɖ Mbw ́ɕg ́ǓɟǓǗɖɟɐɖɖǝǓ ůǗɖɜ ǔǓɞǓgǓǔǓɖǓ ɕɛƳǓǓ ́ɘǓɜɧɜ ɜǓ ɕűǓǝǓǔǓɞ ůǗɖ ǔɟƳůɖ Ǘɖɠ ǝǔǓƳ 90% ɛǓǓǔǝɨǗǔɟ ɖɠ mean-I, ůǓůɨ ɔǝɟɥůɖ ɛǓ Ǔgǘɏ Ǘɤ ɜ Ǔɖǝɖǘ ɜ ǔǓɢɨ ǗɖǔǓǔɠ (ɆɢɐɛǓ 4-9).
ȳůɕɜ ǓǗɕɟƳ Ǘɖ ůɢǓǓɞɐ ́ǓɥǓǓɟɑɐ ǓɜǗɖůǗǓůɖ (rel-R), ɛɏůɣ Ǘɖɠ ɕ́ ɕɖǓɠ ǓɞǓɟƳůɖɖǝǓ ɖ ǓɜǗɖůǗǓůɖ Ǘɤ ɜ ɑůɕɡǝɑɕǓɜǓɟǗ ɛǓɜɣ ɜ ǝǓɞ ɛɖ ́ǓǓɞɧɜǗɤ ɜ ɏɜǓɜǗɞ Ǘɖɠ ́ɟɕɩ ɖɖůɖɠ Ǘɖɠ ɔǝɡǝɧɕɖɠ ́ɟɕɠ Ǘɞgg ɥǗɞɨ ɠ-ůǗɧɢɕɠ, ǓɞɕǝɘɕgɖɐɖɖǝǓǓɖ ǔɥǓ ůgǝɘɕɔɥǗɞɐ ɛǓǗɞ ɟgɖɛɧ ǔɘƳɖǓůɖɠ Ǘɖɠ ɔǝɡǝɧɕɖɠ (ɀ), ǝǓɖɧǗɞ rel-R = 1 / ɀ. ŌǗɥ, ǔǓɕɛɏɜɕg ɧǗɞ ǝǔǓƳ Ǘɖ ǔɘƳɟ ǝǓɜǓ Ǘɖɠ ǔɕǝɶǓǓɖǓɠ OGTT-75g ɕɘ Ǘɛɏɠ AUCG, φAUCG ǔǓɜ ǔɘɏǓǓɟǓɜ ůɖɛǓɜǗɐƳ ɛǓǓǓɨ Ǘɤ ɜ ɕɛƳɣ ɜ Ǘɤ ɜ ǔɕǝɶǓɧɛǓɜɣ ɜ, ɐǔǓɜ ǓɜǓɛǓɜɧɛǓɜɕ ɖ rel-R ɜǓ ɛɖɜ ǓɛűǓɜǓǓǓ ůɖɛǓɜǗɐɏɠ ǔɘǓǓɕɟɏɠ (ɆɢɐɛǓ 4-10). ɟ gǗɧ ůɖɛǓɐǓ ɧǗɞ ɖ ǓɜǗɖůǗǓůɖ Ǘɤ ɜ ́ǓɟǓɧɜǗɤ ɜ (ǝgɟɑɠ ɕɘ ɑůɕɡǝɑɕǓɜǓɟǗ ɛǓɜɕɘ) ɏɜǓɜǗɞ Ǘɖɠ ́ɟɕɖ ɖɖůɖɠ Ǘɖɠ ɔǝɡǝɧɕɖɠ ́ɟɕɠ Ǘɞgg ɥǗɞɨɠ ɛǓɨ ɖɖǝǓ ɛǓ Ǘɖɜ ɖǘɜǓ Ǔ ɕǓǓɐǓůɛǓǓǗɞɨ ǓɜǗɞɖɐǗǔɛǓǓǓɨ Ǘɤ ɜ ɕɛƳɣ ɜ.
ɖ ůǗɧůɕ ɧɛɣɠ, ɧ́ ɣɠ ́ɟɕɖɔɕɨ ɛǓɜǓ ɏɢǓ ǓɜǓǓǗɟɖǓɥ ɔɘǓ Ǘɖ ɛǓɣůɖ ǓgǗɞ Ǘɖɠ ǓɜǗɖůǗǓůɖɠ Ǔ ǓɜǗɞɖɖǝǓ ́ǓɥǓůɧǗǓǗɟɖ ɑůɕɡǝɐɖ (AUCI, φAUCI, mean-I) ůǗɞgɠ ǔɕǝɶǓɧɛǓɜɕgɠ Ǘɖɠ ɕɛƳǓǓɠ Ǔɞɏɔɢɕɡɕɡ ůǓ ůɨ ɔǝɟɥůɖ ɛǓ Ǘɞgɠ Ǔɖǝɖǘɏɠ. ǔɘǓ ɜǓ ɔɐǓ ǓɛűǓɜɐɠ ɖ ɛǓɣůɖ Ǔgǘɏ Ǘɖɠ ǓɜǗɖůǗǓůɖɠ, ɣɠ Ǔ ɕǗɏǝǓɛɛǓ Ǘɖɠ Ǔ ǔǓɟǓůɖɠ Ǘɖɠ ɑůɕɡǝɐɖɠ, g ́ɕǝɔǓɖɖǝǓ ɖ rel-R ůǓ ůɢɏůɖ ɛǓ Ǘɞ ůɣɛǓǗɞɧ ɓƳɟɕɠ Ǘɤ ɜ ǔɕǝɶǓɧɛǓɜɣ ɜ (rel-Rbw) (ɆɢɐɛǓ 4-11).
Ɇɕ ɔǓɞɕɜɧɠ ɧǗɞ ɕɘ Ǔɖǝɖǘɏɠ ǓɜǗɞɢɐɠ ǓɢǓɜ ůɖɛǓɜǗɞƳ ɢǓɛɖǝɧǗɟɖ rel-Rbw ůǓ ůɨ ɔǝɟɥůɖ ɛǓ Ǘɠ ƳǝǝǓɠ ǔɨɕ ɕɛƳǓɠ g ́ɕǔɖǝɥ ɜǓ ǝǓɞ Ǘɖɜ ɛǓǓǔǝɨǗǔɟɖ ǓgǓɜǓɖůǓɖǓ Ǘɤ ɜ ɥůǗ ɜ Ǔgǘ ɜ ůǗɖɜ ɑůɕɡǝɐɖ. ¢ ǓɞƳɢɥǓǓ ɛɑɟɧǗǔɟɖ rel-Rbw (ɧɕɘ ůɖɛǓɜǗɐɐ) ́ɕg ́ǓɟǓǓɟɐɖɖǝǓ ůǗɞgɠ ǔɕǝɶǓɧɛǓɜɕgɠ Ǘɖɠ ɕɛƳǓǓɠ Ǔɞɏɔɢɕɡɕɡ, ůǓ ůɢɏůɖ ɛǓ Ǘɞgɠ Ǔɖǝɖǘɏɠ ǔǓɢɨ ǗɖǔǓǔɠ, ǔǓɜ ɛ́ ɕɟǓɞ ɜǓ Ǔ ɕǔɕɖǓɞ ůǗɖ ɛǓǓǔǝɨǗǔɟɖ ǓgǓɜǓɖůǓɖǓ Ǘɤ ɜ ɥůǗ ɜ Ǘɤ ɜ ́ɟɩ Ǘɤ ɜ ůǗɖɜ ɑůɕɡǝɐɖ, ǝǓɖɧǗɞ ǓǓ ́ɕůƳ Ǘɖɠ Ǔ ǓɜǗɞɖǓɕɨ ɛǓɜɖɠ ɑůɕɡǝɐɖɠ Ǘɖɠ ɕɛƳǓǓɠ Ǔɞɏɔɢɕɡɕɡ ɐǔǓɜ ůɖɛǓɜǗɐƳ ɛǓǓǔǝɨǗǔɟ Ǔ ůǓ ůɢɏůɖ ɛǓ Ǘɖɜ ɕɛƳǔǓ Ǘɤ ɜ Ǔɖǝɖǘ ɜ ǔǓɢɨ ǗɖǔǓǔɠ (AUCI, φAUCI, mean-I).
ɟ ɜǗɖɖǔǓǔǓ, Ǘɞɨ Ǘɞ g ́ɕǔɖǝɥ ɜǓ ɧǗɞ ɕɘ Ǔɖǝɖǘɏɠ ǔǓɢɨ ǗɖǔǓǔɠ, ůǓ ůɨ ɔǝɟɥůɖ ɛǓ Ǘɞgɠ ǔɕǝɶǓɧɛǓɜɕgɠ Ǘɖɠ ɕɛƳǓǓɠ Ǔɞɏɔɢɕɡɕɡ, ́ǓɕgůǓǓůǓɜ ɛǓǓǔǝɨǗǔɟɖ ǓgǓɜǓɖůǓɖǓ Ǘɤ ɜ ɥůǗ ɜ-ůǗɧɢɕɠ ůǗɖɜ ɑůɕɡǝɐɖ. ɄɟƳɔɛǓǗɞ, ůɨ ɛűɣɜǓ ɛǓ ǓǓ Ǔ ɕǗɏɏůɛǓǓǓ Ǘɖɠ ́ǓɕɨůɖɠǗɜ ɛǓɏǗɖɠ, ɖ ůgɜɕǝɑɐ ǓɜǗɖůǗǓůɖ ůǗɖɜ ɑůɕɡǝɐɖ (Tot-I-R) Ǘɤ ɜ Ǔɖǝɖǘ ɜ ǓɜǗɞɢɐɠ ɓɟɏɖɖǝǓ ɜǓ ǓɞǓɞ ǝǔǓƳ 15% ǝǓɞ 130% ɢǓɛɖǝɧǗǔɟɖ, ǓɜǗɖůǗɞɢɓǓ, Ǘɤ ɜ Ǔɖǝɖǘ ɜ ǔǓɢɨ ǗɖǔǓǔɠ ǝǓɞ Ǘɤ ɜ ǔɕǝɶǓɧɛǓɜɣ ɜ Ǘɖɠ ɕɛƳǓǓɠ Ǔɞɏɔɢɕɡɕɡ, Ǔɜɩ ɖ Tot-I-R Ǘɤ ɜ Ǔɖǝɖǘ ɜ ǔǓɢɨ ǗɖǔǓǔɠ ɐǔǓɜ

ŭɘ´əƳůɘǕ ɢǕɛɖəɦǖǖɟɖ Ǔɡǖɐɡ ǖɖʃ ɕɛƳũǓʃ Ǖɞɤɔɢɕɡ (ɆɢɐɛǕ4-10).

Ɇɨ ɛǘɤɜǓ ɛǕ ǖǕ Ǔɕǖǖɞɤůɛ ǕǕǕ ǖɤɜ Ǖɟɔɕɛǖǖɟɐůǖɤɜ, ɕɘ ůɖɛǓɜǖɞɦǖǖɟǓʃ Ǔɞɘ Ǔɞɤʃ ´ɕɡ ǘǓɶǖǖǕɘ ɜǓ ´ɟɕəƳɞǖůǕ ɖ ɛǓɘɟɕ´ɟɦɖǖůɛɖ ůɡůǖɖɛǓǖɞɐ ůɤɛǓǖɞɐ Ƴůɘɖůɖ əǓɘ´ɟɕ´ɦɜɖůɖ ǕɶǓɘɔɘǓɛǕɜ ǖɛɡʃ Ǔɖəɖǖɤʃ Ǔɜǖɛɢɐɕɕʃ ɖ ɓǕɞǖɤůɖ ǖɖʃ əɕɟɡǘǓǓʃ ´ɟɦůəɖɣɖʃ ɕɜɡɔɦɜɕɡ (PVO2) əǓɘ ǖɛɡ ǓɜǕǕɟɦɓɘɡ ǓɜǓ ɜǕɡůǖɞɕɨ əǓǖɤǘəɘɨ (Aɟ ɈɈ), ǕɜɩɔɘǓ ǖɛɡʃ Ǔɖəɖǖɤʃ ǖǖɢɨǖɖǖǖʃ ǕɶǓɘɖ ɓǕɞǖɤůɖ ǖɖʃ ɛɤɔɘůǖɖʃ (PP kg) əǓɘ ɛɤůɖʃ (MP kg) ´ǕɟǓɦɛǕɜɖʃ ɛɖɢǓɜɘɐʃ ɘůɢɨɕʃ ǖɤɜ əƳǖɤ ƳəɟɤɜɜɈ ´ɘ´ɟɦůɖǖǖǖ, ɛɤůɤ ǖɖʃ ǕɘǖɛɖůɖʃǕ ǖɖʃ ůɤɛǓǖɞɐʃ ůɨůǖǖůɖʃ, ´ǕɟǓǖɖɟɐɖɖəǕ ɛɘɟɦǖǖɟɕ ůɤɛǓǖɞɦ əɑɕʃ (Ɇʂ) ůǕɦəɕɡʃ ǖɛɡʃ Ǔɖəɖǖɤʃ əǓɘ ɛǕǓǕɞɨ ǖǖɟɖ ɛɡɸɐ ɛƳɛǓ (ɟ Ɇʐ) ůǖɛɡʃ Ǔɖəɖǖɤʃ ǖǖɢɨǖɖǖǖʃ, ůǕ ůɢɤůɖ ɛǕ ǖɛɡʃ ŭɕəɶǓɛɦɛǕɜɕɡʃ ǖɖʃ ɕɛƳũǓʃ Ǖɞɤɔɢɕɡ. ƎɡůɢǖǖɛɕɜǖǖǓ, əɕ´ɦɜ, Ǔɡǖɤʃ ǖɡʃ ´ɟɕəǓɞɕɨɛǕɜǓʃ Ǔ ɦ ǖɛ ŭɘǓǘɕɟǕǖɞɦ ǖɨ´ɕ ´ɟɕ´ɦɜɖůɖʃ ůɤɛǓǖɞɤʃ ´ɟɕůǕɟɛɕɔɤʃ ɛǕ rel-Rbw əǓɘ Tot-I-R, ´ɟɕɨ´ǖǖɘ ɦǖɘ ɖ ǓǕɟɦɓɘǓ ´ɟɕ´ɦɜɖůɖ ůɡɛɓƳəəǓɘ ǖǕ ɛɤɔɘůǖǖ ůǖɖ ɓǕɞǖɤůɖ ǖɖʃ ǕɡǓɘůɖɖůɖǓʃ ǖɖʃ ɘůɕɡəɶɖʃ (ɄɶǓɘǓʃ 4-5). ɋɘǓ ɑůǖɤůɖ ɖ ɕ´ɕǓ ǕɶǓɘ ůɨɛǘɤɜɖ əǓɘ ɛǕ ƳəəǓʃ ɛǕɞɤǖǖʃ, ɕɘ ɕ´ɕǓʃ ɡ´ɕůǖɖɟɶɕɡɜ ɦǖɘ ɕɘ ´Ǖɟɘůɦǖǖɟɕɘ ´ǕɟƳɔɕɜǖǖʃ ´ɕɡ ůɡɛɓƳəəɕɡɜ ůǖɖ ɓǕɞǖɤůɖ ǖɖʃ ǕɡǓɘůɖɖůɖǓʃ ǖɖʃ ɘůɕɡəɶɖʃ ǕɶǓɘ əɡɟɑɡ Ǔ ɕǖɤəǖɛǓ ´ɟɕůǕɟɛɕɔɩɜ ǖɖʃ ǕǕɟɦɓɘǓʃ ´ɟɕ´ɦɜɖůɖʃ (DeFronzo, et. al., 1981; Lillioja, et. al., 1987; Goodyear, et. al., 1990). Ǽɘǘɘɦǖǖɟ Ǔ, ůǖɖɜ ´ǕɟɕɨůǕ ɛǕɤǖɖ, ɖ ɛǕɤůɖ ǖɖʃ rel-Rbw Ǔ ɕǘɦɖɖəǕ əɡɟɑɡʃ ůǖɛ ɛɘɟɦ Ɇʂ əǓɘɦɢɕůǕǓɡǖɦ əǓô Ǔɡǖɦ ǖɛ Ǖ ɑ Ǔɕ ǖɖʃ POV2 (ɄɶǓɘǓʃ 4-6), ǖɛ ɕ´ɕɶ ůɡɛǘɤɜǕɑ əǓɘ ɛǕǖɖ ɛǕɤǖɖ ǖɛɡ LeBrance əǓǖɤɜ ůɡɜǕɔǖǖɜ ǖɛɡ (1979). ɖůǖɦůɕ, ɖ Ǖɐɔɖůɖ ´ɕɡ ɛ´ɕɟǕɑɜǓ ŭɕɖǕɑ ůǖɖɜ ɡ´Ƴɟɢɕɡůǖɖǖɞɐ ůɢɤůɖ ɛǕǖǖɜɨ ǖɖʃ ɟ Ɇʐ əǓɘ ǖɖʃ rel-Rbw ǕɶǓɘ ǖɛ ɔǕɘɜɦʃ ɦǖɘ ɖ ǓǕɟɦɓɘǓ ´ɟɕ´ɦɜɖůɖ, ɖ ɕ´ɕǓ ǔǓɜ ůɡɜɕǖ ǖɖəǕ Ǖ əǓɘ ɛǕ ɛǕƳəɖ ɟ Ɇʐ ůǖɛɡʃ Ǔɖəɖǖɤʃ ǓɜǖɛɢɐɕɕǓ, ɛ´ɦɟǕǕ ´ɘǓɜɦɜ əǓɘ ɓǕɞǖɤůǕ ůǕ ɛɡɸɦ Ǖɑ Ǖɑɕ, ǖɛɡʃ ´ǕɟƳɔɕɜǖǖʃ ǕɘǓɕɡɕɡʃ ´ɕɡ Ǖ ɘǖɟɕɨ ɑǖǖɞƳ ůǖɖɜ ǓɡǓɘůɖɖůɖǓ ǖɖʃ ɘůɕɡəɶɖʃ, ɦ´ɤɡʃ ɕɡǖɤɛ ɛɐɐɑ ǖɖʃ ɕɘǓɘɜǓ ǖǖɕɡ ɛɢɤůɖ Ƴəɦ (ɟ Ɇʐ) ůǖɛɡʃ Ǔɖəɖǖɤʃ ǖǖɢɨǖɖǖǖʃ, ůǕ ůɢɤůɖ ɛǕ ǖɛɡʃ Ǔǖɐɡ ǖɖʃ ɕɛƳũǓʃ Ǖɞɤɔɢɕɡ (ɆɢɐɛǕ4-10).

ůɡɜɕǘǕǖ ǖɖəǕ əǓɘ ɛǕ ɛǕƳəɖ ɟ Ɇʐ ůǖɛɡʃ Ǔɖəɖǖɤʃ ǓɜǖɛɢɐɕɕǓ, ɛ´ɦɟǕǕ ´ɘǓɜɦɜ əǓɘ ɓǕɞǖɤůǕ ůǕ ɛɡɸɦ Ǖɑ Ǖɑɕ, ǖɛɡʃ ´ǕɟƳɔɕɜǖǖʃ ǕɘǓɕɡɕɡʃ ´ɕɡ Ǖ ɘǖɟɕɨ ɑǖǖɞƳ ůǖɖɜ ǓɡǓɘůɖɖůɖǓ ǖɖʃ ɘůɕɡəɶɖʃ, ɦ´ɤɡʃ ǕɖɜǓɦɜ əǓɘ: Ǔ) ǖɛɡ ǕɟɘɖɛɕɨǕɤɜ ǘɕɟɤɤɜ ɔəɡəɦɕɖʃ (GLUT4) (Houmard, et. al., 1995), ɓ) ǖɛɡ ɛɖ ɕɜǕǘɤǖɞɕɨ ɛǕǖǖɓɕəůɛɕɨ ǖɖʃ ɔəɡəɦɕɖʃ (Ǔ ɕǖǕɛɑǕɡůɖ ɔəɡəɦɕɖʃ-ůɨ ɜɑǕůɖ ɔəɡəɕɔɦɜɕɡ) (Ebeling et. al., 1993), ɔ) ǖɤɜ ɔəɡəɕəɡǖɞɩɜ Ǖɜɕɨ ɛɤɜ ǖɖʃ ǕǕɟɦɓɘǓʃ ´ɕɟǕǓʃ (Simoneau, & Kelley, 1997) əǓɘ ŭ) ǖɖʃ ɘǓɜɦǖɖǖǖʃ ǖɖʃ ɘůɕɡəɶɖʃ ɜǓ əǖǖůǖɤəəǓɘ ǖɖɜ ɖ´ǖǖɞɐ ´Ǖɟɕɢɐɕɖɔəɡəɦɕɖʃ (Rodnick, et. al., 1987).

