

The correlation between Lactate dehydrogenase activity and sperm concentration in the seminal plasma of infertile men.

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Abstract:

This study included 43 semen samples collected from sub-fertile and 10 samples of fertile men, after the abstinence period (3 to 5 days); it was conducted in the laboratory of Babylon Maternity and children, and private laboratories during the period from October 2016 to March 2017.

The study was aimed to expose for reasons of unexplained infertility in most cases, through valued the correlation between LDH activity and sperm concentration in the seminal plasma of infertile men and in comparison it with fertile men.

The results revealed significant differences ($P < 0.05$) in an average of the activity level of Lactate dehydrogenase enzyme between the different groups, the highest level was shown in the groups of fertile and normospermia and the lowest level in the oligospermia and oligo-asthenospermia, also revealed a significant negative correlation ($P < 0.05$) between LDH activity and sperm concentration in the seminal plasma of oligo-asthenospermia, the negative correlation observed in the group of normospermia and oligospermia while fertile men has positive correlation.

It was concluded the significance of LDH activity to detecting the capacity of gland secretion and ordinary semen components.

KEY WORDS: Lactate Dehydrogenase, seminal plasma, infertility.

Introduction

The seminal plasma is essential part of human semen required for sperms survival and passage in the sexual canal of female (1). It has the large variation of components and enzymes, lactate dehydrogenase (LDH) is essential in various metabolic processes which deliver the energy for spermatozoa viability, movement, and fertility (2).

Lactate dehydrogenase existing in all cells of the body and merely generate in the cytoplasm, the actions of isoenzyme current in the several organs and tissues (3). It is transmission enzyme of hydrogen that catalysis the oxidation of L-lactate to pyruvate in reverse reaction, and nicotinamide-adenine dinucleotide (NAD)⁺ make as acceptor of hydrogen, in the last stage for anaerobic glycolysis chain (4). The major percentage of LDH activity in the seminal plasma produces from prostate, and about 30 % is attributable to the sperm specific isoenzyme LDH-C4 (5).

The seminal plasma enzymes are interrelating with the absence or presence of sperms and infertility of men, several articles has been done for evaluation the enzymes activities in the seminal plasma and correlation with male infertility (6). Several reasons lead to male infertility such as congenital malformations or external factors such as anabolic steroids, smoking, alcohol, medicines, other reasons have ratio is about (40-50%) cause idiopathic

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infertility for men (7). The world health organization (WHO) classified the patients of infertility depending on the semen parameters after seminal fluid analysis. (8).

Materials and methods

Semen specimens:

The samples were collected from patients via masturbation after 3-5 days of sexual abstinences, then the specimens liquefy at 37C°, and the seminal fluid analysis was performed to detect the sperm parameters. According to the seminal fluid analysis the infertile patients classified into normospermia 22/43 samples, oligospermia 10/43 samples, oligo-asthenospermia 11/43samples, in addition to 10 samples of fertile men.

Preparation of specimens for LDH assessment:

The first process centrifugation of semen samples at 3000 rpm for ten minutes to remove the cells (sperms and round cells). The supernatant (seminal plasma) was taken and transformed to new plane tube and centrifugation also at 3000 rpm for 10 minutes, the supernatant was frozen at -20C° until the test.

Lactate Dehydrogenase (LDH) activity:

It was measured in the seminal plasma depend on the kinetic method, by using kit of Lactate dehydrogenase (LDH), made by Bio Maghreb (Tunisian company).

Statistical analysis:

It was done by using statistical package for social science (SPSS) (the version 16.0) was adopted to infer the significance, mean and standard deviation (SD), and to compare the effectiveness of enzymes in different groups by using Duncan experiment design, and the relationship between linear activity of enzyme and semen parameters and using the linear regression test (linear regression), which expresses these relations by linear equations and correlation coefficients for each relationship. These factors reflect the nature of the linear relations and the extent of the two axes (9).

