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Lipids and Testicular Function

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We studied 19 male patients with primary hyperlipoproteinaemia, a control group of 28 healthy men and 44 infertile males before any treatment was undertaken. Spermiogram, seminal biochemical studies, measurements of plasma hormone levels and lipid determinations were carried out. Most hyperlipoproteinaemic patients showed abnormalities in the spermiograms and the mean values were lower than in the controls except for semen volume. Seminal biochemical determinations were normal in the majority and the hormone profile showed some abnormal values, mainly for E_2. Lipid abnormalities were more common in azoospermic infertile men and mean lipid levels were higher. Correlation studies suggest that high levels of C and/or Tg are associated with poor semen quality and higher FSH levels. The results of our studies suggest that high lipid levels exert adverse direct effects at the testicular level.

Recent studies have suggested that plasma testosterone levels (T) are related to lipids and lipoproteins in normal and infertile men [1]. However, in the literature we have found only the paper by Perova et al. [2] particularly concerned with T and lipid studies in patients with lipid disorders, reporting that the ratios of triglycerides and cholesterol to apolipoproteins B were inversely related to T levels.

We performed two studies: the major aim of the first was to investigate the testicular function in patients with primary hyperlipoproteinaemia and of the second to assess whether and to what degree testicular function relates to plasma lipids in infertile patients.

Material and methods

Protocol 1. We studied 19 patients, aged 20–49 years, with primary hyperlipoproteinaemia (5, 9 and 5 type IIa, IIb and IV, respectively, according to Fredrickson) before any treatment was undertaken. At least two spermiograms and seminal biochemical studies (fructose, acid phosphatase and glyceryl-phosphoryl-choline) were performed, more than two weeks and less than three months apart, according to the WHO Laboratory Manual [3], as well as measurements by radioimmunoassays of FSH, LH, prolactin (PRL), T and estradiol (E_2). Plasma lipid determinations were made for total cholesterol (C), triglyceride (Tg) and lipoprotein electrophoresis. A control group composed of 28 healthy men was

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studied for semen comparison. Statistical analyses used were Student's *t*-test and simple correlation tests.

Protocol 2. We studied 44 consecutive patients, aged 20–45 years, who had consulted us because of infertility; 8 were azoospermic (no sperm in ejaculated semen), 25 oligozoospermic ($< 20 \times 10^6$/ml sperm) and 11 normozoospermic ($\geq 20 \times 10^6$/ml sperm). Spermiograms, seminal biochemistry, plasma hormones and lipid determinations were the same as those performed in Protocol 1. In this group we also measured dihydrotestosterone (DHT), high density lipoprotein cholesterol (HDL_c) and low density lipoprotein cholesterol (LDL_c). For statistical analysis we used Student's *t*-test as well as simple and partial correlation tests.

Results

Protocol 1. Most patients showed abnormalities in sperm motility, morphology and viability. Seminal biochemical determinations were normal in the majority of cases and the hormone profile showed only abnormal values of FSH, LH and T in around 20% of the patients, whereas in the majority PRL was normal and E_2 was abnormal (Table 1).

Table 1

Frequency of patients with primary hyperlipoproteinaemia with normal or abnormal spermiograms, seminal biochemistry and hormone levels

	Normal		Abnormal	
	n	%	n	%
Spermiogram				
Density	16	84.2	3	15.8
Motility	5	26.3	14	73.7
Normal morphology	5	26.3	14	73.7
Viability	9	47.4	10	52.6
Volume	16	84.2	3	15.8
Seminal biochemistry				
Fructose	14	87.5	2	12.5
Acid phosphatase	11	68.8	5	31.2
GPC	13	81.3	3	18.7
Hormones				
FSH	13	76.5	4	23.5
LH	10	71.4	4	28 6
PRL	15	93.8	1	6.2
T	13	81.3	3	18.7
E_2	6	40.0	9	60.0

Table 2

Results of spermiograms in patients with primary hyperlipoproteinaemia and in the control group ($\bar{X} \pm$ SEM)

Spermiogram	Hyperlipoproteinaemia (n = 19)	Control group (n = 28)
Density (10^6/ml)	63.4± 9.7*	104.8± 15.3
Motility (%)	26.4± 3.9*	72.0± 3.6
Normal morphology (%)	35.0± 3.8*	68.0± 2.8
Volume (ml)	3.2± 0.3	3.2± 0.2

* $p < 0.05$

Table 3

Frequency of infertile patients with abnormal lipid values

Lipid determinations	Azoospermic		Oligozoospermic		Normozoospermic	
	n	%	n	%	n	%
Cholesterol	1	12.5	0	—	0	—
Triglyceride	6	75.0	9	36.0	4	36.4
HDL_c	4	50.0	15	60.0	6	54.5
LDL_c	3	37.5	5	20.0	5	45.4
Lipoprotein electrophoresis	4	50.0	4	16.0	1	9.1