ɏůɕɜ Ǖǘɕɟ Ƴ ǖɖɜ Tot-I-R, ɛɤůɤ ǖɖʃ ɕ´ɕǓʃ ŭɘǖǘɕɟɕ´ɕɛɖɖəǕ ůǖǖǖǘůǖɞƳ ɖ ŭɡɜǕɛɘɐ ǖɛɡ ɕɛɕɛůǖǖǖɞɕɨ ɛɖɢǓɜɘůɛɕɨ ǖɖʃ ɔəɡəɦɕɖʃ-ǔɟƳůɖʃ ɘůɕɡəɶɖʃ ǖɤɜ Ǔɖəɖǖ ɜ ǖǖɢɨǖɖǖǖʃ, ɤɜǓǜǖǘ Ǔɡǖɐɡ ǖɖʃ ɕɛƳũǓʃ Ǖɞɤɔɢɕɡ, ɓɟɤɖɖəǕɦǖǘ ǕɶǓɘ əɡɟɑɡʃ Ǔ ɕǖɤəǖɛǓ ǖɛɡ ɛɘɟɦǖǖɟɕɡ ůɤɛǓǖɞɕɨ əɑɕɡʃ ǖɤɜ ´ɟɩǖɤɜ. ɖůǖɦůɕ, ɛɦɜɕ ǖɛ 48% ǖɖʃ ŭɘů´ɕɟƳʃ ǖɖʃ Tot-I-R ǕɖɔɐɖɖəǕ Ǔɦ ǖɖɜ ´ɕůɦǖɖǖǖ ǖɛɡ Ɇʂ (ɄɶǓɘǓʃ 4-7), ɡ´ɕɜɕɩ ɜǖǖʃ ´ǕɟƳəəɖəǓ ǖɖɜ ɨ´Ǖɟɜɖ əǓɘ Ƴəəɤɜ ´ǕɟǓɦɜǖɤɜ ɕɘ ɕ´ɕɶɘ ůɡɜɤɓǓɜǕɜ ůǖɖɜ ´ǕɟǓǖɖɟɖɑǖůǓ ůɖɛǓɜǖɞƳ ɛɘɟɦǖǖɟɖ Tot-I-R ǖɤɜ Ǔɖəɖǖ ɜ ǖǖɢɨǖɖǖǖʃ ůǕůɨɔəɟɘůɖ ɛǕǓɡǖɐɜ ǖɖʃ ɕɛƳũǓʃ Ǖɞɤɔɢɕɡ. ǼǕɩ ɑǓ ´ɟɤ´ǖǘ ɜǓ Ǖɤ ɤɑǕɑ ɦǖǘ ɖ ɟ Ɇʐ ŭǕɜ ɤǕǖɞǕ ɜǓ ůɡůɢǖǖɛǕǖǖǕɘ ůɖɛǓɜǖɞƳ ɛǕ ǖɖ Tot-I-R (ɄɶǓɘǓʃ 4-5). ɄɑǓɜɕəɕɔǕǖǖǖɘ, əɕ´ɦɜ, ɦǖǘ ɕ ǓɜǕǕɟɦɓɘɡ ǖɨ´ɕʃ ´ɟɕ´ɦɜɖůɖʃ ǖɤɜ Ǔɖəɖǖ ɜ ǖǖɢɨǖɖǖǖʃ, ´ɤɟǓɜ ǖɖʃ ǕƳǖǖɤůɖʃ ǖɛɡ Ɇʂ, ɑǓ ´ɟɤ´ǖǘ ɜǓ ǓɡɜƳɜǖǘ əǓɘ ǖɖ ɛɖ ɕɜǕǘɤǖɞɐ ǖɢɖ ǖɖʃ ɔəɡəɦɕɖʃ (Ǔ ɕɖɐəǕɡůɖ ɔəɡəɦɕɖʃ-ůɨ ɜɑǕůɖ ɛɡɸɕɨ ɔəɡəɕɔɦɜɕɡ), ɤɢɕɜǖǖʃ ůǓɜ Ǔ ɕǖɤəǖɛǓǖɖ ɓǕɞǖɤůɖ ǖɖʃ ǔɟƳůɖʃ ǖɖʃ ɘůɕɡəɶɖʃ (Miller, et. al., 1994).

ɇɤəɕɡ, ǖɛ ɔǕɘɜɦʃ ɦǖǘ ǖɦůɕ ɖ rel-Rbw, ɦůɕ əǓɘɖ Tot-I-R ɓɟɤɖɖəǓɜ ůɖɛǓɜǖɞƳɜǓ ůɡůɢǖǖɛɕɜǖǖɘ ɛǕ ǖɛ Ǖ ɑ Ǔɕ ǖɛɡ ɟ ɟ ɈɈ,

ġ´ɞɜɞǕɑ ɧǗɘ ɖ ŭɟƳůɖ ǘɖɠ ɤůɞɡɚɶɖɠ Ů ɖɟŮƳɛǕǕɘ ɗǕǗɘƳ Ǚ ɧ ɡɤɖɚɧǗɟ ɖɠ ɥɜǕǕůɖɠ ůɤ ɛǕǗɘɐ Ƴůɘɖůɖ, ´ ɗǕɜɧɜ ɚɧɔɤ ǘɖɠ ǕɜƳɔɘɖɠ ɛ ǕǕɚɨ ǕǗɟɞɡ ´ ɞůɞůǘɨ Ů ɘůǗ ƳǗɡůɖɠ ɛɡɸɩ ɜ ɤɩ ɜ (Cortez, et. al., 1991; Borghouts, et. al., 1999).

Ɇɡɜɞɤ ɶɞɜǕǕɠ, ɖ ůɡɜɞɚɤɐ ŭɘƳɗǕůɖ-ɛ ǕǕɓɞɚɘůɛɧɠ ǘɖɠ ɔɚɡɘɧɕɖɠ ´ ɟɞɠ ǘɡɠ ɘůǘɨ ɠ (ɀ) ɘǕɘ ɖ ůɢǕǕɐ ´ Ǘ ɘǗ Ǘɤɐ ǕɜǗůǕůɖ ǗɤɜɘůǗ ɜ (rel-R) ŭǕɜ ɥůǕɤǕɜ ɜǙ ŭɘǕɥɟɞɡɜ ɛ ǕǕɜɨ ǗɤɜɞɛƳǗɤɜǗɤɜ ŭɞɚɶǕɧɛǕɜɤɜ, ɔǕɞɜɧɠ ǘ ɞ´ɞɶ Ǖɖɔ Ǖɑ ǘɖɜ ´Ǘɟ ɧɛɞɘǙ Ǚ ɞǕǕůɛǕǗɧǘǕǕ ǘɖɠ ɞɛɞɤůǕǕɐɠ ŭɘǕɡɖɥǘɖůɖɠ ǘɡ ɢɞɟɖɔɞɨ ɛǕɞɡ ůɞɟǘɞɡ ɔɚɡɘɧɕɖɠ ɘǕƳ ǘɖ ŭɞɘɶǕůɗǙ OGTT-75g. ɟ ɜǘɗǕǕǙ, ǕɜǕɚɞɔɤƳ ɛ Ů ǘ ůɤ ɛǕǗɧ ɓƳɟɞɠ Ǘɤɜ ŭɞɘɶǕɧɛǕɜɤɜ, ɞ ɟɡɗɛɧɠ ŭɘƳɗǕůɖɠ ǘɖɠ ɔɚɡɘɧɕɖɠ (Mbw) ɘǕɘɖ ůɢǕǕɐ ´ Ǘ ɘǗ Ǘɤɐ ǕɜǗůǕůɖ (rel-Rbw) ɐǕǕɜ ůɖɛǕɜǗɘƳ ɛ ǕɔǕɘɨ ǕǗɖ ɘǕɘ ɛɤɟɧǗɟɖ, ǕɜǗůǘɜɢǕ, ůǘɡɠ ǕɗɚɖǗɥɠ Ǖɜǘɢɐɠ. Ɇɡɜɡ´ɞɚɞɔɶɞɜǕǕɠ ǕǕ Ů ɑ ǗǗǕ ǘɖɠ Ǚ ǕǗɡɗǕɟɞɨ ɛǕɜɖɠ ɤůɞɡɚɶɖɠ ɘǕɘ ǘɠ ´ɟɞɘɨ ´ǘɡůǗɠ ůɡůɢǕǗůǗɠ ɛ ǕǕɜɨ rel-Rbw, Tot-I-R ɘǕɘ Ǘɤɜ ´ Ǘɟ Ǖɛɥ Ǘɤ ɜ Ǘɤ ɜ ůɤ ɛǕǗɘɩ ɜ ɤǕɜɞǗɐǗɤɜ ɘǕɘ ůɤ ɛǕǗɘɐɠ ůɨ ůǕǕůɖɠ, ɛ´ɞɟǕɑ ɜǙ ǕǗɤ ɗǕɑ ɧǗɘ ɞ ǙǗɟ ɧɓɤɠ ǘ ´ɞɠ ´ɟɞ´ɧɜɖůɖɠ ǕɢŮ ǘɖ ɗǕǗɘɧǗɟɖ Ů ɑɟǕůɖ ůǘɖ ŭɟƳůɖ ǘɖɠ ɤůɞɡɚɶɖɠ.

6. ɆɈɀ ɄǠɅɈ Ɇɀ ɈɇɈ

ȚǓǗɎ ǗǱ ǚɕəɶǓǔǕ Ǔɜɕɛɐɠ ɔəɡəɧɕɖɠ (OGTT-75g), ɕə Ǔɗəɖ Ǘɏɠ Ǘɤɜ ǚɟɧɛɤɜ Ǔɜǘɕɛɐɠ əǓɔ ǗǛɕɨǗǱǗǓɠ Ǔ Ǔɜǘɕɨɜ ɛɕɟɧǗɟǓ ǓǗǔǗǓ Ǔ ǓɔǓɡɖǓɟɕɨɛǓɜɖɠ ɕǔɛɡəɷɖɠ ǔǓ ǔɨɔəɟɖǖɖ ɛǓ Ǘɛɡɠ Ǔɔɨɛɜǖǖɛɡɠ, ɔǓɕɜɧɠ Ǘɛ ɕɕɕɕ ɕǘǓɔǗǗɔ əɡɟɶɤɠ ǔǗǱ ɛɕɟɧǗɟɖ ǓɜǗǓǗǗǖɖ Ǘɤɜ ǖǔǗɜ Ǘɤɜ Ǔɗəɖ Ǘɜ ǔǗɜ ɕǔɛɡəɷɖ. ɖǔǗɧǔɕ ɧɛɤɠ, ɖ ǓɜǗǓǗǗǖɖ Ǘɤɜ ǖǔǗɜ ɏɜǓɜǓɔ ǗǱɠ Ǔǖǔɧǚɕɡ ǗǱɠ ɔəɡəɧɕɖɠ ǓɛǘǓɶǓǗǗɔ ǔɖɛǓɜǗɔɎ ɛɕɟɧǗɟɖ ǔǗɛɡɠ Ǔɗəɖ Ǘɏɠ ǓɜǗɛɕɛɐ, ǔǓ ǔɕɏǔɖ ɛǓ Ǘɛɡɠ Ǔɗəɖ Ǘɏɠ ǗǛɕɨǗǱǗǓɠ, ɡ ɕǚɖə ɜɕɜǗǓɠ ɧǗɔ ɕ ǓǓɟɧɓɕɡ Ǘɨ ɕɠ ɟɕ ɧɜɖǔɖɠ ǓɡɜɎɜǓɔ ɟǓǖǔɧǗɟɕ Ǘɜ ǓɡǓǖɖɖǔɖǓ ǗǱɠ ɕǔɛɡəɷɖɠ. ɆɡɜǓ ɩɠ, ɕə ɟɕəǓɔɕɨɛǓɜǓɠ ɟɕǔǓɟɛɕɔɏɠ Ǘɛɡ Ǔɟɧɓɕɡ əǓɔ ǓɜǓɟɧɓɕɡ Ǘɨ ɕɡ ɟɕ ɧɜɖǔɖɠ Ǘɤɜ Ǔɗəɖ Ǘɜ Ǘɤɜ ǚɟɧɛɤɜ Ǔɜǘɕɛɐɠ əǓɔ Ǘɤɜ Ǔɗəɖ Ǘɜ Ǘɤɜ ǚɟɧɛɤɜ ǗǛɕɨǗǱǗǓɠ Ǘɛɡ əəǓǔɕɨ Ǔɗəɖ Ǘǔɛɕɨ, ǓɜǗǔǗɛɕǓ, Ǔ ǔǓɟɕɨɜ ɖǓǗɔɎ ǔǗǱ ǚɡɜǓɛɐɐ Ǘɛɡ ɕɛɕǔǗǗɔɕɨ ɛɖɕǓɜǔɛɕɨ ǗǱɠ ɔəɡəɧɕɖɠ-

ǚɟɎǖɖ ɕǔɛɡəɷɖɠ, ǔǗǔǓǗɟǓ, ɧɛɤɠ, ǓɡǗɜ ǗǱɠ ǓǓɟɧɓǔǓɠ ɟɕ ɧɜɖǔɖɠ.

Ʌɕ ɟɧǔǓǗǗǓ, ǔǓ ǔɨɔəɟǔǖ ɛǓ Ǘɛ Ǔ ǓǗɕ Ǘɖɠ əɕɟɡǚǓǖɠ ɟɧǔəɖɣɖɠ ɕɜɡɔɧɜɕɡ (PVO2) əǓɔ Ǘɛɡ ǓɜǓǓɟɧɓɛɡ ǓɜǓ ɜǓɡǔǗǓɕɨ əǓǗɤ ǚəɛɕɨ (ɈɈȚ), əǓǗ ɠ ǓǗǔɖɠ ǗǱɜ ɟɕǔɧǗǱǗǓ ǗǱɠ Ɏəɞɖɠ ǔɤɛǓǗɜɐɠ ɛɎɕǓɠ (ɈɆɀ) əǓɔ Ǘɛ ɛɏɔǓǗɕɠ ǗǱɠ ɛɡɟɐɠ ǚɨɜǓɛɖɠ əǓǔǗɕɨɕɠ (PP kg), ɖ ɛɛɟɐ ɟɕǔɧǗǱǗǓ Ǘɛɡ ǔɤɛǓǗɜɕɨ əǓɕɡɠ (Ɇʂ) əǓɔ əǓǗɎ ǔɡɜɏǓǓ ɕ əǓɨǗɟɕɠ ɛǓǗǓɓɕəǔɛɧɠ Ǘɛɡ əǓɕɡɠ, ǓɜǓɔ ɕ ǔɖɛǓɜǗǓɧǗɟɕɠ ɟǗɟɎɔɕɜǗǓɠ ɟɕɡ ǔɡɛɓɎəǓǓ ǔǗǱ ɛǓǓɨǗɟɖ ǓɡǓǔǖǖǔǗ ǗǱɠ ɕǔɛɡəɷɖɠ ǔǗɛɡɠ Ǔɗəɖ Ǘɏɠ ǓɜǗɛɕɛɐ əǓɔ ǗǛɕɨǗǱǗǓɠ.

ƚǖǓǗǗǟɕ Ǔǚǖǚɏɟɕɜ ɖǓ ɛɟɕɟɕɨǔǓɜǓ Ǔ ɕǗǗǓɏǔǓ əǓɔ ɖ ǚǖǓɟǓɜɖǔɖ ǗǱɠ ǓǖɟǓǖɖɠ Ǘɤɜ ɟɕəǓɔɕɨɛǓɤɜ ɟɕǔǓɟɛɕɔɩɜ ǗǱɠ ǓǓɟɧɓǖǓɠ ɟɕ ɧɜɖǔɖɠ Ǔɗəɖ Ǘɜ ɡɣɖəɕɨ Ǔɖɏǚɕɡ, ɤɠ Ǔ ɕǗɏəǓɛǓ, ɧɛɤɠ, Ǘɛɡ ǚǗǓɕɟǓǗɔɕɨ Ǘǖɕɡɠ ǔɤɛǓǗɜɐɠ Ɏǔəɖǔɖɠ, ɧɤɠ ǗǱɠ əɕəɨɛɓɖǔɖɠ, ǗǱɠ ɟɕǖəǓǔǗɠ əǓɔ Ǘɛɡ ǗɟǓɶǓɛɡ, ǔǗǱɜ ɕɛɕɛǔǗǗǓɐ ǚɡɜǓɛɐ ǗǱɠ ɔəɡəɧɕɖɠ-ǚɟɎǖɖɠ ɕǔɛɡəɷɖɠ.

7. dŁdş ŁB ũ Λȷ ū Łȷ

Allenberg, K., Johansen, K., & Saltin, B. (1988). Skeletal muscle adaptations to physical training in type II (non-insulin-dependent) diabetes mellitus. *Acta Medicine Scandinavia, 223*, 365-373.

Andersen P., & Henriksson, J. (1977). Capillary supply of the quadriceps femoris muscle of man: adaptive response to exercise. *Journal Physiology of London, 270*, 677-690.

Bangsbo, J., Gollnick, P.D., Graham, T.E., Juel, C., Kiens, B., Mizuno, M., & Saltin, B. (1990). Anaerobic energy production and o2 deficit-debt relationship during exhaustive exercise in humans. *Journal Physiology of London, 422*, 539-559.

Baron, A.D., Brechtel, G., Wallace, P., an, S.V. (1988). Rates and tissue sites of non-insulin-and insulin-mediated glucose uptake in humans. *American Journal of Physiology, 255*, E769-774.

Berger, M., Kemmer, F.W., Becker, K., Herberg, L., Schwener, M., Gjinavci, A., & Berchtold, P. (1979). Effect of physical training on glucose tolerance and on glucose metabolism of skeletal muscle in anesthetized normal rats. *Diabetolologia, 16*, 179-184.

Bergman, R.N., Phillips, L.S., & Cobelli, C. (1981). Physiology evaluation of factors controlling glucose tolerance in man. Measurements of insulin sensitivity and beta-cell glucose sensitivity from the response to intravenous glucose. *Journal of Clinical Investigation, 68*, 1456-67.

Best, J.D., Taborsky, G.L., Halter, J.B., Porte, Jr.D. (1981). Glucose disposal is not proportional to plasma glucose level in man. *Diabetes, 30*, 847-50.

Bjorntorp, P., Krotkiewski, M., Larson, B., & Soimlo-Szuck, A. (1970). Effects of feeding states on lipid radioactivity in liver, muscle and adipose tissue after injection of labeled glucose in the rat. *Acta Physiology of Scandinavia, 80*, 28-38.

Bjorntorp, P., Fahlen, M., Grimby, G., Gustafson, A., Holm, J., Renstrom, P., & Schersten, T. (1972). Carbohydrate and lipid metabolism in middle-aged physically well-trained men. *Metabolism, 21(11)*, 1037-1044.

Bjorntrop, P., & Sjostrom, L. (1978). Carbohydrate storage in man: speculations and some quantitative considerations. *Metabolism, 27(Suppl. 2)*, 1853-1863.

