

## AN ANALYSIS OF EFFECT OF DIET ON SEMEN PARAMETERS

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### ABSTRACT

**Introduction:** The importance of diet in determining the quality of human semen has been recognized for quite some time. Mediterranean' dietary pattern derived by principal component analysis (PCA), which was characterized by high intakes of vegetables, fruits and seafood, was positively associated with total sperm count. With the above background, we conducted a study to know the adherence to Mediterranean diet and its effect on semen parameter.

**Materials & methods:** This cohort study was conducted in NEIGRIHMS from Jan 2016 to December 2018. We included 411 male partners aged 20–45 years and without any medical history of systemic diseases, cryptorchidism, varicocele, microorchidism, vasectomy or hormonal treatment in the last six months in the study after adequate counseling. Participants were informed about the importance of intake of Mediterranean diet (Med diet) and to quit smoking. After 6 months to 1 year of following the advice, the participants came to andrology laboratory for semen analysis. The semen parameters, Mediterranean diet score and smoking habits were correlated by using spss software version 22.

**Results & Observations:** It is seen that individual calculated p-value for coefficients of Progressive motility rate, Non- Progressive motility rate and Morphology are less than 0.05 at 5% level of significance. Also it shows from the table that there may be positive correlation with Mediterranean diet score.

**Conclusion:** Greater adherence to this traditional diet was associated with a lower likelihood of having an abnormal semen profile, which suggests that dietary modifications and compliance to the Med diet may help improve semen parameter.

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## INTRODUCTION

Fertility problems are serious concerns affecting the lives of at least 12% of population<sup>[1]</sup>. Beside the pathological causes of infertility, like dysgenetic, neuroendocrine or gonadal, the issues related to socio-cultural and environmental factors such as decline of number of marriages, or the increasing average age at marriage caused by difficulties of work placement and last but not the least dietary factors. In an average of almost 40% of infertile couples, the male partner is the sole or contributing cause in the inability to conceive<sup>[2]</sup>. The importance of diet in determining the quality of human semen has been recognized for quite some time.

Semen analysis is the cornerstone of the laboratory examination for male infertility and a recent comprehensive review has even pointed to a tremendous decrease in semen quality parameters<sup>[3]</sup>. Apart from the genetic and endocrinal risk factors, lifestyle especially diet has been suggested to play an important role in male fertility. Diet presents a potential opportunity for intervention, and therefore an important consideration in the counseling of sub fertile healthy young men<sup>[4]</sup>. A 'prudent' dietary pattern characterized by a high intake of fruits, vegetables, chicken, fish and whole grains was

associated with higher sperm progressive motility. 'Mediterranean' dietary pattern derived by principal component analysis (PCA), which was characterized by high intakes of vegetables, fruits and seafood, was positively associated with total sperm count<sup>[5]</sup>. Studies among men of sub fertile couples have also revealed that a 'Mediterranean' dietary pattern, characterized by high intakes of fruits, vegetables, fish and whole grains, is related to lower DNA fragmentation, higher sperm motility<sup>[6]</sup>, higher sperm concentration and higher levels of testosterone<sup>[7]</sup>. In this study we had counseled the young male partner about the significance of Mediterranean diet and life style changes in affecting the semen parameters. Our institute North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences (NEIGRIHMS) is situated in the north east part of India where people basically takenon vegetarian diet especially meat and rice with hardly any fruits or vegetables. With the above background, we conducted a study to know the adherence to Mediterranean diet and its effect on semen parameter.

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**MATERIALS & METHODS**

The present study was conducted in NEIGRIHMS from Jan 2016 to December 2018. The couples with primary infertility, seeking evaluation and treatment at the infertility centre NEIGRIHMS participated in the cohort study. We included 411 male partners aged 20–45 years and without any medical history of systemic diseases, cryptorchidism, varicocele, microorchidism, vasectomy or hormonal treatment in the last six months in the study after adequate counseling. Informed consent was taken from all the participants. Participants were informed about the importance of intake of Mediterranean diet (Med diet) and to quit smoking. After 6 months to 1 year of following the advice, the participants came to andrology laboratory for semen analysis. To evaluate the level of adherence to the Med diet, the Meddiet Score was calculated for each participant [8], by taking into account the consumption of food items from nine food groups, as well as olive oil and alcoholic beverages. The components and the scoring system for calculating Meddiet Score are shown in Table 1. The range of the Meddiet Score is 0–55, with higher values indicating greater adherence to the Med diet [9].

**Table 1** The Mediterranean diet score

How often do you consume	Frequency of consumption (servings/week or otherwise stated)	1	2	3	4	5
Non-refined cereals (whole grain bread, pasta, rice, etc.)	Never	1–6	7–12	13–18	19–31	>32
	0	1	2	3	4	5
Potatoes	Never	1–4	5–8	9–12	13–18	>18
	0	1	2	3	4	5
Fruits	Never	1–4	5–8	9–15	16–21	>22
	0	1	2	3	4	5
Vegetables	Never	1–6	7–12	13–20	21–32	>33
	0	1	2	3	4	5
Legumes	Never	<1	1–2	3–4	5–6	>6
	0	1	2	3	4	5
Fish	Never	<1	1–2	3–4	5–6	>6
	0	1	2	3	4	5
Red meat and products	≤1	2–3	4–5	6–7	8–10	>10
	5	4	3	2	1	0
Poultry	≤3	4–5	5–6	7–8	9–10	>10
	5	4	3	2	1	0
Full fat dairy products (cheese, yoghurt, milk)	≤10	11–15	16–20	21–28	29–30	>30
	5	4	3	2	1	0
Use of olive oil in cooking (times/week)	Never	Rare	<1	1–3	3–5	Daily
	0	1	2	3	4	5
Alcoholic beverages (ml/day, 100 ml = 12 g ethanol)	<300	300	400	500	600	>700 or 0
	5	4	3	2	1	0