Results

The estimation of LDH activity in seminal plasma of fertile and infertile patients showed significant decrease ($P<0.05$) in all infertile groups except the normospermia compared to fertile group. Also, all the normospermic patient showed significant increasing ($P<0.05$) of LDH activity compared to other infertile groups and the results revealed significant decreasing ($P<0.05$) of LDH activity in oligospermia, oligo-asthenospermia (figure 1).

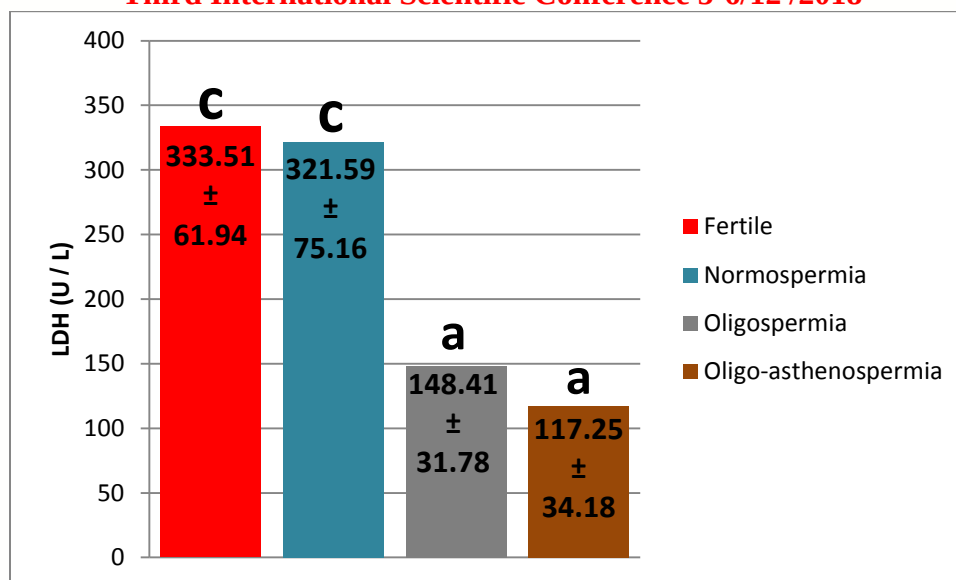


Figure (1) Lactate dehydrogenase activity levels
different letters mean significant differences. (mean± S.D.)

The results revealed positive correlation between sperm concentration and LDH activity in the seminal plasma of fertile men ($r = 0.080$) (figure-2), while the negative correlations in normospermia ($r = - 0.063$), oligospermia ($r = - 0.312$) (Fig 3,4) and oligo-asthenospermic patient have significant negative correlation ($P < 0.05$) ($r = - 0.704^*$) (figure-5).

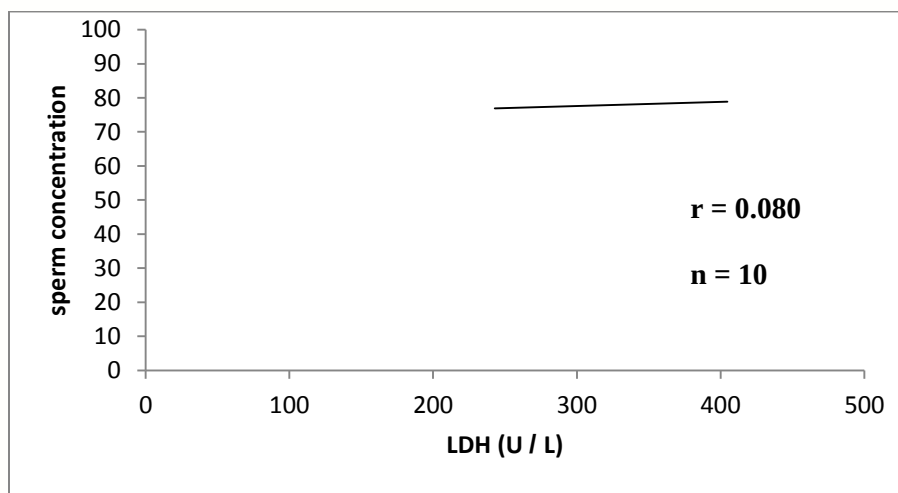


Figure-2 the correlation between sperm concentration and LDH activity in the seminal plasma of fertile men.