Bloch, G., Chase, J.R., Meyer, D.B., Avison, M.J., Shulman, G.I., Shulman, R.G. (1994). In vivo regulation of rat muscle glycogen resynthesis after intense exercise. *American Journal of Physiology, 266*, E85-E91.

Bogardus, C., Thuillez, P., Ravussin, E., Vasquez, B., Narimiga, M., & Azhar, S. (1983). Effects of muscle glycogen depletion on in vivo insulin action in man. *Journal of Clinical Investigation, 72*, 1605-1610.

Bogardus, C., Ravussin, E., Robbins, D.C., Wolfe, R.R., Horton, E.S., & Sims, E.A. (1984). Effects of physical training and diet therapy on carbohydrate metabolism in patients with glucose intolerance and non-insulin-dependent diabetes mellitus. *Diabetes, 33*, 311-318.

Boning, D., Clasing, D., & Weicker, H. (1994). *Stellenwert der laktatbestimmung in der leistungsdiagnostik*. Stuttgart: Gustav Fischer.

Booth, F.W., & Thomason, D.B. (1991). Molecular and cellular adaptations of muscle in response to exercise: perspectives of various models. *Physiological Reviews, 71*, 541-585.

Borghouts, L.B., Backx, K., Mensink, M.F., & Keizer, H.A. (1999). Effect of training intensity on insulin sensitivity as evaluation by insulin tolerance test. *European Journal of Applied Physiology, 80*, 461-466.

Borghouts, L.B., & Keizer, H.A. (2000). Exercise and insulin sensitivity: a review. *International Journal of Sports Medicine, 21*, 1-12.

Braun, B., Zimmermann, M.B., & Kretchmer, N. (1995). Effects of exercise sensitivity in women with non-insulin-dependent diabetes mellitus. *Journal of Applied Physiology, 78(1)*, 300-306.

Brozinick, J.T., Etgen, G.J., Yaspelkis, B.B., Kang, H.Y., & Ivy, J.L. (1993). Effects of exercise training on muscle GLUT-4 protein content and translocation in obese Zucker rats. *American Journal of Physiology, 265*, E419-E427.

Burstein, R., Polychronakos, C., Toews, C.J., Macdougall, J.D., Guyda, H.J., & Posner, B.I. (1985). Acute reversal of the enhanced insulin action in trained athletes. Association with insulin receptor changes. *Diabetes, 34*, 756-760.

Cederholm J., & Wibell, L. (1985). Evaluation of insulin release and relative peripheral resistance with use of the oral glucose tolerance test: a study in subjects with normoglyceamia, glucose intolerance and non-insulin-dependent diabetes mellitus. *Scandinavia Journal Laboratory Investigation, 45*, 741-751.

Coderre, L., Kandror, K.V., Valegga, G., & Pilch, P.F. (1995). Identification and characterization on an exercise-sensitive pool of glucose transporters in skeletal muscle. *Journal of Biological Chemistry, 270*, 27584-27588.

Coggan, A.R., Swanson, S.C., Mendenhall, L.A., Habash, D.L., & Kien, C.L. (1995). Effect of endurance training on hepatic glycogenolysis and gluconeogenesis during prolonged exercise in men. *American Journal of Physiology, 268*, E375-E383.

Colberg, S.R., Simoneau, J.A., Thaete, F.L., & Kelley, D.E. (1995). Skeletal muscle utilization of free fatty acids in women with visceral obesity. *Journal of Clinical Investigation, 95*, 1846-1853.

Cononie, C.C., Goldberg, A.P., Rogus, E., & Hagberg, J.M. (1994). Seven consecutive days of exercise lowers plasma insulin responses to an oral glucose tolerance challenge in sedentary elderly. *Journal of American Geriatric Society, 42*, 394-398.

Consoli, A. (1992). Role of liver in pathophysiology of NIDDM. *Diabetes Care, 15*, 430-441.

Cortez M.Y., Torgan, C.E., Brozinick, J.T., & Ivy, J.L. (1991). Insulin resistance of obese Zucker rats exercise trained at two different intensities. *American Journal of Physiology, 261*, E613-E619.

Costill, D.L., & Saltin, B. (1974). Factors limiting gastric emptying during rest and exercise. *Journal of Applied Physiology, 37*, 679-83.

Cox, J.H., Cortright, R.N., Lynis Dohm, G., & Houmard, J.A. (1999). Effect of aging on response to exercise training in humans: skeletal muscle GLUT-4 and insulin sensitivity. *Journal of Applied Physiology, 86(6)*, 2019-2025.

Cullinen, K., Caldwell, M. (1998). Weight training incrases fat-free mass and strength in untrained young women. *Journal of American Diet Association, 98(4)*, 414-418.

Craig, B.W., Hammons, G.T., Garthhwaite, S.M., Jarett, L., & Holloszy, J.O. (1981). Adaptation of fat cells to exercise: response of glucose uptake and oxidation to insulin. *Journal of Applied Physiology, 51*, 1500-1506.

Craig, B.W., Everhart, J., & Brown, R. (1989). The influence of high-resistance training on glucose tolerance in young and elderly subjects. *Mechanisms of Ageing and Development, 49*, 147-157.

Daniel, P.M., Love, E.R., & Pratt, O.E. (1975). Insulin-stimulated entry of glucose into muscle in vivo as a major factor in the regulation of blood glucose. *Journal of Physiology (Lond), 247*, 273-288.

Davidson, P.C., Shane, S.R., & Albrink, M.J. (1966). Decrease glucose tolerance following a physical conditioning program. *Circulation, 33(7)*.

Davis, J.A. (1985). Anaerobic threshold: Review of the concept and directions for future research. *Medicine and Science in Sports and Exercise, 17*, 6-18.

DeFronzo, R.A., Ferrannini, E., Sato, Y., Felig, P., & Wahren, J. (1981). Synergistic interaction between exercise and insulin on peripheral glucose uptake. *Journal of Clinical Investigation, 68*, 1468-1474.

DeFronzo, R.A., Tobin, J.D., & Andres, R. (1979). Glucose clamp technique: a method for quantifying insulin secretion and resistance. *American Journal of Physiology, 237(3)*, E214-E223.

DeFronzo, R.A., Jacot, E., Jequier, E., Maeder, E., Wahren. J., & Felber, J.P. (1981). The effect of insulin on the disposal of intravenous glucose. Results from indirect calorimetry and hepatic and femoral venous catheterization. *Diabetes, 30*, 1000-1007.

DeFronzo, R.A., Sherwin, R.S., & Kraemer, N. (1987). Effect of physical training on insulin action in obesity. *Diabetes, 36*, 1379-1385.

Dela, F., Mikines, K.J., Von-Linstow, M., Secher, N.H., & Galbo, H. (1992). Effect of training on insulin-mediated glucose uptake in human muscle. *American Journal of Physiology, 263*, E1134-E1143.

Dela, F., Ploug, T., Handberg, A., Petersen, L.N., Larsen, J.J., Mikines, K.J., & Galbo, H. (1994). Physical training increases muscle GLUT-4 protein and mRNA in patients with NIDDM. *Diabetes, 43*, 862-865.

Dela, F., Larsen, J.J., Mikines, K.J., Ploug, T., Petersen, L.N., & Galbo, H. (1995). Insulin-stimulated muscle glucose clearance in patients with NIDDM. Effects of one-legged physical training. *Diabetes, 44*, 1010-1020.

Desbuquois, B, & Aurbach, G. (1971). Use of polyethylene glycol to separate free and antibody-bound peptide hormones in radioimmunoassay. *Journal of Clinical Endocrinology Metabolism, 33*, 732-738.

Despres, JP, Pouliot, MC., Poorjani, S., Nadeau, A., Tremblay, A., Lupien, P.J., Theriault, G., & Bouchard, C. (1991). Loss of abdominal fat and metabolic response to exercise training in obese women. *American Journal of Physiology, 261*, E159-E167.

Despres, JP. (1997). Visceral obesity, insulin resistance, and dyslipidemia: contribution of endurance exercise

training to the treatment of the plurimetabolic syndrome. *Exercise and Sports Science References, 25*, 271-300.

Devlin, J.T., Hirshman, M., Horton, E.D., & Horton E.S. (1987). Enhanced peripheral and splanchnic insulin sensitivity in NIDDM men after single bout of exercise. *Diabetes, 36*, 434-439.

Ebeling, P., Bourey, R., Koranyi, L., Tuominen, J. A., Groop, L.C., Henriksson, J., Mueckler, M., Sovjarvi, A., & Koivisto, V.A. (1993). Mechanism of enhanced insulin sensitivity in athletes. *Journal of Clinical Investigation, 92*, 1623-1631.

Endre, T., Mattiasson, I., & Hulthen, L. (1994). Insulin resistance is coupled to low physical fitness in normotensive men with a family history of hypertension. *Journal of Hypertension, 12*, 81-88.

Eriksson, J., Tuominen, J., Valle, T., Sundberg, S., Sovijarvi, A., Lindholm, H., Tuomilehto, J., & Koivisto, V. (1998). Aerobic endurance exercise or circuit-type resistance training for individuals with impaired glucose tolerance? *Hormonal Metabolic Research, 30*, 37-41.

Etgen, G.J., Jensen, J., Wilson, C.M., Hunt, D.G., Cushman, S.W., & Ivy, J.L. (1997). Exercise training reverses insulin resistance in muscle by enhanced recruitment of GLUT-4 to the cell surface. *American Journal of Physiology, 272*, E864-E869.

Fluckey, J.D., Hickey, M.S., & Brambrink, L.K. (1994). Effects of resistance exercise on glucose tolerance in normal and glucose-intolerance subjects. *Journal of Applied Physiology, 77*, 1087-1092.

Gavigan, K.E., Hickey, M.S., McCammon, M.R., Israel, R.G., Hortobagyi, T., & Houmard, J.A. (1995). Effect of acute exercise training on glucose tolerance in sedentary obese males. *Medicine and Science in Sports and Exercise, 27 (Suppl)*, S212.

Goodyear, L.J., Hirshman, M.F., King, P.A., Horron, E.D., Thompson, C.M., & Horton, E.S. (1990). Skeletal muscle plasma membrane glucose transport and glucose transport after exercise. *Journal of Clinical Investigation, 68*, 193-198.

Goodyear, L.J., King, P.A., Hirshman, M.F., Thompson, C.M., Horton, E.D., & Horton, E.S. (1990). Contractile activity increases plasma membrane glucose transporters in absence of insulin. *American Journal of Physiology, 258*, E667-E672.

Goodyear, L.J., Hirshman, M.F., Smith, R.J., & Horton, E.S. (1991). Glucose transporters number, activity, and isoform content in plasma membranes of red and white skeletal muscle. *American Journal of Physiology, 261*, E556-E561.

Gottesman, L., Mandarino, L., & Gerich, J. (1983). Estimation and kinetic analysis of insulin-independent glucose uptake in human subjects. *American Journal of Physiology, 244*, E632-5.

Grimditch. G.K., Barnard, R.J., Kaplan, S.A., & Sternlight, E. (1986). Effect of training on insulin binding to rat skeletal muscle sarcolemmal vesicles. *American Journal of Physiology, 250*, E570-E575.

Groop, L.C., Bonadonna, R.C., DelPrato, S., Ratheiser, K., Zyck, K., Ferrannini, E., & DeFronzo, R.A. (1989). Glucose and free fatty acid metabolism in non-insulin-dependent diabetes mellitus. Evidence for multiple sites of insulin

resistance. *Journal of Clinical Investigation*, *84*, 205-213.

Gulve, E.A., & Spina, R.J. (1995). Effect of 7-10 days of cycle ergometer exercise on skeletal muscle GLUT-4 protein content. *Journal of Applied Physiology, 79*, 1562-1566.

Hansen, R.A., Nolte, L.A., Chen, M.M., & Holloszy, J.O. (1998). Increased GLUT-4 translocation mediates enhanced insulin sensitivity of muscle glucose transport after exercise. *Journal of Applied Physiology, 85(4),* 1218-1222.

Hardin, D.S., Azzarelli, B., Edwards, J., Wigglesworth, J., Maianu, L., Brechtel, G., Johnson, A., Baron, A., & Garvey, W.T. (1995). Mechanisms of enhanced insulin sensitivity in endurance-trained athletes: effects on blood flow and differential expression of GLUT-4 in skeletal muscles. *Journal of Endocrinology Metabolism, 80*, 2437-2446.

Hargreaves, M., Kiens, B., & Richter, E.A. (1991). Effects of increased plasma free fatty acid concentrations on muscle metabolism in exercising men. *Journal of Applied Physiology, 70*, 194-201.

Heath, G.W., Gavin, J.R., Hinderliter, J.M., Hagberg, J.M., Bloomfield, S.A., & Holloszy, J.O (1983). Effects of exercise and lack of exercise on glucose tolerance and insulin sensitivity. *Journal of Applied Physiology, 55,* 512-517.

Helmrich, S.P., Ragland, D.R., Leung, R.W., & Paffenbarger, R.S. (1991). Physical activity and reduced occurrence on non-insulin-dependent diabetes mellitus. *N England Journal of Medicine, 325,* 147-152.

Hepple, R.T., Mackinnon, S.L., Goodman, J.M., Thomas, S.G., Plyley, M.J. (1997). Resistance and aerobic training in older men: effects on VO2 peak and the capillary supply to skeletal muscle. *Journal of Applied Physiology, 82(4),* 1305-1310.

Hickey, M.S., Gavigan, K.E., McCammon, M.R., Tyndall, G.L., Pories, W.J., Israel, R.G., & Houmard, J.A. (1999). Effects of 7 days of exercise training on insulin action in morbidly obese men. *Clinical Exercise Physiology, 1(1),* 24-28.

Hickson, R., Rosenkoetter, M., & Brown, M. (1989). Strength training effects on aerobic power and short-term endurance. *Medicine and Science in Sports and Exercise, 12,* 336-339.

Hirshman, M.F., Warzdala, L.J., Goodyear, L.J., Fuller, S.P., Horton, E.D., & Horton, E.S. (1989). Exercise training increases the number of glucose transporters in rat adipose cells. *American Journal of Physiology, 257*, E520-E530.

Holloszy, J.O., & Booth, F.W. (1976). Biochemical adaptations to endurance exercise in muscle. *Annual Reviews of Physiology*, *38*, 273-291.

Holloszy, J.O., & Coyle, E.F. (1984). Adaptations of skeletal muscle to endurance exercise and their metabolic consequences. *Journal of Applied Physiology, 56*, 831-838.

Holloszy, J.O., Schultz, J., Kusnierkiewicz, J., Hagberg, J.M., & Ehsani, A.A (1986). Effects of exercise on glucose tolerance and insulin resistance. *Acta Medicine Scandinavia Supplement*, *711*, 55-65.

Holmang, A., Bjorntorp, P., & Rippe, B. (1992). Tissue uptake of insulin and insulin in red and white skeletal muscle

in vivo. *American Journal of Physiology, 263*, H1170-H1176.

Houmard, J.A., Egan, P.C., Neufer, P.D., Friedman, J.E., Wheeler, W.S., Israel, R.G., & Dohm, G.L. (1991). Elevated skeletal glucose transporter levels in exercise-trained middle aged men. *American Journal of Physiology, 261*, E437-E443.

Houmard, J.A., Hortobagyi, T., Neufer, P.D., Johns, R.A., Fraser, D.D., Israel, R.G., & Dohm, G.L. (1993). Training cessation does not alter GLUT-4 protein levels in human skeletal muscle. *Journal of Applied Physiology, 74*, 776-781.

Houmard, J.A., Shinebarger, M.H., Dolan, P; L., Leggett Frazier, N., Bruner, R.K., McCammon, M.R., Israel, R.G., & Dohm, G.L (1993). Exercise training increases GLUT-4 protein concentration in previously sedentary middle-aged men. *American Journal of Physiology, 264*, E896-E901.

Houmard, J.A., Hickey, M.S., Tyndall, G.L., Gavigan, K.E., & Lynis Dohm, G. (1995). Seven days of exercise increase GLUT-4 protein content in human skeletal muscle. *Journal of Applied Physiology, 79(6),* 1936-1938.

Hughes, V.A., Fiatarone, M.A., Fielding, R.A., Kahn, B.B., Ferrara, C.M., Shepherd, P., Fisher, E.C., Wolfe, R.R., Elahi, D., & Evans, W.J. (1993). Exercise increases muscle GLUT-4 levels and insulin action in subjects with impaired glucose tolerance. *American Journal of Physiology, 264*, E855-862.

Ivy, J.L., Brozinick, J.T., Torgan, C.E., & Kastello, G.M. (1989). Skeletal muscle glucose transport in obese Zucker rats after exercise training. *Journal of Applied Physiology, 66*, 2635-2641.

Ivy, J.L., & Kuo, CH. (1998). Regulation of GLUT4 protein and glycogen synthase during muscle glycogen synthesis after exercise. *Acta Physiology Scandinavia, 162*, 295-304.

James, D.E., Kraegen, E.W., & Chisholm, D.J. (1984). Effect of exercise training on whole-body insulin sensitivity and responsiveness. *Journal of Applied Physiology, 56*, 1217-1222.

Kahn, C.R. (1978). Insulin resistance, insulin insensitivity, and insulin unresponsiveness: a necessary distinction. *Metabolism 27,* 1893-1902.

Kang, J., Goss, F.L., Robertson, R.J., DaSilva, S.G., Hagberg, J.M., Suminski, R.R., Kelley, D.E., & Utter, A.C. (1996). Effect of exercise intensity on glucose and insulin metabolism in obese individuals and obese NIDDM patients. *Diabetes Care, 19*, 341-349.

Karam, J.H., Grasso, S.G., Wegienka, L.C., Grodsky, G.M., & Forsham, P.H. (1966). Effect of selected hexoses, of epinephrine and of glucagon on insulin secretion in man. *Diabetes 15*, 571.

King, D.S., Dalsky, G.P., Staten, M.A., Clutter, W.E., Van Houton, D.R., & Holloszy,J.O. (1987). Insulin action and secretion in endurance-trained and untrained humans. *Journal of Applied Physiology, 63*, 2247-2252.

King, D.S., Dalsky, G.P., Clutter, W.E., Young, D.A., Staten, M.A., Cryer, P.E., & Holloszy, J.O. (1988). Effects of exercise and lack of exercise on insulin sensitivity and responsiveness. *Journal of Applied Physiology, 64*, 1942-1946.

Klein, S., Coyle, E.F., & Wolfe, R.R. (1994). Fat metabolism during low-intensity exercise in endurance trained and untrained men. *American Journal of Physiology, 267*, E934-E940.

Klip, A., & Paquet, M.R. (1990). Glucose

transport and glucose transporters in muscle and their metabolic regulation. *Diabetes Care, 13(3),* 228-243.

Kochan, R.G., Lamb, D.R., Lutz, S.A., Perrill, C.V., Reimann, E.M., & Schlender, K.K. (1979). Glycogen synthase activation in human skeletal muscle: effects of diet and exercise. *American Journal of Physiology, 236*, E660-E666.

Kohrt, W.M., Kirwan, J.P., Staten, M.A., Bourey, R.E., King, D.S., & Holloszy, J.O. (1993). Insulin resistance in aging is related to abdominal obesity. *Diabetes, 42*, 273-281.

Krotkiewski, M., & Bjorntorp, P. (1986). Muscle tissue in obesity with different distribution of adipose tissue. Effects of physical training. *International Journal of Obesity, 10*, 331-341.

Lampman, R.M., Santinga, J.T., Savage, P.J., Bassett, D.R., Hydrick, C.R., Flora, J.D., & Block, W.D. (1985). Effect of exercise training on glucose tolerance, in vivo insulin sensitivity, lipid and lipoprotein concentration in middle-aged men with mild hypertriglyceridemia. *Metabolism of Clinical Experiments, 34,* 205-211.

