

## EFFECT OF CARICA PAPAYA (L.) SEED EXTRACT ON LIPID METABOLITES IN MALE ALBINO RATS

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### ABSTRACT

The objective of the present study was to find out the impact of *Carica papaya* seed extract on lipid metabolism. *Carica papaya* seed extract was administered for 15 days to adult male albino rats according to WHO protocol. The administration of *Carica papaya* seed extract shows degradation of total lipids, probably due to papain present in *Carica papaya*, indicating impaired lipid metabolism in the testis. The extract also influences some alterations in the chemical composition of the seminal plasma and prostatic fluid by increasing the lipofusein granules in seminal fluid. The reduced lipase activity indicates the inhibition of lipoprotein lipase activity, increased energy expenditure, inhibition of nutrient absorption from the gastrointestinal tract. The amount of fatty acids and polar compounds of high molecular weight present in the seeds of *C. papaya*, may be responsible for elevated free fatty acids and contraceptive efficacy. The accumulation of phospholipids represent that they were not utilized for spermatogenesis, sperm maturation and for the formation of seminal plasma. The reduced cholesterol levels in testes indicate the reduction in steroidogenesis. Accumulation of cholesterol in sex accessory organs is a direct evidence for anti androgenic action of *Carica papaya* seed extract.

**Keywords:** *Carica papaya* seed extract, Lipid metabolism, Antifertility.

### INTRODUCTION

Antifertility means capable of reducing or eliminating fertility or contraceptive [1]. Attention has been given to the medicinal value of herbal remedies for safety, efficacy and economy [2&3]. Ethnobotanical knowledge provides very useful basic clues not only in the problem relating to nomenclature identification of crude drugs extract but also in the discovery and the use of medicinal plants. Contraception is a subset of birth control technique and literally means the prevention of fertilization. *Carica papaya* Linn. is a monoecious, dioecious or hermaphrodite tree; it belongs to the family Caricaceae [4]. It is widely cultivated throughout world and is used as food and traditional medicine, particularly as an antiseptic and contraceptive. *Carica papaya* is a plant amid few whose fractions have been exploited and documented for its antifertility properties [5&6]. The locally available and widely distributed *C. papaya* seed have shown great promise in male contraception in animal models. [7-13]. But all these studies were confined to histological and sperm metabolism. In light of these facts, the present study was conducted to monitor the effects of *Carica papaya* seed extraction on the reproductive system of adult male albino rats with special emphasis on the lipid metabolism.

### MATERIALS AND METHODS

Healthy adult male Wistar strain albino rats (90days old, weight 180±10g) were administered with 150mg/kg body wt/day of ethanol extract of *papaya* seed orally for 15days. The ethanol extract was prepared according to WHO protocol CG-04, 1983 [14]. Seeds were shed-dried, powdered and extracted with 95%ethanol (v/v) at 55-60°C for 3h. The solvent was distilled off under reduced pressure; the resulting mass was dried under vacuum and kept at 24°C until use. The control animals were given normal saline or sterile distilled water. Both control and experimental rats were maintained in standard air conditioned animal house at a temperature of 25±2°C, photoperiod of 12 hours light and 12 hours dark cycle, with a relative humidity of 50 ± 5% and fed on standard rat feed obtained from Hindustan Lever Ltd., Mumbai, India. The usage of animals was approved by the Institutional Animal Ethics resolution number 18/2012-2013/(i)/a/CPCSEA/IAEC/SVU/CC-SHB Dt: 01-07-2012.

Twenty four hours after the last dose, the animals were autopsied. The tissues like testes, epididymis, seminal vesicle and prostate gland were isolated used for biochemical analysis. The Total lipids [15], Lipase activity [16-18], free fatty acid [19], glycerol [18&20], Phospholipids [21], Triglycerides [22], Total Cholesterol [23] were estimated in control and experimental rat tissues.

### RESULTS AND DISCUSSION

The data represented in table-1 shows the effect of *Carica papaya* seed extract on lipid profiles of reproductive tissues of control and *Carica papaya* seed extract administered male albino rats.

The levels of total lipids in reproductive tissues like testes and epididymis were significantly decreased while in the seminal vesicle and prostate gland they are significantly elevated.

Apart from carbohydrates, lipids are the second major fuel for mammalian organisms. The lipid content and distribution of the mammalian germ cell change in an ordered fashion from the first spermatogonial cell division, through spermatogenesis and epididymal maturation to capacitation and fusion with the oocyte in the female genital tract [24&25]. The lipid composition of the sperm membrane exerts a significant effect upon the functional quality of spermatozoa [26&27]. The degradation of lipids is probably due to papain present in *Carica papaya* [28] indicating impaired lipid metabolism in the testis [29]. The higher lipid indicates the elevation in lipid metabolism and lipogenesis, suggesting some alterations in the chemical composition of the seminal plasma and prostatic fluid. Hence the seed extract increases the lipofusein granules in seminal fluid [5] (Lohiya *et al.*, 1999).

The *Carica papaya* seed extract showed significant reduced lipase activity in testes and epididymis. But in secretory organs like seminal vesicle and prostate gland this enzyme activity was significantly increased. Lipase is an enzyme that catalyzes the formation or hydrolysis of fats (lipids) [30]. Lipases perform essential roles in the digestion, transport and processing of dietary lipids (e.g. triglycerides, fats, oils) in most, if not all, living organisms. The reduced lipase activity indicates the inhibition of lipoprotein lipase activity, increased energy expenditure, inhibition of nutrient absorption from the gastrointestinal tract [31&32].