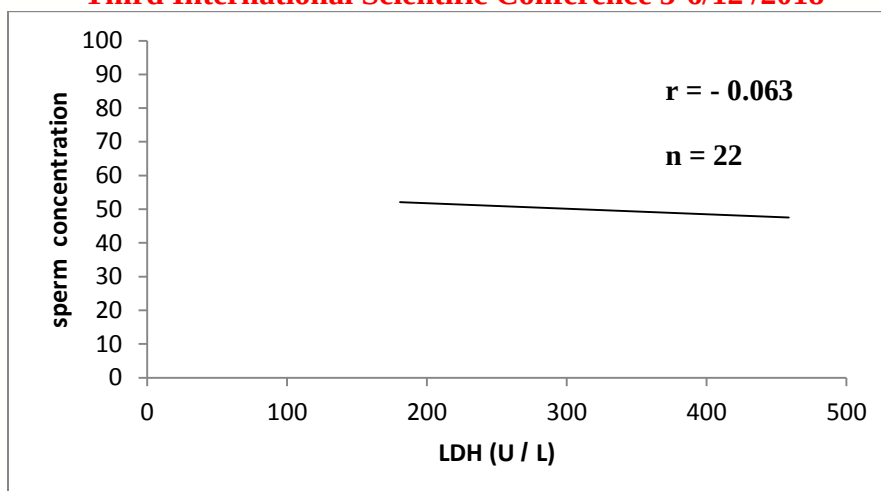


Figure-3 the correlation between sperm concentration and LDH activity in the seminal plasma of normospermia.

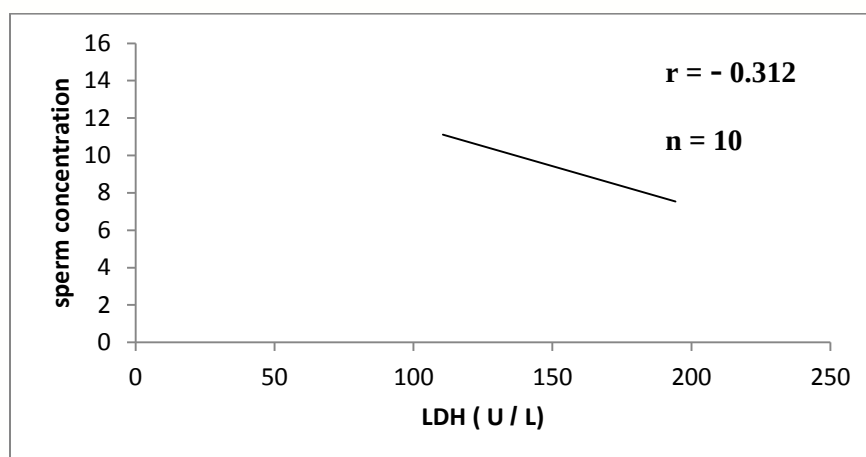


Figure-4 the correlation between sperm concentration and LDH activity in the seminal plasma of oligospermia