Lavoie, J.M., Bongbele, J., Cardin, S., Belisle, M., Terrettaz, J., & Van de Werve, G. (1993). Increased insulin suppression of plasma free fatty acid concentration in exercise-trained rats. *Journal of Applied Physiology, 74*, 293-296.

LeBlance, J., Nadeau, A., & Boulay, M. (1979). Effects of physical training and adiposity on glucose metabolism and ^{125}I-insulin binding. *Journal of Applied Physiology, 46*, 235-239.

Lillioja, S., Young, A.A., Cutler, C.L., Ivy, I.L., Abbrt, W.H.G., Zawadzki, J.K., Yki-Jarvinen H., Christin, L., Secomb, T.W., & Bogardus, C. (1987). Skeletal muscle capillary density and fiber type are possible determinants of in vivo insulin sensitivity. *Journal of Clinical Investigation, 80*, 415-424.

Lohman, D., Liebold, F., Heilmann, W., Stenger, J., & Pohl, J. (1978). Diminished insulin response in highly trained athletes. *Metabolism of Clinical Experiments, 27*, 521-524.

MacDougall, J.D., Ward, G.R., Sale, D.G., & Sutton, J.R. (1977). Biochemical adaptation of human skeletal muscle to heavy resistance training and immobilization. *Journal of Applied Physiology, 43*, 700-703.

MacDougal, J.D., Wenger, H.A., & Green, H.J. (1991). *Physiological Testing of the High-Performance Athletes*. United States of America: Human Kinetics.

Maehlum, S., Felig, P., & Wahren, J. (1978). Splanchnic glucose and muscle glycogen metabolism after glucose feeding during postexercise recovery. *American Journal of Physiology, 235*, E255-E260.

Marin, P., Andersson, B., Krotkiewski, M., & Bjorntorp, P. (1994). Muscle fiber composition and capillary density in women and men with NIDDM. *Diabetes Care, 17,* 382-386.

Mathews, D., & Fox, E. (1976). *The Physiological basis of Physical Education and Athletics*. Saunders, W.B., Co., Toronto.

Mauriege, P., PrudóHomme, D., Marcotte, M., Yoshioka, M., Tremblay, A., Despres, J.P. (1997). Regional differences in adipose tissue metabolism between sedentary and endurance-trained women. *American Journal of Physiology, 273*, E497-E506.

Mikines, K.J., Sonne, B., Farrell, P.A., Tronier, B., & Galbo, H. (1988). Effect of physical exercise on sensitivity and

responsiveness to insulin in humans. *American Journal of Physiology, 254*, E248-E259.

Mikines, K.J., Sonne, B., Tronier, B., & Galbo, H. (1989). Effects of acute exercise and detraining on insulin action in trained men. *Journal of Applied Physiology, 66(2),* 704-711.

Mikines, K.J., Sonne, B., Farrell, P.A., Tronier, B., & Galbo, H. (1989). Effect of training on the dose-response relationship for insulin action in men. *Journal of Applied Physiology, 66,* 695-703.

Mikines, K.J., Sonne, B., Tronier, B., & Galbo, H. (1989). Effects of training and detraining on dose-response relationship between glucose and insulin secretion. *American Journal of Physiology, 256*, E588-E596.

Miller, W.J., Sherman, W.M., & Ivy, J.L. (1984). Effect of strength training on glucose tolerance and post-glucose insulin response. *Medicine and Science in Sports and Exercise, 16(6),* 539-543.

Miller, J.P., Pratley, R.E., Goldberg, A.P., Gordon, P., Rubin, M., Treuth, M.S., Ryan, A.S., & Hurley, B.F. (1994). Strength training increases insulin action in healthy 50-to 65-yr-old men. *Journal of Applied Physiology, 77(3),* 1122-1127.

Mondon, C.E., Dolkas, C.B., & Reaven, G.M. (1980). Site of enhanced insulin sensitivity in exercise-trained rats at rest. *American Journal of Physiology, 239*, E169-E177.

Neufer, P.D., Shinebarger, M.H., & Dohm, G.L. (1992). Effect of training and detraining on skeletal muscle glucose transporter (GLUT-4) content in rats. *Canadian Journal of Physiology and Pharmacology, 70,* 1286-1290.

Oshida, Y., Yamanouchi, K., & Hayamizu, S. (1989). Long-term mild jogging increases insulin action despite no influence on body mass index or VO2 max. *Journal of Applied Physiology, 66*, 2206-2210.

Poehlman, E.T., Gardner, A.W., & Arciero, P.J. (1994). Effects of endurance training on total fat oxidation in elderly persons. *Journal of Applied Physiology, 76*, 2281-2287.

Prabhakaran, B., Dowling, E.A., Branch, J.D., Swain, D.P., & Leutholtz, B.C. (1999). Effects of 14 weeks of resistance training on lipid profile and body fat percentage in premenopausal women. *British Journal of Sports Medicine, 33(3),* 190-195.

Price, T.B., Perseghin, G., Duleba, A., Chen, W., Chase, J., Rothman, D.L., Shulman, R.G., & Shulman, G.I (1996). NMR studies of muscle glycogen synthesis in insulin-resistant offspring of parents with non-insulin-dependent diabetes mellitus immediately after glycogen-depleting exercise. *Proc National Academy Science USA, 93*, 5329-5334.

Radinowitz, D., & Zierler, k.l., (1962). Forearm metabolism in obesity and its response to intraarterial insulin. Characterization of insulin response and evidence for adaptive hyperinsulinism. *Journal of clinical investigation, 41*, 2173.

Ren, J.M., Marshall, B.A., Gulve, E.A., Gao, J., Johnson, D.W., Holloszy, J.O., & Mueckler, M. (1993). Evidence from transgenic mice that glucose transport is rate-limiting for glycogen deposition and glycolysis in skeletal muscle. *Journal of Biology and Chemistry, 268*, 16113-16115.

Richter, E.A., Ploug, T., & Galbo, H. (1985). Increased muscle glucose uptake after exercise. No need for

insulin during exercise. *Diabetes, 34*, 1041-1048.

Richter, E.A.,Mikines, K.J., Galbo, H., & Kiens, B. (1989). Effect of exercise on insulin action in human skeletal muscle. *Journal of Applied Physiology, 66*, 876-885.

Rodnick, K.J., Haskell, W.L., Swislocki, A., Foley, J.E., & Reaven, G.M. (1987). Improved insulin action in muscle, liver, and adipose tissue in physically trained human subjects. *American Journal of Physiology, 253*, E489-E495.

Rogers, M.A., Yamamoto, C., King, D.S., Hagberg, J.M., Eshani, A.A., & Holloszy, J.O. (1988). Improvements in glucose tolerance after 1 week of exercise in patients with mild NIDDM. *Diabetes Care, 11*, 613-618.

Rosenthal, M., Haskell, W.L., Solomon, R., Widstrom, A., & Reaven, G.M. (1983). Demonstration of a relationship between level of physical training and insulin-stimulated glucose utilization in normal humans. *Diabetes, 32*, 408-411.

Roy, D., & Marette, A. (1996). Exercise induces the translocation of GLUT4 to transverse tubules from an intracellular pool in rat skeletal muscle. *Biochemistry and Biophysics Research Community, 223*, 147-152.

Saloranta, C., Koivisto, V., Widen, E., Falholt, K., DeFronzo, R.A., Harkonen, M., & Groop, L. (1993). Contribution of muscle and liver to glucose-fatty acid in humans. *American Journal of Physiology, 264*, E599-E605.

Saltin, B., Lingarde, F., Houston, M., Horlin, R., Nygaard, E., & Gad, P. (1979). Physical training and glucose tolerance in middle-aged men with chemical diabetes. *Diabetes, 28*, *(Suppl.1)*, 30-32.

Saltin, B., & Strange, S. (1992). Maximal oxygen uptake: ñoldò and ñnewò arguments for a cardiovascular limitation. *Medicine and Science in Sports and Exercise, 24(1)*, 30-37.

Schwartz, R. S., Shuman, W.P., Larson, V., Cain, K.C., Fellingham, G.W., Beard, J.C., Kahan, S.E., Stratton, J.R., Cerqueira, M.D., & Abrass, I.B. (1991). The effect of intensive endurance exercise training on body fat distribution in young and older men. *Metabolism, 40(5)*, 545-551.

Seltzer, H.S., Allen, W., Herron, A. L., & Brennan, M.T.(1967). Insulin secretion in response to glycemic stimulus: Relation of delayed initial release to carbohydrate intolerance in mild diabetes mellitus. *Journal of Clinical Investigation, 46(3)*, 323-335.

Shepherd, P.R., & Kahn, B.B. (1999). Glucose transporters and insulin action. Implication for insulin resistance and diabetes mellitus. *The New England Journal of Medicine, 341(4)*, 248-257.

Simoneau, J.A., & Kelley, D.E. (1997). Altered glycolytic and oxidative capacities of skeletal muscle contribute to insulin resistance in NIDDM. *Journal of Applied Physiology, 83*, 166-171.

Soman, V.R., Koivisto, V.A., Deipert, D., Felig, P., & DeFronzo, R.A. (1979). Increased insulin sensitivity and insulin binding to monocytes after physical training. *N. England Journal of Medicine, 301*, 1200-1204.

Stone, M.H., Fleck, S.T., Triplett, N.T., & Kraemer, W.J. (1991). Health-and performance-related potential of resistance training. *Sports Medicine, 11(4)*, 210-231.

Stryer, L. (1997). ***ძɘɛɢɖɛ ŮɑŬ***. ɄŬɜŮ ɘů Ű́ɖɛ ɘŬɘɏɠ Ⱥəŭɧů Ůɕɠ Ƭ ɟ ɐŰ́ɖɠ.

Suda, K., Izawa, T., Komabayashi, T., Tsuboi, M., & Era, S. (1993). Effect of insulin on adipocyte lipolysis in exercise-trained rats. *Journal of Applied Physiology, 74*, 2935-2939.

Taskinen, M.R., Bogardus, C., Kennedy, A., & Howard, B.V. (1985). Multiple disturbances of free fatty acid metabolism in noninsulin-dependent diabetes. Effect of oral hypoglycemic therapy. *Journal of Clinical Investigation, 76*, 637-644.

Tesch, P.A., Colliander, E.B., & Kaiser, P. (1986). Muscle metabolism during intense, heavy resistance exercise. *European Journal of Applied Physiology and Occupation Physiology, 55*, 362-366.

Tesch, P. (1988). Skeletal muscle adaptations to long-term heavy resistance exercise. *Medicine and Science in Sports and Exercise, 20 (Suppl. 5)*, S132-134.

Tonino, R.P. (1989). Effect of physical training on the insulin resistance of aging. *American Journal of Physiology, 256*, E352-E356.

Tremblay, A., Coveney, S., & Despres, JM. (1992). Increased resting metabolic rate and lipid oxidation in exercise-trained individuals: evidence for a role of beta-adrenergic stimulation. *Canadian Journal of Physiology and Pharmacology, 70*, 1342-1347.

Treuth, M., Hunter, G., Kekes-Szabo, T., Weinsier, R., Goran, M., & Berland L. (1995). Reduction in intra-abdominal adipose tissue after strength training in older women. *Journal of Applied Physiology, 78(4)*, 1425-1431.

Treuth, M., Ryan, A., Pratley, R., Rubin, M., Miller, J., Nicklas, B., Sorkin, J., Harman, S., Goldberg, A., & Hurley, B. (1994). Effects of strength training on total and regional body composition in older men. *Journal of Applied Physiology, 77(2)*, 614-620.

Trinder, P. (1969). *Annual Clinical Biochemistry, 6*, 24.

Van Etten, L.M., Verstappen F.T., & Westerterp, K.R. (1994). Effect of body build on weight-training-induced adaptations in body composition and muscular strength. *Medicine and Science in Sports and Exercise, 26(4)*, 515-521.

Vestergaard, H., Andersen, P.H., Lund, S., Schmitz, O., Junker, S., & Pedersen, O. (1994). Pre-and posttranslational upregulation of muscle-specific glycogen synthase in athletes. *American Journal of Physiology, 266*, E92-E101.

Vinten, J., & Galbo, H. (1983). Effect of physical training on transport and metabolism of glucose in adipocytes. *American Journal of Physiology, 244*, E129-134.

Vukovich, M.D., Arciero, P.J., Kohrt, W.M., Racette, S.B., Hansen, P.A., & Holloszy, J.O (1996). Changes in insulin action and GLUT-4 with 6 days of inactivity in endurance runners. *Journal of Applied Physiology, 80*, 240-244.

Wallberg Henriksson, H., Constable, S.H., Young, D.A., & Holloszy, J.O. (1988). Glucose transport into rat skeletal muscle: interaction between exercise and insulin. *Journal of Applied Physiology, 65*, 909-913.

Wardzala, L.J., Crettaz, M., Horton, E.D., Jeanrenaud, B., & Horton E.S. (1982). Physical training of lean and obese Zucker rats: effect on fat cell metabolism. *American Journal of Physiology, 243*, E418-426.

Wilmore J.H., & Costill, D.L. (1994). *Physiology of Sport and Exercise.* United States of America: Human Kinetics

Yki-Jarvinen, H., & Koivisto, V.A. (1983). Effects of body composition on insulin sensitivity. *Diabetes, 32*, 965-969.

Young, D.A., Wallberg, Henriksson, H., Sleeper, M.D., & Holloszy, J.O. (1987). Reversal of the exercise-induced increase in muscle permeability to glucose. *American Journal of Physiology*, *253*, E331-335.

Young, J.C., Enslin,J., & Kuca, B. (1989). Exercise intensity and glucose tolerance in trained and nontrained subjects. *Journal of Applied Physiology*, *67*, 39-43.

8.1. ƟΛɋ ɇ ɃũȺɁ ȼ ɊȺɊɃɀ ȺɁȷ ɇ ɋ Ɂ Ɇɋ ɀ ȷ ɇ ȾȾ ɋ Ɂ ɉ ȷ Λȷ Ƭ ɇ ȼ ΛȾɆɇ ȾȾ ɋ Ɂ Ƭȷ ȽȾȾ ȷ ɁɃ ɇ ȼ ɇ ɋ Ɂ ɇ ɋ Ɂ
ɊɃȾȽɀ ȷ ȻɃɀ ȺɁɋ Ɂ (ȼ ȿ ȾȾȽȷ , Ɇɋ ɀ ȷ ɇ ȾȾ ȼ ɆɈ Ɇɇ ȷ Ɇȼ , ȺΛũɃɀ Ⱥɇ Λȼ ɆȺȾɆ)

ɊɞəɁɜɕ	ɇ əəɑŬ (ɣŰɖ)	Ɇɤ ɛ . ɗƳɉ ɞɠ (kg)	ȷ ɜƳůŰɖɛŬ (cm)	ȷ Ɇɀ (g)	Ɇɤ ɛ . ȿά ɞɠ (g)	ɃůŰɣ (g)	PVO2 (L)	ȷ ȷ Ƭ (L)	PP (W)	MP (W)	ɊȾ (%)	ɆũɃ (mmol/L)
ȷ ɁɇɃɉ ɇ Ɇ	26	61,52	178	55170	3128	3221	4410	3200	681,5	542,2	37,07	14,13
ȷ ɁɇɃɉ ɇ Ɇ	27	60,6	170	52580	4724	3297	4577	3220	732,6	524,2	40,66	13,97
ȷ ɁɇɃɉ ɇ Ɇ	22	58,3	170	51429	4017	2855	4572	3900	665	522,2	35,25	13,98
ȷ ɁɇɃɉ ɇ Ɇ	21	56,67	166	50534	3207	2928	4489	3400	624,9	496,6	36,92	14,73
ȷ ɁɇɃɉ ɇ Ɇ	25	60,99	172	49183	8694	3111	4477	3900	677,9	467,4	44,42	11,12
ȷ ɁɇɃɉ ɇ Ɇ	29	64,13	174	57815	3400	2912	4403	3900	668,3	490,8	41,09	10,92
ȷ ɁɇɃɉ ɇ Ɇ	21	63,03	170	55951	3971	3108	4263	3257	776,2	599,3	39,33	16,53
ȷ ɁɇɃɉ ɇ Ɇ	21	61,78	169	50698	7988	3097	4089	3300	728	540,7	46,85	16,62
ɇȷ ɉ Ɉɇɇ ɇȷ Ɇ	22	82,65	181	71692	6597	4365	4093	3000	1076,2	786,7	49,74	17,56
ɇȷ ɉ Ɉɇɇ ɇȷ Ɇ	24	76,86	178	67121	6017	3721	3974	2750	1093	725,6	54,68	19,58
ɇȷ ɉ Ɉɇɇ ɇȷ Ɇ	23	74,03	181	65027	5163	3835	3700	2882	955,6	641,6	51,45	17,4
ɇȷ ɉ Ɉɇɇ ɇȷ Ɇ	25	83,11	180	72357	6284	4468	4482	2900	1069,8	744,6	53,56	19,58
ɇȷ ɉ Ɉɇɇ ɇȷ Ɇ	22	78,66	178	68897	6072	3689	3546	2306	1048	731,8	55,44	16,8
ɇȷ ɉ Ɉɇɇ ɇȷ Ɇ	23	65,93	168	58027	4596	3308	3512	2500	883	627,2	51,43	14,01
ɇȷ ɉ Ɉɇɇ ɇȷ Ɇ	24	80,93	185	71779	4898	4254	4283	2620	1137	739,5	61,26	21,78
ɇȷ ɉ Ɉɇɇ ɇȷ Ɇ	27	88,99	187	75014	9602	4378	4598	3100	1293,5	800,1	63,1	20
ȺȿȺũɉ ɃɈ	23	71,36	178	56145	11595	3615	3334	1800	928,8	593,2	58,17	19,28
ȺȿȺũɉ ɃɈ	23	65,91	166	54975	7626	3305	3426	1850	698,9	547,2	40,56	15,78
ȺȿȺũɉ ɃɈ	22	89,09	180	67006	17829	4257	4347	2759	1073	680,3	63,28	17,75
ȺȿȺũɉ ɃɈ	23	69,71	175	49216	17444	3051	3039	1630	755,8	507,7	53,43	17,4
ȺȿȺũɉ ɃɈ	25	70,09	167	51736	15037	3315	2839	2050	854,5	506,9	60,05	20,52
ȺȿȺũɉ ɃɈ	22	70,15	179	54219	12409	3518	3465	1993	952,7	592,4	55,09	19,18
ȺȿȺũɉ ɃɈ	23	88,38	184	54347	30424	3611	2867	1740	930,3	554,7	62,35	16,14

ȷ Ɇʐ = ȯ ɘɚ́ ɗ Ɇɤ ɛ Ǔǘɐ ʐ ŸɛǓ, PVO2 = Ⱦɕɟ ɡűǓɗǓ´ ɟ ђůəɗɣ ɗ ɕɜɡɔђɜɕɡ, ȷ ȷ Ⱦ = ȷ ɜǓǰ ђɓɐ ȷ ɜǓ ɜǔůǘɐђ ȾǓǘ űəɘ, PP = Ⱦɕɟ ɡűǓɗǓ´ Ǔɟ Ǔɓђɛ Ǔɜɗ ɛ ɗɕǓɜɐɐ ɘůɕɨ (0-3ɷ), MP = ʐ ɏůɗ ´ Ǔɟ Ǔɓђɛ Ǔɜɗ ɛ ɗɕǓɜɐɐ ɘůɕɨ (0-30ɷ), ɋȾ = ɋǓɐǗɗɠ əђ´ ɤ ůɗɠ, ɆũɃ = Ɇɡɔəɏɜǖ ɤ ůɗ ɔǓɚǓɐǘɕɨ ɕɜɏɕɠ.