In the present study the testicular free fatty acids were increased in testes, epididymis and prostate, the extent of increment is more in epididymis. But in seminal vesicle they reduced significantly. Fatty acids are important sources of fuel because, when metabolized, they yield large quantities of ATP. Many cell types can use either glucose or fatty acids for this purpose. The testis is an extraordinary organ regarding the fatty acid (FA) metabolism. Although rich in polyunsaturated fatty acids (PUFAs), the testis is continuously drained of these FAs as the spermatozoa are transported to the epididymis; the epididymis shows more elevation in free fatty acids [33]. It is likely that the amount of fatty acids and polar compounds of high molecular weight present in the seeds of *C.*

papaya, which may be responsible for elevated free fatty acids and contraceptive efficacy [34].

The glycerol content was significantly reduced in all reproductive tissues except in epididymis, where it was elevated. Glycerol is the backbone of triglycerides, the most important storage form of fat; it is an important metabolite in energy metabolism involved in both oxidation and synthetic processes [35]. Unlike the free fatty acids, glycerol cannot be reutilized by adipose tissue. The measurement of circulating levels of glycerol and free fatty acids are considered to reflect lipolysis, and may be useful to evaluate lipolysis under various conditions in clinical studies [36].

Phospholipids are essential molecules found in all cellular membranes [37]. During sperm maturation in the epididymis, the anterior head membrane undergoes a well-defined series of chemical changes. These include an enrichment of highly unsaturated phospholipids, which leads to a decrease in general membrane stability [38].

In the present study the phospholipids were elevated in all reproductive tissues the accumulation of these phospholipids resulted by the administration of *Carica papaya* seed extract, as they were not utilized for spermatogenesis, sperm maturation and for the formation of seminal plasma. Thus the *Carica papaya* seed extract shows its antispermatic property by accumulation of phospholipids in all reproductive tissues.

Triglycerides are an important measure of heart health. The reduced triglycerides were noticed in all tissues including in serum. It has

been reported that the elevated levels of plasma triglycerides associated with a higher incidence of coronary heart disease [39]. Hence, the reduced triglycerides represent there was no risk of coronary heart disease when the *Carica papaya* seed extract used for infertility.

Mammalian cells require cholesterol which plays an important role in acting as precursor molecule in the synthesis of steroid hormones [40] and its level is related to fertility [41&42]. The decreased testicular levels indicate the decreased steroidogenesis as it is the precursor molecule of steroid hormones, such as progesterone, testosterone and cortisol [43].

But the accessory organs showed different trend in cholesterol levels, as they were elevated more. The sex accessory organs are androgen dependents. The testes secrete low levels of androgens due to the inhibition of testicular cholesterol levels. Accumulation of cholesterol is a direct evidence for antiandrogenic action of *Carica papaya* seed extract [44].

## CONCLUSIONS

It is concluded that the the reduced triglycerides represent no risk of coronary heart disease when the *Carica papaya* seed extract used for infertility. Accumulation of cholesterol is a direct evidence for antiandrogenic action of *Carica papaya* seed extract.

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**Table 1: Lipid profiles in reproductive tissues of Control and Papaya seed extract treated rats.**

S. No.	Parameter	Control, seed extract, % change and significance			
		Testis	Epididymis	Seminal vesicles	Prostate gland
1.	Total Lipids (mg/g wet wt)	80.10±7.25	64.16±5.33	75.79±6.54	78.70±4.26
		61.25±4.89	39.57±2.29	98.52±7.36	96.11±6.57
		-23.53*	-38.32*	+29.99*	+22.12*
2.	Lipase activity ( $\mu$ moles of PNPA cleaved/mg protein/hr)	0.591±0.033	0.623±0.045	0.747±0.052	0.752±0.041
		0.472±0.026	0.486±0.031	0.953±0.076	0.996±0.074
		-20.13*	-21.99*	+27.57*	+32.44*
3.	Free Fatty acids (mg/g wet wt)	19.07±1.43	16.83±1.10	23.00±2.15	40.39±3.92
		21.32±1.97	24.68±1.86	16.83±1.10	49.37±3.96
		+11.79***	+46.64*	-26.82*	+22.23**
4.	Glycerol (mg/g wet wt)	48.71±3.89	67.64±4.51	48.71±3.81	70.59±6.28
		31.40±2.92	91.11±6.73	40.47±3.95	56.15±4.33
		-35.53*	+34.69*	-16.91**	-20.45*
5.	Phospholipids (mg/g wet wt)	33.3±2.73	30.4±1.82	23.9±1.84	41.9±3.63
		42.2±3.61	39.2±2.43	28.5±2.13	48.9±4.15
		+26.72*	+28.94*	+19.24**	+16.70*
6.	Triglycerides (mg/g wet wt)	46.66±2.31	37.14±2.65	33.92±1.86	33.57±2.46
		34.04±2.85	30.23±2.03	25.59±1.73	24.52±1.66
		-27.04*	-18.60*	-24.55*	-26.95*
7.	Total Cholesterol (mg/g wet weight)	3.507±0.180	0.952±0.076	0.544±0.043	6.191±0.580
		1.220±0.095	1.716±0.142	1.155±0.101	5.808±0.444
		-65.21*	+80.25*	+112.3*	-6.18NS

Mean+ SD of six individual observations.

+ and - indicates percent increase and decrease respectively over control.

\*P<0.001, \*\* P<0.01, \*\*\* P<0.05 indicates the level of significance.

NS- non significant changes.

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