Table 4

Lipid levels in infertile patients ($\bar{X} \pm$ SEM)

Lipids	Azoospermic (n = 8)	Oligozoospermic (n = 25)	Normozoospermic (n = 11)
Cholesterol	218.5± 43.3 a* c***	172.0± 27.6 b NS	189.2± 28.7
Triglyceride	249.9± 154.3 a** c**	135.1± 97.2 b NS	115.5± 50.0
HDL_c	365 ± 8.4 a: NS c: NS	38.6± 7.3 b NS	43.9± 14.3
LDL_c	132.1± 41.9 a*** c: NS	106.3± 30.6 b NS	122.3± 31.5

a: Azoospermic vs. oligozoospermic
b: Oligozoospermic vs. normozoospermic
c: Azoospermic vs. normozoospermic

*$p < 0.005$
**$p < 0.01$
***$p < 0.05$
NS: Not significant

Table 5

Correlations between lipids, semen parameters and hormone levels in infertile patients

	Cholesterol	Triglycerides	HDL_c	LDLc
Semen				
Density	−0.05	−0.14	0.39**	0.06
Motility	−0.10	−0.18	0.12	0.01
Morphology	−0.20	−0.40**	0.29	0.12
Viability	−0.28	−0.35***	0.32***	0.02
Acid phosphatase	0.26	0.19	−0.23	0.16
Fructose	0.17	0.02	−0.26	−0.02
GPC	0.07	0.11	−0.14	0.00
Hormones				
FSH	0.45*	0.22	−0.05	0.34
LH	0.17	−0.03	0.13	0.18
PRL	0.08	0.32***	−0.03	−0.12
T	−0.36***	−0.18	0.13	−0.24
DHT	−0.38***	−0.20	0.18	0.28
E_2	−0.06	−0.08	0.02	0.00

*$p < 0.01$
**$p < 0.025$
***$p < 0.05$

Mean values of the spermiogram were significantly lower than in the controls ($p < 0.05$), except for semen volume (Table 2).

Correlation analysis suggests that high levels of C and/or Tg are associated with poorer semen quality. No correlation was found between lipids and hormone levels

Protocol 2. Lipid abnormalities were more common in azoospermic than in oligozoospermic and normozoospermic infertile men (Table 3).

Mean levels of C, Tg and LDL_c were higher in azoospermic than in oligozoospermic and normozoospermic patients; Tg was also higher in oligozoospermic than in normozoospermic patients. There was a tendency to lower levels of HDL_c in azoospermic and oligozoospermic, but the differences compared to normozoospermic patients were not significant (Table 4).

Positive correlations were found between HDL_c and sperm density and viability, C and LDL_c, FSH and Tg and PRL. Negative correlations were noted between Tg and normal sperm morphology and viability and between C, T and DHT (Table 5).

Discussion

The results indicate that patients with primary hyperlipoproteinaemia generally present spermiogram anomalies, especially sperm motility, morphology and viability. The correlation studies suggest that high levels of C and/or Tg may cause adverse effects in semen quality, especially sperm viability.

With regard to seminal biochemistry determinations and hormone profile of hyperlipoproteinaemic patients it is demonstrated that the majority of them are normal, suggesting a normal function of the accessory sex glands, and of the hypothalamo-pituitary-gonadal axis, although it is possible that a subtle disorder of this axis not evident in basal conditions may be involved.

The finding that E_2 was lower than normal in 60% of the hyperlipoproteinaemic patients might suggest a disorder in androgen metabolism and it is necessary to determine whether it is related to the spermatogenetic abnormalities at the testis level and/or at the peripheral level due to the primary lipid disorder.

Our results indicate that lipid abnormalities are more common in infertile patients with severe spermatogenetic damage; also lipid levels are higher in these patients, except HDL_c levels that are lower. The correlation studies suggest that high levels of C and/or Tg and low levels of HDL_c are associated with poor semen quality; because of the higher FSH levels and C–FSH correlations in these patients it is possible that all these findings are related to the spermatogenetic damage.

In conclusion, the results of our studies seem to indicate that high lipid levels exert direct adverse effects at the testicular level, mainly in the seminiferous tubules.

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References

1. Mendoza, S. G.: Hypertriglyceridemia and hypoalphalipoproteinaemia in azoospermic and oligospermic young men. Relationships of endogenous testosterone to triglyceride and high density lipoprotein cholesterol metabolism. *Metabolism, 30*, 481 (1981).
2. Perova, N. V.: Alteration of apoproteins of very low density lipoprotein from blood plasma in hypertriglyceridemia. *Vopr. Med. Khim. 25*, 185 (1979).
3. WHO Special Programme of Research, Development and Research Training in Human Reproduction. In: M. A. Belsey et al. (eds): Laboratory Manual for the Examination of Human Semen and Semen-Cervical Mucus Interaction. Press Concern, Singapore 1980.