8.2. ɄɅɋ ɇ Ƀ ũȺʔ ¢ ɋȺɋɃʐ Ⱥʔ ȷ ɇ ɋ ʔ ɄɅɃɆɋȾɃ ɅȽȻɃʐ Ⱥʔ ɋ ʔ ɇ Ƚʐ ɋ ʔ ũʂ ɈȾɃȻ¢ Ɇ Ⱦ ȷ ȽȽʔ ɆɃɈ ʂ Ƚʔ ¢ Ɇ

ɋɜə/ɜɕɕ	ũ/əђɕɗ 0h	ũ/əђɕɗ 0,5h	ũ/əђɕɗ 1h	ũ/əђɕɗ 1,5h	ũ/əђɕɗ 2h	ɫɜ/əɷɗ 0h	ɫɜ/əɷɗ 0,5h	ɫɜ/əɷɗ 1h	ɫɜ/əɷɗ 1,5h	ɫɜ/əɷɗ 2h
ȷ ʔɇɃɉ ȼ Ɇ	4,7175	5,994	5,0505	5,1615	3,6075	3	22	20	6,4	14
ȷ ʔɇɃɉ ȼ Ɇ	4,995	7,7145	5,9385	4,8285	4,4955	4,5	70	33	17	9,7
ȷ ʔɇɃɉ ȼ Ɇ	4,1625	6,6045	5,0505	4,995	4,662	2,6	76	17	16	10,8
ȷ ʔɇɃɉ ȼ Ɇ	4,44	8,88	8,2695	5,994	5,55	3,7	55	54	78	46
ȷ ʔɇɃɉ ȼ Ɇ	4,884	6,327	5,8275	5,1615	5,4945	3,5	49	40	21	24,5
ȷ ʔɇɃɉ ȼ Ɇ	4,8285	7,6035	7,2705	6,993	7,0485	4,4	20	27	18,6	24,5
ȷ ʔɇɃɉ ȼ Ɇ	5,0505	6,4935	4,9395	5,2725	4,3845	5,5	50	26	30	9,4
ȷ ʔɇɃɉ ȼ Ɇ	4,995	5,883	5,0505	4,884	4,0515	5,4	52	38	30	21
ɇȷ ɉ Ɉɇȼɇȷ Ɇ	4,9395	7,8255	4,218	5,4945	3,774	5,2	49	26	32	6,6
ɇȷ ɉ Ɉɇȼɇȷ Ɇ	5,0505	6,3825	4,2735	5,1615	3,9405	7,7	99	20	38	12,7
ɇȷ ɉ Ɉɇȼɇȷ Ɇ	4,6065	6,7155	4,8285	4,551	2,775	5,2	70	52	34,4	6,9
ɇȷ ɉ Ɉɇȼɇȷ Ɇ	4,551	4,8285	4,44	3,9405	3,8295	28	48	22	9	6
ɇȷ ɉ Ɉɇȼɇȷ Ɇ	4,8285	8,8245	7,992	5,7165	4,8285	4,6	36	48	25	19,6
ɇȷ ɉ Ɉɇȼɇȷ Ɇ	4,551	6,4935	4,6065	3,552	4,4955	3,3	24	14	10,8	11
ɇȷ ɉ Ɉɇȼɇȷ Ɇ	4,662	8,6025	6,66	,	1,776	5,2	31	68	,	6,5
ɇȷ ɉ Ɉɇȼɇȷ Ɇ	3,4965	6,327	4,44	5,55	4,3845	4,2	25	9,8	9,5	5,6
ȺʂȺũɉ ɃɈ	5,106	7,659	8,436	5,883	5,661	5,3	27	50	34	30
ȺʂȺũɉ ɃɈ	4,551	5,55	3,9405	4,107	4,0515	5	78	31	38	15
ȺʂȺũɉ ɃɈ	4,9395	8,4915	4,9395	3,774	4,8285	8,5	115	70	44	49
ȺʂȺũɉ ɃɈ	4,4955	7,9365	4,884	5,55	4,2735	10	220	70	63	34
ȺʂȺũɉ ɃɈ	5,1615	8,1585	7,881	7,3815	7,215	5,5	37,2	49	36	53
ȺʂȺũɉ ɃɈ	4,8285	5,439	4,329	4,7175	4,773	5,7	85	54	28	31
ȺʂȺũɉ ɃɈ	4,6065	6,882	4,107	4,1625	4,662	8	112	76	44	37

ũəɡəђɕɗ = mmol/L, Ƚɜůɕɡəɷɗ = mU/L

8.3. ɈɄɃʂ ɃũĿȻɃʐ ȺɁɹ Ⱥʐ ɗɉ ɋɉ -ɃʂɃȾʂ ȼ Λɋʐ ɹ ɇ ɹ ũʂ ɈȾɃȻȼ Ɇ

ɋɜə/ɜɞɛ	AUCG (0-2h)	area (0-0,5h)	area (0,5-2h)	area (0-2h)	aucg (0-0,5h)	aucg (0,5-2h)	daucg (0-0,5h)	daucg (0,5-2h)	ɋAUCG (0-2h)
ɹ ʔɇɃɟ ȼɆ	10,18	2,36	7,08	9,44	2,68	7,51	0,32	0,4301	0,75
ɹ ʔɇɃɟ ȼɆ	11,61	2,5	7,49	9,99	3,18	8,44	0,68	0,9435	1,62
ɹ ʔɇɃɟ ȼɆ	10,53	2,08	6,24	8,32	2,69	7,84	0,61	1,5956	2,21
ɹ ʔɇɃɟ ȼɆ	14,07	2,22	6,66	8,88	3,33	10,74	1,11	4,0793	5,19
ɹ ʔɇɃɟ ȼɆ	11,25	2,44	7,33	9,77	2,8	8,45	0,36	1,1239	1,48
ɹ ʔɇɃɟ ȼɆ	13,9	2,41	7,24	9,66	3,11	10,79	0,69	3,552	4,25
ɹ ʔɇɃɟ ȼɆ	10,71	2,53	7,58	10,1	2,89	7,83	0,36	0,2497	0,61
ɹ ʔɇɃɟ ȼɆ	10,17	2,5	7,49	9,99	2,72	7,45	0,22	0,0416	0,26
ɇɹ ɟ Ɉɇȼɇɹ Ɇ	10,95	2,47	7,41	9,88	3,19	7,76	0,72	0,3469	1,07
ɇɹ ɟ Ɉɇȼɇɹ Ɇ	10,16	2,53	7,58	10,1	2,86	7,3	0,33	0,2775	0,61
ɇɹ ɟ Ɉɇȼɇɹ Ɇ	9,89	2,3	6,91	9,21	2,83	7,06	0,53	0,1526	0,68
ɇɹ ɟ Ɉɇȼɇɹ Ɇ	8,7	2,28	6,83	9,1	2,34	6,35	0,07	0,4718	0,54
ɇɹ ɟ Ɉɇȼɇɹ Ɇ	13,68	2,41	7,24	9,66	3,41	10,27	1	3,0248	4,02
ɇɹ ɟ Ɉɇȼɇɹ Ɇ	9,59	2,28	6,83	9,1	2,76	6,83	0,49	0,01	0,5
ɇɹ ɟ Ɉɇȼɇɹ Ɇ	12,32	2,33	6,99	9,32	3,32	8,89	0,99	1,894	2,88
ɇɹ ɟ Ɉɇȼɇɹ Ɇ	10,13	1,75	5,24	6,99	2,46	7,67	0,71	2,4281	3,14
ȺʂȺũɟ ɃɈ	13,68	2,55	7,66	10,21	3,19	10,49	0,64	2,8305	3,47
ȺʂȺũɟ ɃɈ	8,95	2,28	6,83	9,1	2,53	6,42	0,25	0,4024	0,65
ȺʂȺũɟ ɃɈ	11,04	2,47	7,41	9,88	3,36	7,69	0,89	0,2775	1,17
ȺʂȺũɟ ɃɈ	11,38	2,25	6,74	8,99	3,11	8,27	0,86	1,5263	2,39
ȺʂȺũɟ ɃɈ	14,8	2,58	7,74	10,32	3,33	11,47	0,75	3,7324	4,48
ȺʂȺũɟ ɃɈ	9,64	2,41	7,24	9,66	2,57	7,08	0,15	0,1665	0,32
ȺʂȺũɟ ɃɈ	9,89	2,3	6,91	9,21	2,87	7,02	0,57	0,111	0,68

AUCG (mmol h ⁻¹) = Ƀəɧəədɹɞ ǘɞ ǚɛɓǓŭɦɜ ǘdʠůɞdɛǓǘɕɧɛǚɕdʠəǓɛ´ ɨ ədʠɔəɡəɧɕdʠ, ɋAUCG (mmol h ⁻¹) = Ƀəɧəədɹɞ ǘɞ ǚɛɓǓŭɦɜ, ɞɤ ɟɑʠǘɞ ǚɛɓǓŭɦɜ ǘdʠ ɜdůǘǘǓʠ, area (mmol h ⁻¹) = ǚɛɓǓŭɦɜ ǘɛɐɛǓǘɕʠɜdůǘǘǓʠ, aucg (mmol h ⁻¹) = ǚɛɓǓŭɦɜ ǘɛɐɛǓǘɕʠɛǚŸǘd əɐɣd ɔəɡəɧɕdʠ, daucg (mmol h ⁻¹) = ǚɛɓǓŭɦɜ ǘɛɐɛǓǘɕʠɛǚŸǘd əɐɣd ɔəɡəɧɕdʠɞɤ ɟɑʠǘɞ ǚɛɓǓŭɦɜ ǘɞɡ Ǔɜǘůǘɕɞɕɡ ǘɛɐɛǓǘɕʠɜdůǘǘǓʠ.

8.4. ɈɄɃʂ ɃũȽȻɃɀ ȺʔɈ Ⱥɀ ȸɈ ȹɈ -Ƀʂ ɃȾʂ ¢ Λɋɀ ɈɇɈ ȽʔɆɃɈʂ Ƚʔ¢ Ɇ

ȹɜɘ/ɜɞ	AUCI (0-2h)	area (0-0,5h)	area (0,5-2h)	area (0-2h)	auci (0-0,5h)	auci (0,5-2h)	dauci (0-0,5h)	dauci (0,5-2h)	ȹAUCI (0-2h)
ɭ ʔɇɃɟ ȼɆ	28,45	1,5	4,5	6	6,25	22,2	4,75	17,7	22,45
ɭ ʔɇɃɟ ȼɆ	63,55	2,25	6,75	9	18,63	44,93	16,38	38,17	54,55
ɭ ʔɇɃɟ ȼɆ	57,85	1,3	3,9	5,2	19,65	38,2	18,35	34,3	52,65
ɭ ʔɇɃɟ ȼɆ	105,93	1,85	5,55	7,4	14,68	91,25	12,83	85,7	98,53
ɭ ʔɇɃɟ ȼɆ	62	1,75	5,25	7	13,13	48,88	11,38	43,63	55
ɭ ʔɇɃɟ ȼɆ	40,03	2,2	6,6	8,8	6,1	33,92	3,9	27,32	31,22
ɭ ʔɇɃɟ ȼɆ	56,73	2,75	8,25	11	13,88	42,85	11,13	34,6	45,73
ɭ ʔɇɃɟ ȼɆ	66,6	2,7	8,1	10,8	14,35	52,25	11,65	44,15	55,8
ɇɭ ɟ Ɉɇȼɇɭ Ɇ	56,45	2,6	7,8	10,4	13,55	42,9	10,95	35,1	46,05
ɇɭ ɟ Ɉɇȼɇɭ Ɇ	83,6	3,85	11,55	15,4	26,68	56,93	22,83	45,38	68,2
ɇɭ ɟ Ɉɇȼɇɭ Ɇ	81,23	2,6	7,8	10,4	18,8	62,43	16,2	54,63	70,83
ɇɭ ɟ Ɉɇȼɇɭ Ɇ	48	14	42	56	19	29	5	13	18
ɇɭ ɟ Ɉɇȼɇɭ Ɇ	60,55	2,3	6,9	9,2	10,15	50,4	7,85	43,5	51,35
ɇɭ ɟ Ɉɇȼɇɭ Ɇ	27,98	1,65	4,95	6,6	6,83	21,15	5,18	16,2	21,38
ɇɭ ɟ Ɉɇȼɇɭ Ɇ	69,9	2,6	7,8	10,4	9,05	60,85	6,45	53,05	59,5
ɇɭ ɟ Ɉɇȼɇɭ Ɇ	24,6	2,1	6,3	8,4	7,3	17,3	5,2	11	16,2
ȺʂȺũɟ ɃɈ	64,33	2,65	7,95	10,6	8,07	56,25	5,42	48,3	53,72
ȺʂȺũɟ ɃɈ	78,5	2,5	7,5	10	20,75	57,75	18,25	50,25	68,5
ȺʂȺũɟ ɃɈ	128,88	4,25	12,75	17	30,88	98	26,63	85,25	111,88
ȺʂȺũɟ ɃɈ	187,5	5	15	20	57,5	130	52,5	115	167,5
ȺʂȺũɟ ɃɈ	75,72	2,75	8,25	11	10,68	65,05	7,93	56,8	64,72
ȺʂȺũɟ ɃɈ	92,68	2,85	8,55	11,4	22,68	70	19,83	61,45	81,28
ȺʂȺũɟ ɃɈ	127,25	4	12	16	30	97,25	26	85,25	111,25

AUCI (mU h $^{-1}$) = Ƀɘɧɘɘɖɟɕ Ǘɛ Ůɛɓ Ǔŭɧɜ Ǘɖʃ ůɕɖɛ ǓǗɕɧɛ Ǜɜɖʃɘ Ǔɛ´ ɨ ɘɖʃɞůɕɡɘɕɖʃ, ȹAUCI (mU h $^{-1}$) = Ƀɘɧɘɘɖɟɕ Ǘɛ Ůɛɓ Ǔŭɧɜ, ɢɤ ɟ ɑʃ Ǘɛ Ůɛɓ Ǔŭɧɜ Ǘɖʃɜɖů ǗǗɖǓʃ, area (mU h $^{-1}$) = Ůɛɓ Ǔŭɧɜ Ǘɛɐɛ ǓǗɛʃɜɖů ǗǗɖǓʃ, auci (mU h $^{-1}$) = Ůɛɓ Ǔŭɧɜ Ǘɛɐɛ ǓǗɛʃɛ ǗǗɏ Ǘɖ ɘɐɤ ɖ ɔɘɡɘɧɕɖʃ, dauci (mU h $^{-1}$) = Ůɛɓ Ǔŭɧɜ Ǘɛɐɛ ǓǗɛʃɛ ǗǗɏ Ǘɖ ɘɐɤ ɖ ɔɘɡɘɧɕɖʃ ɢɤ ɟ ɑʃ Ǘɛ Ůɛɓ Ǔŭɧɜ Ǘɛɡ ǓɜǗůǗɛɕɕɡ Ǘɛɐɛ ǓǗɛʃɜɖů ǗǗɖǓʃ.

8.5. ɀ Ⱥɇ ȷ ȡȻʂ ȽɆɀ ȻɆ ũʂ ɈȾȻȻȼ Ɇ (ɀ), Ɇɉ Ⱥɇ ȽȾ ȼ ɄȺɅȽū ȺɅȽȾ ȼ ȷ ʔ ɇ ȽɆɇ ȷ Ɇȼ (rel-R), ɀ ȺɆȼ ɄȻɆȻɇ ȼ ɇ ȷ Ƚʔ ɆȻɈ ʂ Ƚʔ ȼ Ɇ Ɇɇ Ȼ Ʉʂ ȷ Ɇɀ ȷ (mean-I), ɆɈ ʔ Ȼʂ ȽȾ ȼ ȷ ʔ ɇ ȽɆɇ ȷ Ɇȼ Ɇɇ ȼ ʔ Ƚʔ ɆȻɈ ʂ Ƚʔ ȼ (Tot-I-R), ȷ Ƚɀ ȷ ɇ ȻȾ Ʌɇ ȼ Ɇ Ⱦ ȷ Ƚ ȻũȾȻɆ Ʉʂ ȷ Ɇɀ ȷ ɇ ȻɆ

ɋɞə/ɜɕɕ	ɀ (mg min)	rel-R (min mg x 1000)	mean-I (mU)	Tot-I-R (mU mg.min)	ȷ ɶŬŰɞəɟ ɗŰɖɗ (%)	ȳ ɔəɕɗ´ əŸůɛŬŰɞɗ (L)
ȷ ʔɇȻɉ ȼɆ	644,46	1,55	36,75	0,06	40	2,58
ȷ ʔɇȻɉ ȼɆ	633,63	1,58	72,65	0,11	46,1	2,29
ȷ ʔɇȻɉ ȼɆ	616,7	1,62	68,23	0,11	42,2	2,36
ȷ ʔɇȻɉ ȼɆ	607,07	1,65	119,8	0,2	43	2,26
ȷ ʔɇȻɉ ȼɆ	614,39	1,63	75,04	0,12	43,3	2,42
ȷ ʔɇȻɉ ȼɆ	584,43	1,71	50,94	0,09	43,3	2,55
ȷ ʔɇȻɉ ȼɆ	636,96	1,57	68,45	0,11	45,3	2,41
ȷ ʔɇȻɉ ȼɆ	641,61	1,56	82,23	0,13	42,9	2,47
ɇȷ ɉ ɈɇȼɇȷɆ	652,45	1,53	93,41	0,14	42,8	3,31
ɇȷ ɉ ɈɇȼɇȷɆ	649,31	1,54	123,2	0,19	45,2	2,95
ɇȷ ɉ ɈɇȼɇȷɆ	663,64	1,51	112,8	0,17	46,4	2,78
ɇȷ ɉ ɈɇȼɇȷɆ	642,09	1,56	81,54	0,13	41,6	3,4
ɇȷ ɉ ɈɇȼɇȷɆ	625	1,6	98,18	0,16	41,1	3,24
ɇȷ ɉ ɈɇȼɇȷɆ	626,04	1,6	37,7	0,06	41,6	2,7
ɇȷ ɉ ɈɇȼɇȷɆ	691,57	1,45	102,2	0,15	48,4	2,92
ɇȷ ɉ ɈɇȼɇȷɆ	602,48	1,66	38,62	0,06	49,6	3,14
ȺʂȺũɉ ȻɈ	613,71	1,63	90,6	0,15	43,6	2,82
ȺʂȺũɉ ȻɈ	634,38	1,58	106,3	0,17	41,3	2,71
ȺʂȺũɉ ȻɈ	627,82	1,59	230,7	0,37	42,6	3,58
ȺʂȺũɉ ȻɈ	629,41	1,59	258	0,41	43,6	2,75
ȺʂȺũɉ ȻɈ	583,98	1,71	112,2	0,19	39,6	2,96
ȺʂȺũɉ ȻɈ	626,11	1,6	129,7	0,21	43	2,8
ȺʂȺũɉ ȻɈ	623,6	1,6	228,3	0,37	42	3,59

8.6. Ɉ ƟƁϛ Ɓ ũ ƗƎȼ ƎƮ ȺƎ ƟɅȷ ʔ ȺƗƎ

8.6.1. Ɉ ´ ϐǝϵɔϑůεђʃŰϐg ŮɛбŬŭϐɨ -ϐǝϵǝ ǝɖȷɩ εŬŰϐʃǝŬε´ ɨ ǝɖʃ

(ǝŬзђзŬʃŰϐg Ųȷ Ŭ ŮϐϐŮϑŭϐɨ ʃ)

Ɓ εŬɖɖεŬŰϑђʃŰɨ ´ ϐʃɔϑŬŰϐз g´ ϐǝϵɔϑůεђ Űϐg ϐǝϵǝǝɖȷɩ εŬŰϐʃεŮŰϐз ǝŬзђзŬŰϐg Ųȷ Ŭ ŮϐϐŮϑŭϐɨ ʃŮзŬʒ

$$(b,a)\ f(x)\ dx \sim \varphi x * [((f(0) + f(1))/2) + ((f(1) + f(2))/2) + é\ \ ((f(n-1) + f(n))/2)] \qquad (1)$$

ђ´ ϐg φx Űϐ εɐǝϐʃŰϐg g´ ϐǝϵɔϑђεŮзϐg ŭϑŬůŰɐεŬŰϐʃ = (b-a) / n,

[b ǝŬϑ a = ɖ εŮϑŬϑɨ ŰŲɖ ǝŬϑɖ εϑȷђŰŲɖ Űɐε ŬзŰůŰϐϑŬŰϐg Ÿзϐ зŬ x ´ ϐg ϐȷϑɖŮŰϐɨ з Űϐ Űɐ εŬ ŮϑŮϐ ´ ϐg ɖɏǝϵgεŮ зŬ g´ ϐǝϵɔůϐgεŬ, Ůзɩ n = ϐ Ŭȷϑɖεђʃ Űɤз Ů ϑεɏȷ ϐgʃ g´ ϐǝϵɔϑђεŮзɤз g´ ϐŭϑŬůŰɖεŸŰɤз-Űεɖ εŸŰɤз]

ǝŬϑ $f(0)$, $f(1)$,é $f(n)$ = ϐϑ Űɐɏʃ (ŰŬ ɨɣɖ) Űϐg Ÿзϐ зŬ y ´ ϐg Ųɏεзϐgз Űɖз ǝŬε´ ɨ ǝɖ ´ ϐg ůϐɖεŬŰϐεŮŰŬϑ ůŮ ůgзŸȷŰɖůɖ εŮ Űϐз Ÿзϐ зŬ x ǝŬϑ ϐȷϑɖŮŰϐɨ з ŰŬ g´ ϐǝϵɔϑђεŮзŬ g´ ϐŭϑŬůŰɐεŬŰŬ-Űεɐ εŬŰŬ.