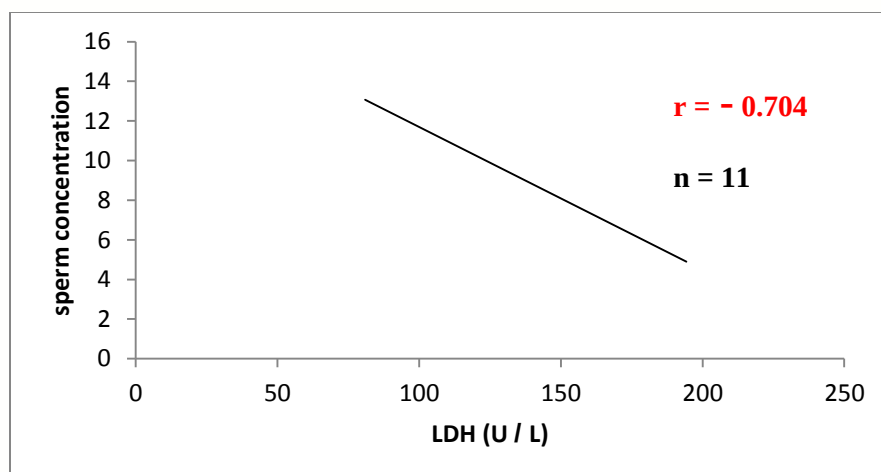


Figure-5 the significant ($P < 0.05$) negative correlation between sperm concentration and LDH activity in the seminal plasma of oligo-asthenospermia.

Discussion

Lactate dehydrogenase activity levels:

An investigation described the relationship between LDH-C4 activity in seminal plasma and male infertility (10), also debated the correlation of LDH isoenzyme and infertility for different organisms, and refer to the seminal fluid enzymes in derive from the secretions of the reproductive glands such as seminiferous tubule, epididymis, seminal vesicles, and the prostate gland (11).

The LDH-C4 isoenzyme is the important element in the metabolic processes needed for fertility and encoded by a third gene, creation of LDH-C4 is essential for active spermatogenesis (12). Feng *et al* (2015) clarified the activity level of LDH in seminal plasma more than serum for several infertility persons (13).

The results in this study showed significant decreasing ($P<0.05$) of LDH activity in the infertile groups except the normospermia compared to fertile group, also the results revealed the normospermic patient showed significant increase ($P<0.05$) of LDH activity compared to other infertile groups, that may be refer to the similarities in the semen parameters between groups of fertile and normospermia and the correlations between LDH activity and sperm parameters or may be refer to the normal activity of prostate secretion. The increasing in the percentage of live and normal sperm corresponded to an increasing in LDH activity in the seminal fluid. It has been stated that LDH plays an important metabolic role in sperm capacitation and fertilization (14). Amadou *et al* (2014) revealed non-significant differences ($P<0.05$) between seminal plasma LDH activity of normospermia and azoospermia(6).

Also, the results revealed significant decreasing ($P<0.05$) of LDH activity in oligospermia, oligo-asthenospermia, that may refer to the prostate function is the main source (5) and may be indicates the role of the enzyme in finding the balance between the pyruvate and lactate. These components may be important in the buffering competence of semen, or may refer to block out in the gland duct because inflammation or bacterial infection. Pyruvate and lactate are present at high concentrations in oviductal fluid (15) and hence they are commonly utilized as energy substrates by mammalian spermatozoa (16).

Butt and Akram, (2013) mention that the samples of oligospermia were related with significant higher abnormal motility and abnormal morphology (17). The correlation between LDH activity level and sperm motility may be working as a balancing factor to semen thickness, and correlated with LDH function in the metabolic process. The exogenous pyruvate and glucose together speed up the glycolytic machinery for produce sufficient ATP to support progressive motility and capacitation (18).

The correlations between LDH activity and sperm parameters:

The results showed negative correlations between sperm concentration and LDH activity in the seminal plasma of normospermia and oligospermia (Fig 3, 4) compare to positive correlation of fertile (figure-2) that may be refer to function of this enzyme in the semen and effect on the sperm function. Glucose, pyruvate and lactate are present at high concentrations in oviductal fluid (15) and hence they are commonly utilized as energy substrates by mammalian spermatozoa (Mukai and Okuno, 2004). These components may be important in the semen buffering capacity. Hereng *et al* (2011) conclude that exogenous pyruvate and glucose together speed up the glycolytic machinery to produce sufficient ATP to support progressive motility and capacitation(18).

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The significant negative correlation between sperm concentration and LDH in oligo-asthenospermia (figure-5), may be refer to prostate secretion and the effect of this enzyme function on regular the semen component. One study (19) mention several seminal plasma components present in substantial quantities and excluded from studies for many reasons of simplicity and practicality, these include lipids, choline, sialic acid, inositol, ascorbic acid, creatine, and pyruvate.

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