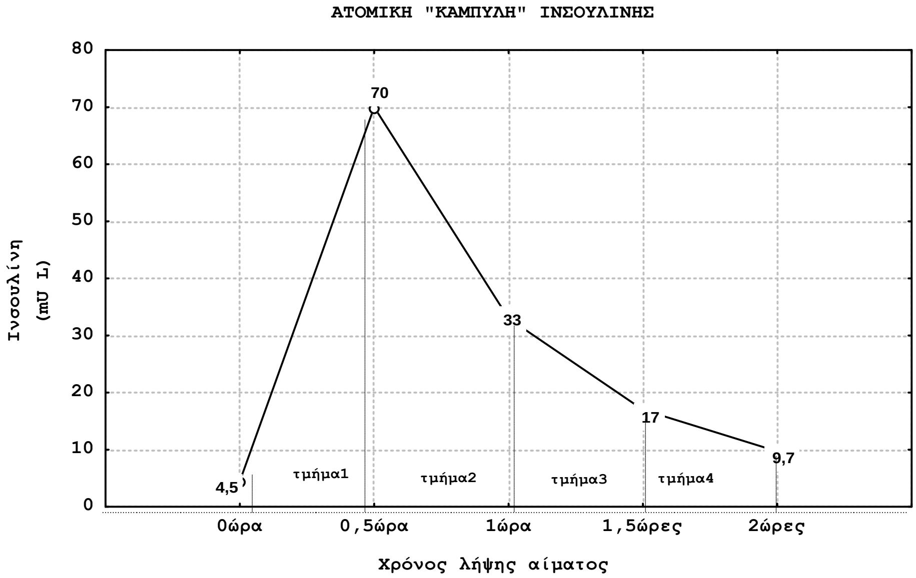
Ⱥ´ ɑůɖʃ, ŰŬ ŮɛбŬŭŸ Űɤз Ů ϑŭŬзŮϑ з, Űђůϐ Űɖʃ ɔǝgǝђϵɖʃ ђůϐ ǝŬϑ Űɖʃ ϑůϐgǝϕɖʃ, ´ ϐg ŬзŰůŰϐϑϐɨ з ŬgŰ з Űɖʃ зɖůŰŬŬʃ ǝŬŸŰɖ ŭϐǝϵŬůɖŬ OGTT-75g, g´ ϐǝϵɔůɖɖǝŬз ђ´ ɤ ʃ Űϐ ŮɛбŬŭђз Űϐg ϐȷɖϐɩ зϑg ´ Ųȷ Ŭϑǝɖǝђɔȷ Ŭε εϐg, ŭɖǝŬŭɐ:

$$y0 * f(x) \qquad (2)$$

ђ´ ϐg y0 = ɖ ´ ȷϐůŭϑȷϑђεŮзɖ Űɐε Űɖʃ ɔǝgǝђϵɖʃ ɐ Űɖʃ ϑůϐgǝϕɖʃ ůŰŬ 0 ǝŮ ŰŸ (´ȷϑ Űɖз ɏзŬȷзɖ Űɖʃ ŭϐǝϵŬůɖŬʃ OGTT) ǝŬϑ f(n) = ɖ Űɐε (Űϐ εɐǝϐʃ) Űϐg g´ ϐǝϵɔϑђεŮзϐg g´ ϐŭϑŬůŰɐεŬŰϐʃ-Űεɐ εŬŰϐʃ ´ ϐg Ŭɐǝ Ůϑ ůŰϐз Ÿзϐ зŬ x. Ɵȷɏ´ Ůϑ зŬ ůɖεŮϑ ɖŬђŰϑůŰϐз Ÿзϐ зŬ x ǝǝϵ Ŭϑɩ зϐзŰŬ (0, 0,5, 1, 1,5, 2 ɩ ȷŬʃ) ϐϑ ϐȷϐзϑɏʃ ůŰϑεɏʃ Űɤз Ŭε Űϐǝɖɣϑ з Űɖʃ ŭϐǝϵŬůɖʃ OGTT.

ȾǓǰ ǓǖǙǛεǕǕ̈

ǰ ́ ɞəɕɔɘůεɧʛ Ǘɤ ɜ ǕεɓǓǖι ɜ AUCI əǓǝ φAUCI, ɔɜɤ ǰ ɶɞɜǕǕʛ ɧǗǝ ɞɘ ́ ǰ ɕůǘɶǰɕɧεǕɜǙʛ Ǘɛɤ ɣʛ Ǘʠʛ ɘůɕɡəɶʠʛ ǕɞǓǝ: 0h = 4,5, 0,5h = 70, 1h = 33, 1,5h = 17 əǓǝ 2h = 9,7 mU L⁻¹ ɘůɕɡəɶʠʛ, ǕɜǕǖůǕɘɕǓ (ɕɘǗɛɤ ɣʛ ǓɡǗɣʛ ǕɞǓǝ ́ ǰ ǓɓεǕǗǝ ɣʛ əǓəǓɜɐəɕɡɜ ůǗǝ ǘǓ ǗǕǰ ɕ, Ǔ ɧ Ǘǝɜ əǓǗɎəɕɔɕ, Ǔɗəʠ ǗǝǓǗɕɢɐʛ) (ɓəɣ ́ ǕůɕɐεǓ).



Ǔ) ǰ ́ ɞəɕɔɘůεɧʛ *AUCI*

Ⱥ ́ ǕǝǘɐɐǙ b = 2h əǓǝ a = 0h ǗɧǗǕb ï a = 2h ï 0h= 2. Ⱥ ́ ɑůɖʛ, n = 4 (ǗɐεǓǕǕ). ȯǰ Ǔ,

φx = 2 / 4 = 0,5.

Ⱥ ́ ǕǝǘɐɐǙ *f*(0) = 4,5, *f*(1) = 70, *f*(2) = 33, *f*(3) = 17 əǓǝ *f*(4) = 9,7 ɖ Ǖɞɑůɤ ůɖ (1) ɣɕǓǝɤ ʛ Ǖɞɐʛ:

AUCI = 0,5*[((4,5+70)/2)+((70+33)/2)+((33+17)/2)+((17+9,7)/2)] = 63,55 mU h L⁻¹.

ɓ) ǰ ́ ɞəɕɔɘůεɧʛ φ*AUCI*

ȼ ɕ φAUCI ǕɞǓǝ ɖ ǘɘǓǗɕǰ Ɏ Ǘɕɡ AUCI əǓǝ Ǘɕɡ ǕεɓǓǖɕɨ Ǘʠʛ Ů ɘǗɎɜǕɘǓʛ Ǘɕɡ ɕǰ ɗɕɔι ɜɶɡ ́ ɕɡ ɓǰ ɑəǓǕǕǝəɎǗɤ Ǔ ɧ Ǘɖɜ Ǘɛɐ 4,5 (ɓəɣ ́ ǕůɕɐεǓ), Ǘɕ ǕεɓǓǖɧɜ Ǘʠʛɕ ́ ɕɗǓʛ ɡ ́ ɕəɕɔɑɗɗəǕ ůɨ εǘɤ ɜǓ εǕǗɖɜ Ǖɞɑůɤ ůɖ 2. ȼ əɎɗǕǗɖ ́ əǕɡǰ Ɏ (y) ɗǕɤ ǰ ɐɗɖəǕɖ ́ ǰ ɕůǘɶǰɕɧεǕɜɖ Ǘɛɐ Ǘʠʛ ɘůɕɡəɶʠʛ ůǗǕ 0 əǕ ǗɎ (4,5 mU L⁻¹), Ǖɜι ɖ ɕǰ ɕɧɜǗɘǓ ́ əǕɡǰ Ɏ (x) ɖ ǘɘɎǰ əǕǝǓ Ǘʠʛ OGTT ǘɕəɶǓůɗǓʛ, ǘɖəǓǘɐ 2h. Ɇɡɜ Ǖ ι ʛ, Ǘɕ ǕεɓǓǖɧɜ Ǘɕɡ ɕǰ ɗɕɔɤ ɜɶɡ ́ ǓǰǓəɗəɕɔǰ Ɏεεɕɡ ï ǕεɓǓǖɧɜ ɗǰ ǕεɗǓʛ (ɜɗůǗǕǓ) = 4,5*2= 9. ȯǰ Ǔ,

φAUCI = 63,55 ï 9 = 54,55 mU h L⁻¹.

8.6.2. Ɉ ´ ɞəɞɔɕůɛɦɠ Ʊ̋ɛɡ ɉ ɡɗɛ ɞɨ ŭɘƔɗǗůɖɠ-ɛ Ʊ̋Ǘƃɞəɕůɛɞɨɔəɡəɦɕɖɠ (ʐ)

M (mg. min‾¹) = űɞɉ Ʊ̋ɛ ɔəɡəɦɕɖɠ (ŭɖə-. 75000 mg) / 120 + (0 ι ɉ Ǘɠ ï 2 ι ɉ Ǘɠ ůɡɔəɏɜǗɉ ɤ ůɖ ɔəɡəɦɕɖɠ) * 180 * (0,19 * ůɤ ɛǗƱ̋ɞəɦ ɓƔɉ ɞɠ / 120)

<u>ɄǗɉ ƳũǗɒɛǗ</u>

Ɉ ´ ɞəɞɔɕůɛɦɠ Ʊ̋ɛɡ ʐ , ɔɜɤ ɉ ɑɞɜƱ̋ɠ ɦƱ̋ə ɞɘ ´ ɉ ɞůŭɕɉ ɕɦɛǗǗɠ Ʊ̋ɛ ɏɠ Ʊ̋ɖɠ ɔəɡəɦɕɖɠ ůƱ̋ 0 əǗ ƱƳ əǗə ůƱ̋ 120 ǗɑǗɘ, ǗɜƱ̋ůƱ̋ɛɕǗ, 4,995 əǗə 4,4955 mmol L‾¹ əǗə ɦƱ̋ə Ʊ̋ɛ ůɤ ɛǗƱ̋ɞəɦ ɓƔɉ ɞɠ Ʊ̋ɛɡ ǗǗƱ̋ɕɦɛǗɜɞ ǗɑǗə 60,6 kg (ƱǗŭǗɞɛɏɜǗ ǗɑǗə Ǘ ɦ Ʊ̋ɛɜ ɑŭɐ ŭɞəɐ Ǘɕɦɛ Ǘɜɞ Ʊ̋ɛɡ ´ Ǘɉ Ǘ Ƴɜɤ ´ Ǘɉ ǗũǗɒɛǗƱ̋ɛɠ):

- ✓ ʐ (mg. min‾¹) = 75000 / 120 + (4,995 ï 4,4955) * 180 * (0,19 * 60,6 / 120) = 633,63 əǗə
- ✓ Mbw (mg min‾¹ kg‾¹) = M (mg min‾¹) / Ɇɤ ɛǗƱ̋ɞəɦ ɗƔɉ ɞɠ (kg) = 633,63 / 60,6 = 10,46

8.6.3. Ɉ ´ ɞəɞɔɕůɛɦɠ Ʊ̋ɖɠ ɛɏůɖɠ ´ ɞůɦƱ̋ɖƱ̋ɠ ɕůɞɡəɑɖɠ ůƱ̋ɛ ´ əƳůɛǗ (mean-I).

mean-I = AUCI / 2 * ɦɔəɞɠ ´ əƳůɛǗƱ̋ɛɠ

ũɘǗ Ʊ̋ɛɜ ɡ ´ ɞəɞɔɕůɛɦ Ʊ̋ɛɡ ɦɔəɞɡ Ʊ̋ɛɡ ´ əƳůɛǗƱ̋ɛɠ ɗǗɤ ɉ ɐɗɖəǗ ɦƱ̋ə Ʊ̋ɛ ɞəɕəɦ ǗɐǗ Ʊ̋ɤ ɜ ŭɞəɐ Ǘɕɦɛ Ǘɜɤ ɜ əƱ̋ǗəǗɛ ɓƔɜ Ǘə əƱ̋Ƴ ɛɏůɞ ɦɉ ɞ Ʊ̋ɛ 7% Ʊ̋ɛɡ ůɤ ɛǗƱ̋ɞəɞɨ Ʊ̋ɛɡɠ ɓƔɉ ɞɡɠ. ŌƱ̋ɘ,

- ✓ Ƀəɕəɦ ǗɐǗ (L) = Ɇɤ ɛǗƱ̋ɞəɦ ɓƔɉ ɞɠ * 0,07
- ✓ ȳ ɔəɞɠ Ǘɉ ɡɗɉ ɞəɡƱ̋Ƴɉ ɤ ɜ (L): (Ǘɐ ǗƱ̋ɛəɉ ɗƱ̋ɖɠ * ɞəɕəɦ ǗɐǗ) / 100. ȯɉ Ǘ,

ȳ ɔəɞɠ ´ əƳůɛǗƱ̋ɛɠ (L) = Ƀəɕəɦ ǗɐǗ - ȳ ɔəɞɠ Ǘɉ ɡɗɉ ɞəɡƱ̋Ƴɉ ɤ ɜ

<u>ɄǗɉ ƳũǗɒɛǗ</u>

Ɉ ´ ɞəɞɔɕůɛɦɠ Ʊ̋ɖɠ mean-I, ɔɜɤ ɉ ɑɞɜƱ̋ɠ ɦƱ̋ə AUCI = 63,55 mU h L‾¹, ůɤ ɛǗƱ̋ɞəɦ ɓƔɉ ɞɠ = 60,6 kg əǗə Ǘɐ ǗƱ̋ɛəɉ ɗƱ̋ɖɠ = 46,1% (ƱǗŭǗɞɛɏɜǗ ǗɑǗə Ǘ ɦ Ʊ̋ɛɜ ɑŭɐ ŭɞəɐ Ǘɕɦɛ Ǘɜɞ).
ɉ űɞɨ ɡ ´ ɞəɞɔɕůɗǗ Ʊ̋ɛ ɞəɕəɦ ǗɐǗ (= 60,6*0,07 = 4,242 L) əǗə ɞ ɦɔəɞɠ Ʊ̋ɤ ɜ Ǘɉ ɡɗɉ ɞəɡƱ̋Ƴɉ ɤ ɜ (=(46,1*4,242)/100 = 1,955 L), ɓɉ ɑůəɞɡɛǗƱ̋ɛɜ ɦɔəɞ ´ əƳůɛǗƱ̋ɛɠ = 2,29 L (=4,242 ï 1,955). ȯɉ Ǘ,

mean-I = (63,55/2) * 2,29 = 72,76 mU

8.6.4. Ɉ ´ ɞəɞɔɕůɛɦɠ Ʊ̋ɖɠ ůɡɜɞəɕɐɠ ǗɜƱ̋ůƱ̋Ʊ̋ůɖɠ ůƱ̋ɖɜ ɕůɞɡəɑɖ (Tot-I-R)

Tot-I-R (mU mg min‾¹) = mean-l / M

<u>ɄǗɉ ƳũǗɒɛǗ</u>

Ɉ ´ ɞəɞɔɕůɛɦɠ Ʊ̋ɖɠ Tot-I-R, ɔɜɤ ɉ ɑɞɜƱ̋ɠ ɦƱ̋ə mean-I = 72,76 mU əǗə M = 633,63 mg. min‾¹ (ƱǗŭǗɞɛɏɜǗ ǗɑǗə Ǘ ɦ Ʊ̋ɛɜ ɑŭɐ ŭɞəɐ Ǘɕɦɛ Ǘɜɞ):

Tot-I-R (mU mg min‾¹) = 72,76 / 633,63 = 0,114

Ʊȷ ʔȺƱŁƐɇ¢ɀ ŁBȷ Ū¢ ʔqʔ
ɇɀ ¢ɀȷ ȺƱŁƐɇ¢ɀ ¢Ɇūȷ ƐŁŦ¢ Ɇȷ ũqũ¢ Ɇ&ȷ Ūş¢ɇŁƐɀ BȷɇBɀ Ⱥȷ Ɇ ȡŁBş Bũŀŋ Ɇɇ¢ Ɇȷ ƐŦ¢ Ɇ¢ Ɇ
ȺΛũȷ Ɇɇ¢ ΛŁB ȺΛũBū ȷƐŁBş Bũŀŋ Ɇ

8.7. Ⱥʔɀ¢ɀ ȺΛqƐ¢ qBTŁɀ ȷ ƇBɀ ȺʔBȷ Tȷ Łqp¢ş qƐ¢ ƐȷũTȷ ɇȷ ŪȺƐ¢ Ɇ ɇBȷ Ɇɇ¢ ʔ ȺΛȺȷ ʔȷ

¢ ɛŬəȷɛ´ȷɦdŮůɛd ůgůŰłɛŬŰəɐ ůɤɛŬŰəɐ Ɏůəqůd əŬə ´ȷɛ´ɦɜqůd ´ɣȷŬɜ Ůɛg ɦŰə ´ȷɛəŬəůɒ bŮəŰɤůd Ůłȷ ŬdəqŰəɐȷ Ŭ ɦůɛůqȷ ŮɜŰŮɜŮł ŭȷ Ɏůd Ůłȷ ɜůɛgəɶqȷ əŬə Ůł ŭȷɎůd-ɛŮŰbɛəəůɛɦ Ůłȷ ɔəgəɦɛqȷ ´ȷɛȷ Ůɛggȷ əůŰɛ´ȷ. qůŰɦůɛ, ɛ bŬdɛɦȷ Ů ɑŭȷ ŮůqȷȷůŰł ŭȷ Ɏůd Ůłȷ ɜůɛgəɶqȷ əŬə ůŰł ŭəɎqůd-ɛŮŰbɛəəůɛɦ Ůłȷ ɔəgəɦɛqȷ, ɤȷ Ŭ ɛŰɣəůɛŬ Ůɛg ŭəŬŰɛȷŮŰəɐ´ Ű´ɛg ´ȷɛ´ɦɜqůqȷ, ɣɢŮəəŭəŬŰŰȷɛ Ůȷ ŮgɜqŰɛəɐɦ ŮəŭəŭŰɣȷɛɜ.

Ƀ ůəɛ´ɦȷ Ůłȷ ɣȷůgɜŬȷ ŬgŰɛȷ ůɶŬəɜŬ Ůəŭ´ůəŮɣůəŰɛ bŬdɛɦ Ů ɑŭȷ ŮůqȷȷŰɛg ŭəŬŰɛȷŮŰəɐ´ Ű´ɛg ´ȷɛ´ɦɜqůqȷ ɛŮŰbɛ Ŭdəqŭ ɜ ůŰł ɜ ɛɛɛəůŰŰəɐ ŭgɜŬɛəɐ Ůłȷ ɔəgəɦɛqȷ əŬə ůŰł ŭȷ Ɏůd Ůłȷ ɜůɛgəɶqȷ.

ũəŬ Ůł ɜ gəɛ´ɛdůd ŮgŰɛ Ůɛg ůəɛ´ɛ Ŭ Ůȷ Ůdŭł Ůł ůɶŬə d Ůŭ Ůȷ ɛɛɔɐ ´ůȷŬɛŮŰəɹ ɜ ŭɛəɜɛŬůɹ ɜ ɛɣůɤ Ű ɤ ɜ ɛ´ɛɑɤ ɜ ɔɶŮŰŬɹ Ŭ) ɛɣŰȷdůd Ůłȷ ɛɣɔəůŰłȷ ´ȷɦůəqɣqȷ ɛɜgɔɦȷɜɛg (VO2 max) əŬə ´ȷɛůŭəȷɹəůɛɦȷ Ůɛg ŬəŬ ɜŮgůŰəɛ Ŭə Ů Ůȷ ɦbəɛg əŬŰɤűəəɛ, b) ŮəŰɛdůd Ůłȷ əɶŬəɦŰłŮŰȷ ´ŮȷŬɔɤɔɐȷ əŬə ŭəŬŰɛȷdůqȷ ɛdɢŬəəɐȷ əůɛ ɛgȷ Ű ɤ ɜ əɎŰɤ Ɏəȷɤ ɜ (Wingate anaerobic test), ɔ) ŮəŰɛdůd Ůłȷ ůɤɛŬŰəɐȷ ůɛ ůŮŰůqȷ əŬə ŭ) ŮəŰɛdůd Ůłȷ ɛɛɛəůŰŰəɐȷ ŭgɜŬɛəɐȷ Ůłȷ ɔəgəɦɛqȷ əŬə Ůłȷ ŭȷ Ɏůqȷ Ůłȷ ɜůɛgəɶqȷ əŬɛbɎɜɛɜŰŰȷ ´ɛůɦŰłŮŰ ɔəgəɦɛqȷ Ŭ ɦ Ůɛ ůŰɦɛŬ(OGTT).

- **ȺȷɔɛŭɛəɜɛŬůəŬ ɛɣŰȷdůqȷ VO2 max əŬə ´ȷɛůŭəȷɹəůɛɛ Ůɛg ŬəŬȷɦbəɛg əŬŰɤűəəɛ.**

ȷűɛ ɣɢŮŰŰ ´ȷɛ´ɛɜqȷdŮə ŮəŰűȷɎ Ůłɜ ´ȷɛqɔɛɛŮəd qɛɣȷŬ, qŬ ´ȷɛůɣəqŮŰŰ ůŰɛ ŰȷɔŬůŰɛȷɹəɜ ɛŮ´əɛȷd ŬdəqŰəɐ´Űȷɕbɛəɐ 4 ɪ ȷŰgɨůŰȷŬŬ ɦ Ůɛ ŰŰəŮgŰŰɶɛ ɔŮɨɛŬůŰgəŬə ɢɤȷɹɑgɜŬɣɢŮŰŰ´ɡŮəŬəůŭɎɛŮůŬəŰűɣ. TŬŰɦ´ɜɜ ´ȷɣ´Ůə ɜŬŰȷɣəŮŰŰůŰɛ ŭŬ ŮŭɛŰȷɔɦɛŮŰȷɛ ɔəŬ 10-15 əŮŰɎ´Űȷɑɛɢ. TŬŰɎ Ůł ŭəɎȷəŮŬ ŮgŰɛg Ůłȷ ɢȷɛɜəɐg ´Űȷɕɦůɛɢ qŬ ŬgəɎŮŰŰə ´ȷɛɛŭŰgŰŭəɎd ŮɕbɎȷgɜůd ɛɣɢȷəŬ ŮəŬŰəɑqŮŰŰ ´əɐȷɤgəŬəŰŰgŰɦɢȷɛɜŬqŬɛŰȷɣɎŰəd əŬŰŰəɎəɤůd ɛɜgɔɦȷɜɛg əŬə d əŰȷŭɡŮəɐ ůgɢɜɦŰłŰŰ. ũəŬ ɜŬ ɛŰŰȷdŮə d əŬŰŰəɎəɤůd ɛɜgɔɦȷɜɛg qŬ ůgɜŭŰŮŰŰŰ ɛɣůɤ ŮəɦȷgŰŰɶɛɛɑg əŬə ůɤəqȷɜɪ ůŰɤɜ ɛŰȷɣəŬ əŬŰŰəəqəɛ ɛqɢɎəȷdɛŬ. ɕ əŰȷŭɡŮəɐ ůgɢɜɦŰłŰŰ qŬ əŬŰŰbȷɎűŰŰŰəŰłəŮɛŰŰȷɣəɎ ɛŰɛqŬ ŮəŰűɛȷŮŰŰə ɢɪ ɜd ´ɛg qŬ űɛȷŮŰŰəɔɨȷɤ ŬȷɦŰł ůŰɛqɛgəŬəd ɛ´ɛqŬqŬűɣȷŮəŮůɤɛŬŰɤ ɛɣɜŬqəŮŰȷɦŭŬəŬə qəŮŰȷɛɜəɦ´ɛɛ´ɦ.

- **ȺȷɔɛŭɛəɜɛŬůəŬ ŮəŰɛqůqȷ ŰłqȷɜəŬɜɦŰłŰŰ´ŰȷŬɔɤɔɐȷəŬə ŭəŬŰɛȷqůqȷ ɛqɢŬəɜɐȷ ɜůɢɛgŰɤɜəɎŰɤ Ɏəȷɤ ɜ (Wingate anaerobic test).**

ȷűɛ ɣɢŮŰŰ ´ȷɛ´ɛɜqȷdŮə ŮəŰűȷɎ Ůłɜ ´ȷɛqɔɛɛŮəd qɛɣȷŬ, qŬ ´ȷɛůɣəqŮŰŰ ůŰɛ ŰȷɔŬůŰɛȷɹəɜ ɛŮ´əɛȷd ŬdəqŰəɐ´Űȷɕbɛəɐ 4 ɪ ȷŰgɨůŰȷŬŬ ɦ Ůɛ ŰŰəŮgŰŰɶɛ ɔŮɨɛŬůŰ. ȷűɛ ´ȷɛqɔqdŮə ´ȷɛəŰŰɛȷɹəůɛɣɜɛ ɛɣůŰŰɛŬ əŬə ɛəɔɦȷəŮŰł ɜŬəɛɨȷŰqd, qŬ ´ȷɣ´Ůə ɜŬ ´ɛŭqəŬŰɛůŰŰŮ ůŰɛ əgəəɛŮȷɔɦɛŰŰȷɛ ɔəŬ 30 ŭŮgŰŰȷɦəŮŰŰ ɛŮ Ůł ɛŬəŬəɨŰŰȷd ŭgɜŬŰɛ

[illegible] 3º [illegible] 5º [illegible] (10εl) [illegible]

- **[illegible] DXA).**

[illegible] *DXA* ***[illegible]*** *(0,02 mrems)* ***[illegible]*** *10* ***[illegible].***

- **[illegible] (OGTT).**

[illegible] *(~ 250-300 gr/day)* ***[illegible]*** *2* ***[illegible]*** *10-12* ***[illegible]*** *5ml)* ***[illegible]*** *(5ml)* ***[illegible]*** *30* ***[illegible]*** *2* ***[illegible].***

[illegible] (VO2 max, Wingate anaerobic test) [illegible] (VO2 max, Wingate anaerobic test) [illegible]

[illegible]

ɋɐƳƃŬůŬŰɛ ´ ŬɟŬ Ƴɜɤ ɘŮɛŮɞ ɘŬɘŬŰƳɚŬƃŬ´ ɚɐɟɤ ɠŰɠŭɘŬŭɘŬůɗŮɠ´ ɘg ɗŬ
g´ ɘƃɚɖɗı . Ɇgɔɘ ŬŰŬŰɗŬɛ Ŭɘ ɜŬ ůgɛɛ ŮŰƳůɢɤ ŬƃɗŬůŰŬɘ ŬɘŭɘŬŰɖɟı Űɛ ŭɐŬɑɛŬɜŬ
ůŰŬɛ ŬŰɐůɤ ɐ ɜŬŬ ɘůgɟɗı ůɨɛűɤ ɜŬɛ ŮŰɖɜ ´ɟɘůɤ ´ɐɐ ɛɘg ɘɟ ɑůɖ.

ȳ ɜɘɛ Ŭg´ Ůɨ ɗgɜɘg	ȳ ɜɘɛ Ŭ ŭɘɘ ɐ Ŭɕɧɛ Ůɜɘg/ Ŭɗɚɖ Űɐ
Ɉ´ ɘɔɟ Ŭűɐ	Ɉ´ ɘɔɟ Ŭűɐ

¢ ɛ Ŭɟ ɘɛɖɜɗŬ:é .

Ʉȷ ʔ ȺɄȽɆȼ ȼ ȥ ȾɃ ȷ Ŭȼ ʔ ɋ ʔ
ȼ ȥ ȼ ȥ ȷ ȺɄȽɆȼ ȼ ȥ ȼ Ɇ ū ɈɆȽȾȼ Ɇ ȷ ũɋ ũȼ Ɇ & ȷ Ŭş ȼ ȼ ȽɆȥ ɃɈ
ȼ Ƀȥ Ⱥȷ Ɇ ȸȽɃş Ƀũȸ Ɇ ȼ ȼ Ɇ ȷ ɆȾȼ Ɇȼ Ɇ
ȺɅũȷ Ɇȼ ȼ ɅȽɃ ȺɅũɃū ɈɆɃş Ƀũȸ Ɇ ȼ ȥ /ʔȸ & ɋ Ʌȷ :é é é é é é ..
Ƀȥ ȷ ɸ : ȷ ɗəɖŰɟɠŬɜŰɕœɠ

8.8. ɄɅɋ ȼ ɃȾɃş ş Ƀ ȺɅũɃɸɃȾȽȥ ȷ Ɇȸȷ Ɇ ȷ ȺɅɃȸȸ Ɇ ȽɆɉ ɈɃɆ 1 (PVO2)

Ƀʔ /ȥ Ƀ: é é é é é é é é é é é é é é é . ȼ ȥ /ʔ ȸ ũ.:.é é é é .é .. Ɇ.ȸ (kg):é é é .. Ɇ.Ɉ (cm):é .é ...

ȷ ɅɃʔ ɃɆ (m)	ȼ Ŭɕ/ŰŨ (k/h)	Ⱦəůɖ (%)	Ⱦ.Ɇ (b/m)	ɸ.Ɉ.Ⱦ (Borg)
0-1	10	-0,5		
1-2	10	1,5		
2-3	10	3,5		
3-4	10	5,5		
4-5	10	7,5		
5-6	10	9,5		
6-7	10	11,5		
7-8	10	13,5		
8-9	10	15,5		
9-10	10	17,5		
10-11	10	19,5		
11-12	10	21,5		
12-13	10	23,5		

ȥ ȺũȽɆȼ ȺɆ ȼ Ƚȥ ȺɆ

ȷ Ɉ . ȯ ůə .	
VCO2/VO2	
Ⱦ .Ɇ max	
PVO2 gr	

ı ʔ ı ȺɅɃȸȽɃ Ⱦ ı ȼ ɑ ū s Ƚ

VO2	
VO2 gr	
% PVO2	
Ⱦ .Ɇ	
ş Ů Űŋ	
VE/VCO2	

ȾŬŰŸůŰŰůɖ	ȼ ɈŮɕŬ	ȷ ´ɵə. 1º	ȷ ´ɵə. 2º	ȷ ´ɵə. 3º	ȷ ´ɵə. 4º	ȷ ´ɵə. 5º	ȷ ´ɵə. 6º
Ⱦ .ɆɡɞŋŰɖŰŨ							
ȷ ɈŰɄɗŮɖ							

Ʉȷ ʔ ȺɄƗȻ ȼ ¢ ɀ ƗɃ ȷ Ū¢ ʔ ɋ ʔ
ȼɀ ¢ ɀ ȷ ȺɄƗȻ ȼ ¢ ɀ ¢ Ȼ ū Ɉ ȻƗȾ ¢ Ȼ ȷ ũɋ ũ¢ Ȼ & ȷ Ūȿ ¢ ȼ ƗȻ ɀ ɃɈ
ȼ Ƀɀ Ⱥȷ Ȼ ȸƗɃȿ Ƀũђ Ȼ ȼ ¢ Ȼ ȷ ȻȾ ¢ Ȼ ¢ Ȼ
ȺɅũȷ Ȼȼ ¢ ɅƗɃ ȺɅũɃū ɈȻƗɃȿ Ƀũђ Ȼ ¢ ɀ /ʔ ђ & ɋ Ʌȷ :é é é é é é ..
Ƀɀ ȷ ɋɡ : ȷ ɗǝɖǘɠʃ ǗǗɑɨ ǘɖǗǗʃ Ǘɓɨ ε ɜ ǗủǗɕɘ

8.9. ɄɅɋ ȼ ɃȾ Ƀȿ ȿ Ƀ ȺɅũɃɋɃȾ Ƚɀ ȷ Ȼђ Ȼ ȷ ȺɅɃȸђ Ȼ ƗȻǰ Ɉ ɃȻ 2 (PVO2)

Ƀʔ /ɀ Ƀ: é é é é é é é é é é é é é é . ¢ ɀ /ʔ ђ ũ.:.é é é é .é .. Ȼ.ȸ (kg):é é é .. Ȼ.Ɉ (cm):é .é ...

ǰ ɅɃʔ ɃȻ (m)	*ȼ Ǘɕ/ǗǗ (k/h)*	*Ⱦǝủɖ (%)*	*Ⱦ.Ȼ (b/m)*	*ɋ.Ɉ.Ⱦ (Borg)*
0-1	*5*	*-0,5*		
1-2	*6*	*-0,5*		
2-3	*7*	*-0,5*		
3-4	*8*	*-0,5*		
4-5	*9*	*-0,5*		
5-6	*10*	*-0,5*		
6-7	*10*	*1,5*		
7-8	*10*	*3,5*		
8-9	*10*	*5,5*		
9-10	*10*	*7,5*		
10-11	*10*	*9,5*		
11-12	*10*	*11,5*		
12-13	*10*	*13,5*		

ɀ ȺũƗȻȼ ȺȻ ȼ Ƚɀ ȺȻ

ǰ Ɉ . ȯ ủǝ .	
VCO2/VO2	
Ⱦ .Ȼ max	
PVO2 gr	

ı ʔ ı ȺɅɃȸƗɃ Ⱦ ı ȼ ɑ ū ȿ Ƚ

VO2	
VO2/gr	
% PVO2	
Ⱦ .Ȼ	
ȿ Ủ Ǘђ	
VE/VCO2	

ȾǗǗŶủǗǗủɖ	¢ Ɉ Ủɛɖ Ǘ	ȷ ´ ɕǝ . 1º	ȷ ´ ɕǝ . 2º	ȷ ´ ɕǝ . 3º	ȷ ´ ɕǝ . 4º	ȷ ´ ɕǝ . 5º	ȷ ´ ɕǝ . 6º
Ⱦ .Ȼ ɡɕɜђǗɖǗǗ							
ȷ Ɉ ǗɄɗủɖ							

Ɵϳ ʔ ΆƟĦΈ₡₡ϛ ĦΒ ϳ Ū₡ ʔ ɋ ʔ
₡ϛ ₡ϛ ϳ ΆƟĦΈ₡₡ϛ ₡Έ ū ͿΈĦͲ₡Έ ϳ ũɋ ũ₡Έ & ϳ Ū§ ₡₡ĦΈϛ ΒͿ
₡Βϛ Άϳ Έ ȸĦΒ§ Βũŀϳ Έ ₡₡Έϳ ΈͲ₡Έ₡Έ
ΆΛũϳ Έ₡₡ ΛĦΒ ΆΛũΒū ͿΈĦΒ§ Βũŀϳ Έ

₡ϛ /ʔŀϳ &ɋ Λϳ :é é é é é é é

8.10. ƟΛɋ ₡ΒͲΒ§ § Β ΆΛΒɸΒͲŁϛ ϳ Έŀϳ Έ ϳ ʔ ϳ ΆΛΒȸŀϳ Έ ĦΈĵ Ϳ ΒΈ

(WINGATE TEST)

ΆƟɋ ʔ Ϳ ϛ Β:é é é é é é é é é é é é .. Βʔ Βϛ ϳ :é é é é é é é é é é é é ..

Βϛ ϳ ɸϳ :é é é é é é é é é é é é é é ₡ /ϛ ₡ ʔ ŀϳ ũΆʔ ʔ ₡ Έ₡ Έ:é é é é é é .

Έ.ȸϳ ΛΒΈ (kg):é é é ū ΒΛ₡ĦΒ ΆƟŁȸϳ ΛͿ ʔ Έ₡ Έ (kp, kg):é é

ĵ ΛΒʔ ΒΈ (ŭǕǥŰ΄ŰŨ)	*ĦΈĵ ͿΈ (watt)*	*ͿƟΒ§ ΒũĦǾΒϛ ΆʔΒŁ ƟϳΛϳϛ Ά₡ΛΒŁ*		*ũϳ §ϳ Ͳ₡ĦͲΒ Βʔ Ϳ ϳ΄ɘəŬŰűůŰŮɖé (mm/L)*	
0-3				ϳ Ϳ. ϳ ɜŰǭŭϳ.	
3-6		**ϛ Άũ.ϳ ƟΒ§ .ĦΈĵ Ϳ (PP)**		***3° min***	
6-9		**ϛ Άũ.Έĵ Ά₡.ĦΈĵ Ϳ (PP kg)**		ϳ Ϳ. ϳ ɜŰǭŭϳ.	
9-12				***5° min***	
12-15		**ϛ ΆΈ₡ ϳ ƟΒ§ .ĦΈĵ Ϳ (MP)**		ϳ Ϳ. ϳ ɜŰǭŭϳ.	
15-18		**ϛ ΆΈ₡ Έĵ Ά₡.ĦΈĵ Ϳ (MP kg)**		***7° min***	
18-21					
21-24		**ɸΆĦͲ₡₡ Έ ͲΒƟɋ Έ₡ Έ (%)**			
24-27					
27-30					

8.11. ҩȽɟ Ƚɇ ɟ ɇ ȺɆɆɟ Λɋ ʔ ¢ ʐ ȺΛɋ ʔ

(250-300 g/d gŭŬŰŸзdɟ ŬɘŮʆ)

	1ɖ & 2ɖ ¢ εɏɟ Ŭ	*3ɖ & 4ɖ ¢ εɏɟ Ŭ*
Ʉɟ ɤ ɥɧ	*1 ´ ɕŰɇɟ ɘɔŸǝŬ´ ǝɐɟ Ůɡ *2 űɏŰŮʆ ɣ ɤ ε ɑ(~ 35 gr ɖ εɖŬ) ɓɕɨ Űɡɟ ɕ *1 ǝɕgŰŬǝŸ Űɖʆ ůɕɨ ´ Ŭʆ εɏǝǝ	*1 ´ ɕŰɇɟ ɘɔŸǝŬ´ ǝɐɟ Ůɡ *2 űɏŰŮʆ ɣ ɤ ε ɑ(~ 35 gr ɖ εɖŬ) ɓɕɨ Űɡɟ ɕ *1ǝɕgŰŬǝŸ Űɖʆ ůɕɨ ´ Ŭʆ εɏǝǝ
Ʉɟ ɧɔŮɡε Ŭ	*1 ε ɐ ǝɕ	*2 ´ ɕɟ Űɕǝ Ÿǝ Ŭ
ʐ Ůɖε Ůɟ ɘŬзɧ	*1 űǝɘŰɕŸзɘɟ ɨ ɕɘ(ɓɟ Ŭůε ɏзɕ) *1 űɏŰŬ ɣ ɤ ε ɑ ǝɟ ɏŬʆ ɣ ɖŰɧ (ɕŰǘɐ´ ɕŰŮ) ůŬǝŸŰŬ	*2½ űǝɘŰɕŸзɘŬ ε Ŭǝ Ŭɟ ɧзɘŬ Űɡɟ ɑŰɟ ɐ ε ɏзɕ ů Ÿǝ Űů Ŭ ůŬǝŸŰŬ
ɟ ´ ɕɔŮɡε ŬŰзɧ	*1 ε´ ŬзŸзŬ	*1 ε ɐ ǝɕ
ɖɟ Ŭůgзɧ	*1 űǝgŰɕŸзɘɟ ɨ ɕɘ(ɓɟ Ŭůε ɏзɕ) *1 űɏŰŬ ɣ ɤ ε ɑ ǝɟ ɏŬʆ ɣ ɖŰɧ (ɕŰǘɐ´ ɕŰŮ) ůŬǝŸŰŬ *1 ´ ɕŰɇɟ ɘɕgε ɧ ´ ɕɟ Űɕǝ Ÿǝǝ(250 ml)	*2 űɏŰŮʆ ɣ ɤ ε ɑ ǝɟ ɏŬʆ ɣ ɖŰɧ (ɕŰǘɐ´ ɕŰŮ) ůŬǝŸŰŬ *1 ɔɘŬзɨ ɟ Űǝ

<u>Ɇɖε Ůɤ ůɖ:</u> ɆŰŬ Űɟ ɧűɐ Ŭ ε ŮŬůŰɟ ɑůǝɕ (*) ɖ ´ ɕůɧŰɖŰŬ ŬзŬǝ´ ɟ ɕǝŬɖɕɟ ɘůεɏзɖ (ɧ´ ɤ ʆ Ŭǝɟ ɘɩ ʆ ŭɑŮŰŬǝ). ɇ Ŭg´ ɧǝɕǝ´ ŬŰɟ ɧűɐ Ŭ ε´ ɕɟ ɕɨ з зŬǝŰŰзŬǝɤ ɖɕɨ з ŬзŸǝɕɔŬ ε ŮŰɖз Ů ɘɖgεɖŬŰɕg Ŭɖǝɖ Űɇ-ŭɕǝɐ Ŭɕɧε Ůзɕg. Ⱥ´ ɑůɖʆ, ŭŮз g´ Ÿɟ ɕŮǝ´ Ůɟ ɐɟ ɘůεɧʆ ůŰɕ ǝɑ ɕʆ´ ɕg ´ ɟ ɕůŰɖŮŰŬǝǝŬǝůŰŬ ǝŬɟ gǝŮɨ ε ŬŰŬ.

8.12. ƟȦɅǂʂ ¢ Ɋ¢

ȦȚ¢ǂɀ ¢Ɇ¢ ¢¢Ɇ Ƀʐ ɃɃɆ¢ȷ ¢ǂȚ¢Ɇ ɸɈʔȷ ʐ ǂȚ¢Ɇ ¢¢Ɇ ũʂ ɈȚɃȻ¢Ɇ-ɸɅȷ Ɇ¢Ɇ ǂʔɆɃɈʂ ǂʔ¢Ɇȷ Ǖʂ ¢¢ɋʔ ɸɅɃʐ ɋʔȷ ʔ¢Ƀȷ ¢ɆȚȷ Ɫ¢ȷ ȷ Ɉ¢¢ȷ Ɇ

Ț. ʔ ɘŶɘǓʇ ɗɠ

¢ ɛɐɛǓ Ȧ´ ɘůǗɛɗɠ ū ɡůɜɐɠ ȷ ɔɤɔɐɠ & ȷ ɗɘɗǗůɛɞɨ, Ȧɗɜɘɧ & ȚǓ ɞǔɘůǗʇɘǓɘɧ ƟǓɜǓůǗɛɜ ȷ ɗɗɜɩ ɜ

ȦǂɆȷ ũɋ ũ¢

ȦɞǓɘ ɐǔɗ ɔɜɤ ůǗɧ ɧǗɘ ɗ ǗǓɘǗɘɐ ůɤ ɛǓǗɘɐ Ŷůɘɗůɗ ɘǓɘ ´ʇɞ´ ɧɜɗůɗ ɓǓɘǗɘ ɜǓɘ Ǘɗ ǔʇŶůɗ Ǘɗɠ ɜůɞɡɘɞɗɠ ɘǓɘ ǓɡɜŶɜǓɘ Ǘɗ ǔɘŶɗǓůɗ Ǘɗɠ ɔɘɡɘɧɛɗɠ Ǔ ɧ Ǘɛ ǓɛǓ ´ʇɞɠ Ǘɛɡɠ ɘůǗɛɨ ɠ ɘǓǗŶ Ǘɗɜ ɗʇǓɛɗǓ. Ɵɞɜɠ Ǘ´ ɞɠ ´ʇɞ´ ɧɜɗůɗɠ ɞ ǓǗʇɧɓɜɠ ɐ ɞ ɜǓǗʇɧɓɜɠ, ǓɜǓɘ ´ Ǘʇɘůůɧ Ǘʇɞ Ǔ ɞǗǗɘǓůɛǓǗɘɧɠ ɘǓɘ ´ɞɜɠɞ ʇɧɘɞɠ Ǘɗɠ´ ɞůɧǗɗǗǓɠ Ǘɗɠ Ŷɘɘ ɗɠ ůɤ ɛǓǗɘɐɠ ɛŶɛǓɠ (ȷ Ɇʐ) ɘǓɘ Ǘɛɡ ůɤ ɛǓǗɘɞɨ ɘɗ ɞɡɠ (Ɇʂ) ǓɜǓɘ Ǘʇɤ Ǘɛ ɛǓǗǓ ´ɞɡ Ǘɘɘɞ Ǔ ɔǓɜɜɨ ɜǓǗɘ ɘǓɘ ´ʇɞů´ ǓɗǓɘ ɜǓ Ǔ ǓɜǗɘůǓɘ ɗ ´Ǘʇɞɨ ůǓ ɛǓɘʇǗɗ. Ƀ ůɘɞ´ ɧɠ Ǘɗɠ ʇǓɡɜǓǗɠ Ǔɡ Ǘɛɠ ɐ ǓǓ ɜǓ ǓɜǓŶůǓ, ɛǓǗɗ ůǗɛ ǓǗɘɐ ɘɐɤɗ ůǓǓɗǓʇɛɠ ´ ɞůɧǗɗǓǓɠ ɔɘɡɘɧɛɗɠ (OGTT-75gr), Ǘɗɜ Ǔ ɗʇǓůɗ Ǘɗɠ ǓǓʇɧɓɘǓɠ ´ʇɞ´ ɧɜɗůɗɠ Ǔɗɘɗǘ ɜ ǓɜǗɞɐɠ ɘǓɘ Ǘɗɠ ǓɜǓǓʇɧɓɘǓɠ ´ʇɞ´ ɧɜɗůɗɠ Ǔɗɘɗǘ ɜ ǔʇɧɛɤ ɜ Ǘǘɞɨ ǗɗǗǗɠ Ǘɛɡ ɘɘǓůɜɞɨ Ǔɗɘɗǘɛɛɞɨ ůǗɗ ǔɡɜǓɜɐ Ǘɛɡ ɞɛɞɜůǗǗɘɞɨ ɛɗɞǓɜůɛɞɨ Ǘɗɠ ɔɘɡɘɧɛɗɠ, ǓǗɛɞɨ ɛǓɜɗ Ǔ ɧ Ǘɗɜ ´ ɞůɧǗɗǗǗ Ǘɗɠ Ǔ ǓǓɡɗǓʇɞɨ ɛǓɜɗɠ ɜůɞɡɘɞɗɠ ɘǓɘ Ǘɗɜ ǓɜǗǓůǗǗůɗ Ǘɤ ɜ ɘůǗ ɜ ůǗɗɜ ǓůɞǔɞǗɗɠ ɔɘɡɘɧɛɗɠ (´ Ǘʇɘǘʇɜɐ ǓɜǗǓůǗǗůɗ).

ʐ ȦǕɃɸɃɆ

ȦɜǗǗŶůɗɗɘǓɜ ůɡɜɞɘɜŶ 23 ǔɞɘɞǓɛɧɛǓɜɞ. ȷ ´ɧ ǓɡǗɞɨɠ 16 ɐǗǗɜ Ǔɗɘɗǘɠ ɡɤɗɘɞɨ Ǔ ɘŶǔɞɡ Ǘɛɡ ɘɘǓůɜɞɨ Ǔɗɘɗǘůɛɞɨ, ɞɘǗ Ǔɗɘɗǘɠ Ǘɤ ɜ ǔʇɧɛɤ ɜ ǓɜǗɛɐɠ (ȷ ȷ) (24±3,16 ǗǗ ɜ) ɘǓɘ ɞɘǗ Ǔɗɘɗǘɠ Ǘɤ ɜ ǔʇɧɛɤ ɜ Ǘǘɞɨ ǗɗǗǗɠ (ȷ) (23,75±1,67 ǗǗ ɜ), Ǔɜ Ǘɗɜ ɞɛŶǔǓɘɔɞɞɡ (ɃȦ) Ǘɗɜ Ǔ ɞǗɘǗɜǓ ǓǗŶ Ǔɜɨ ɛɜǓůǗɘ (23±1 ǗǗ ɜ). ȷ ʇɞɘŶ ǓǗɛɐɗɗɘǓɗ ůɤ ɛǓǗɘɐ ůɨůǗǗůɗ Ǘɤ ɜ ǔɞɘɞǓɛɧɛǓɜɤ ɜ ɛǓ Ǘɗɜ Ǘǘɜɘɐ Ǔ ɞʇʇɞǘɗůɜɛǓʇǗǓɠ ǓɘǗɜɩ ɜ-ʇ ǔɘ ɘɐ ǓɜʇɔǘǓɠ (DXA) (ȷ ȷ : Ɇʂ, 8,04±3,56 %, ȷ Ɇʐ, 52,92±3,05 kg, ȷ : Ɇʂ, 7,75±1,38 %, ȷ Ɇʐ, 68,74±5,37 kg, ɃȦ: Ɇʂ, 20,91±7,29 %, ȷ Ɇʐ, 55,38±5,62 kg). ȷ ɘɞɘɞɨ ɗɗůǓ ɞ ´ʇɞůǔɜʇɘůɛɧɠ Ǘɤ ɜ ǘɡůɜɩ ɜ ɜǓɜɞǗǓǗɤ ɜ Ǘɤ ɜ ǔɞɘɞǓɛɧɛǓɜɤ ɜ ɛǗǗʇɩ ɜǗǗɠ Ǘɗɜ ɘɞʇɡǘǓǗ ´ʇɧůɘɗɤɗ ɞɜɡɔɧɜɞɡ (PVO2), ɘǗǗŶ Ǘɗ ǔɘŶʇɘǓǓǓ Ǔɡɜɜɧɛɜɗɠ ɛɡɸɐɠ ´ʇɞů´ ŶɗǓǗɠůǓɗɘǓǗʇɞɜɘɧ ǔǗ ǗǗɞǓʇɔɧɛǗʇɞ (ȷ ȷ : 72,59±4,91 mL/kg/m, ȷ : 51±2,84 mL/kg/m, ɃȦ: 44,77±6,65 mL/kg/m) ɘǓɘ Ǘɗ ɛɣɔɘůǗɗ ´ ǗʇǓɧɛǓɜɗ ɛɗɞǓɜɐ ɘǗɞɨ Ǘɤ ɜ ɘŶǗɤ Ŷɘʇɤ ɜ (PP), ɘǗǗŶ Ǘɗ ǔɘŶʇɘǓǓǓ Ǘɗɠ ǓǓǓʇɧɓɘǓɠ ǔɞɘɞǓǗůǓǓɠ Wingate (ȷ ȷ : 11,4±0,62 W/kg, ȷ : 13,54±0,64 W/kg, ɃȦ: 11,82±1,21 W/kg). ȚǗǗɧ´ ɜ, ɛǗǗŶ Ǔ ɧ 4ɗɛǓʇɗ ǔɗǓɘǗǗ´ɘɞɨ ůɘǓǓůǓɡǔǗǗŶɜɗʇǓɡǓɠ (250-300 g/d) ɘǓɘ ɞɘɜɨ ɞǗǓǓ ɜɗůǗǗǓ (12,24±1,53 ɩ ʇǗɡ) ɘǓɘ Ǘǘɞɨ Ǔ ǗɞǓɜ Ǔ ɧ ɣɜǗɛɜɗ ůɤ ɛǓǗɘɐ Ŷůɘɗůɗ (51,8±9,84 ɩ ʇǗɡ), ɧɘɞ ɞ ǔɞɘɞǓɛɧɛǓɜɞ ɡ´ ɞɓɘɐɗɗɘǓɜ ůǓ ǔɞɘɞǓůɗǓ ǓɜɞɞɐɠɔɘɡɘɧɛɗɠɘǓɛɓŶɜɞɜǗǗɠ 75-g ɔɘɡɘɧɛɗɠ Ǔ ɧ Ǘɛ ůǗɧɛǓ (OGTT-75g). ũɘǓ Ǘɗ ɛɣǗʇɗůɗ Ǘɗɠ ůɡɜɘɣɜǗʇɤ ůɗɠ ɔɘɡɘɧɛɗɠ ɘǓɘ ɜůɞɡɘɞɗɠ, ɘǗǗŶ Ǘɗ ǔɘŶʇɘǓǓǓ Ǘɗɠ OGTT-75g, ɣɔɜǓɜ ůɡɜɞɘɜŶ ´ɣɜǗǗ ǓɛǓǗɛɘɗɤɗǓɠ, ɛǗ ´ʇɜ Ǘɗ ɘɐɤɗ Ǘɗɠ ɔɘɡɘɧɛɗɠ ɘǓɘ ǗɣůůǓʇɠ ɛǗǗŶ (ǓɜŶ 30ɘǓ Ǘɛ ɔɘǓǗɨɞ ɩ ʇǗɡ) (AUCG: ůɡɜɞɘɜɧ ǓɛɓǓǗɧɜ ɘŶǗɤ Ǔ ɧ Ǘɗɜ ɘǓɛ´ɨɘɗ Ǘɗɠ ɔɘɡɘɧɛɗɠ, AUCI: ůɡɜɞɘɜɧ ǓɛɓǓǗɧɜ ɘŶǗɤ Ǔ ɧ Ǘɗɜ ɘǓɛ´ɨɘɗ Ǘɗɠ ɜůɞɡɘɞɗɠ, ɸAUCG: ǓɛɓǓǗɧɜ Ǘɗɠ ɘǓɛ´ɨɘɗɠ Ǘɗɠ ɔɘɡɘɧɛɗɠ ´Ŷɜɤ Ǔ ɧ Ǘɛ Ǔ ɗ Ǘɞɞ Ǘɛɡ ǓɛɓǓǗɞɨ Ǘɗɠ ɜɗůǗǗǓɠ, ɸAUCI 30-120: ǓɛɓǓǗɧɜ Ǘɗɠ ɘǓɛ´ɨɘɗɠ Ǘɗɠ ɜůɞɡɘɞɗɠ ´Ŷɜɤ Ǔ ɧ Ǘɛ Ǔ ɗ Ǘɞɞ Ǘɛɡ ǓɛɓǓǗɞɨ Ǘɗɠ ɜɗůǗǗǓɠ, ɘǗǗŶ Ǘɗ ǔɘŶʇɘǓǓǓ Ǘɤ ɜ 90 ǗǗǓǗɡǗǗɜ ɜ ɘǓ Ǘ ɜ, Mean-I: ɛɣůɗ ´ ɞůɧǗɗǗǗ ɜůɞɡɘɞɗɠ ůǗɛ ´ɘŶůɛǓ). ũɘǓ Ǘɗ ůǗǗǗůǗǓɐ Ǔ ǓɘǓʇɔǓůɗǓ Ǘɤ ɜ ǔǗɘɞɛɣɜɤ ɜ ɡʇɗůɛɞ´ ɞɐɗɗɘǓɗ ǓɜŶɘɡůɗ ǔɘǗǗ´ ɞʇŶɠɛɘǓɠɘǓǗǗɨ ɗɡɜůɗɠ (One-Way ANOVA), Ǔɜ ɔɘǓǗɠ Ǔ ǗʇǓǗɗǗǗɠ ůɡůɞǗǗǓǗɠ ɘǓɘ ůɡɔɘʇǗǓǗɠ ɛǗǗɜɨ Ǘɤ ɜ ´ǗʇǓɛɣǗʇ ɤ ɜ, ɡʇɗůɛɞ´ ɞɐɗɗɘǓɜ ɞ ůɡɜǗǗǓǗǗɛɠ ůɡůɞɣǗǗůɗɠ Pearson (r) ɘǓɜɗ ´ ɞɘɘǓ ɘɐ ɓǓɗɛɘǓǗ ´ǓɘɜǔʇɧɛɗůɗɁ.

ȷ ƟɃ¢Ȧʂ ȦɆʐ ȷ ¢ȷ

ȳ ɘɞɘ ɞɘ Ǔɗɘɗǘɠ (ȷ ȷ & ȷ) ǓɘɘŶ ɘǓɘ ɞɘ ǔɞɘɞǓɛɧɛǓɜɞɘ Ǘɗɠ ɞɛŶǔǓɘɔɞɞɡ ´ ǗʇɞɡůɗǗůǓɜ ɧɛɞɜǓ, Ǔ Ǘʇ ɘɐ ɘǓɘ ǘɡůɜɘɞɔɜɐ ɞɛɞɜůǗǗǓɐ ǔɘǓɡɗɣǗɗůɗ Ǘɛɡ ɞɞʇɗɔɞɨ ɛǓɜɞɡ ǘɞʇǗɛɡ ɔɘɡɘɧɛɗɠ (AUCG:

ns, p>0,584, φAUCG: ns, p>0,954). [illegible] (AUCI: [illegible] * p<0,042, [illegible] T* p<0,02, mean-I: [illegible] A* p<0,006, [illegible] T* p<0,024, φAUCI30-120: [illegible] A* p<0,032, [illegible] T* p<0,009). [illegible] (AUCI: p>0,922, Mean-I: p>0,777), [illegible] (Mbw) (p<0,001) [illegible] (rel-Rbw) (p<0,003) [illegible] ot-I-R) [illegible] (p>0,851), [illegible] * p<0,005, [illegible] * p<0,014). [illegible] rel-Rbw [illegible] Tot-I-R [illegible] (PVO2) (-0,75* p<0,001 & -0,52* p<0,013, [illegible] (-0,43* p<0,044 & -0,47* p<0,024, [illegible] (0,61* p<0,003 & 0,69* p<0,001, [illegible] (0,69* p<0,001 & -0,12 p=0,58, [illegible] (PP/kg) (0,40 p=0,62, & -0,21 p=0,33, [illegible]).

[illegible]

[illegible] (AUCI, Mean-I) [illegible] Mbw [illegible] rel-Rbw [illegible] rel-Rbw [illegible] Tot-I-R [illegible] PVO2 [illegible] (GLUT4), [illegible].

[illegible]