Participants were asked to abstain from ejaculation for at least 48 hours before sample collection. The semen sample was immediately delivered to the laboratory and incubated in a 37°C incubator. The duration of complete liquefaction (<1 h) was documented. One semen sample was assessed for each subject as per WHO recommendation. The semen parameters, Mediterranean diet score and smoking habits were correlated by using spss software version 22. Azoospermia samples were excluded from our study.

Basically sperm count, progressive motility, vitality and morphology were taken into consideration in our study. Med diet score and the semen parameters were analyzed by linear regression by using software version 21.

**RESULTS & OBSERVATIONS**

It is seen that individual calculated p-value for coefficients of Progressive motility rate; Non- Progressive motility rate and Morphology are less than 0.05 at 5% level of significance. Therefore, we may conclude that Mediterranean diet has

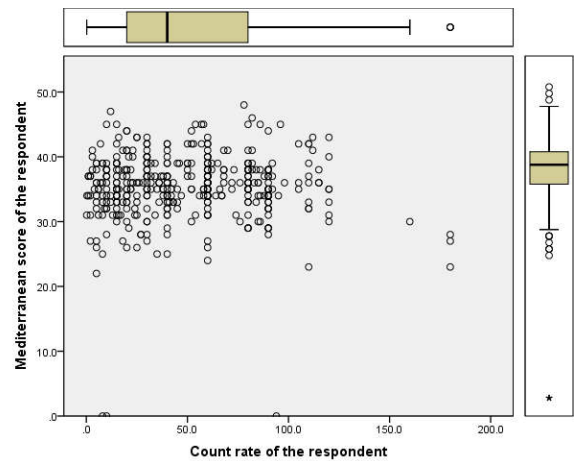
impact on semen parameters. Also it shows from the table 3 that overall semen parameter has significant positive correlation with Mediterranean diet score.

**Table 2** Correlation of semen parameters with Med diet.

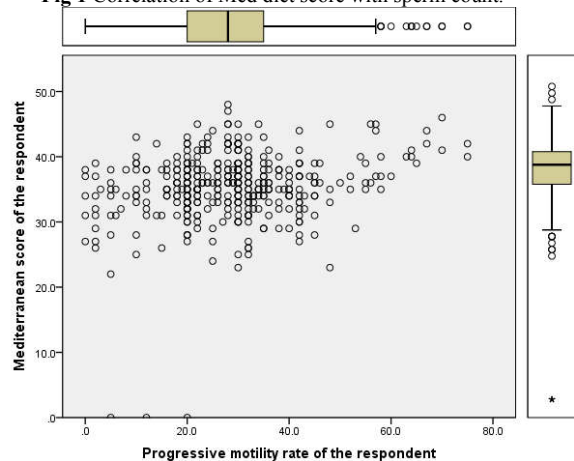
	Pearson Correlation R <sup>2</sup>	Coefficient of independent variables considered	t-statistic value	p-value	95.0% Confidence Interval	
					Lower bound	Upper bound
Count rate	0.005	-0.011	-1.261	0.208	-0.027	0.006
Progressive motility rate	0.235	0.100	5.044	0.000	0.061	0.140
Non-Progressive motility rate	0.302	0.150	6.665	0.000	0.106	0.194
Vitality score	0.117	-0.008	-0.380	0.705	-0.049	0.033
Morphology	0.033	-0.375	-2.071	0.39	-0.730	-0.019

**Table 3** Overall correlation of semen parameter with Med diet

Model	Sum of Squares	df	Mean Square	F	p-value
Regression	1749.807	5	349.961	14.863	0.000
Residual	9535.906	405	23.545		
Total	11285.713	410			



**Fig 1** Correlation of Med diet score with sperm count.



**Fig 2** Correlation of Med diet score with sperm progressive motility.

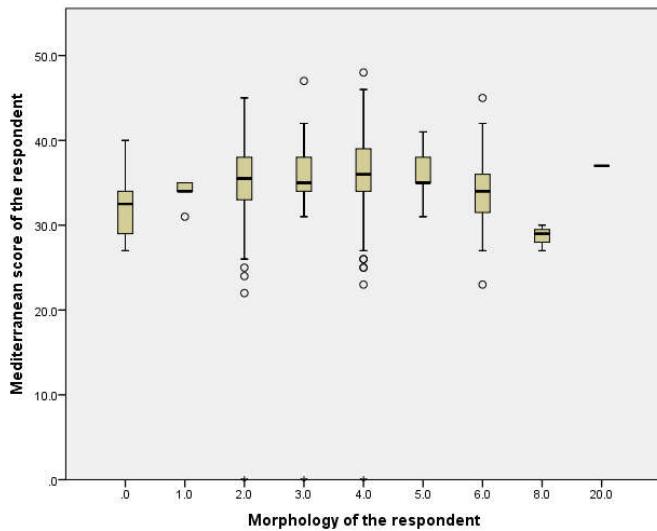


Fig 3 Correlation of med diet score with sperm morphology.

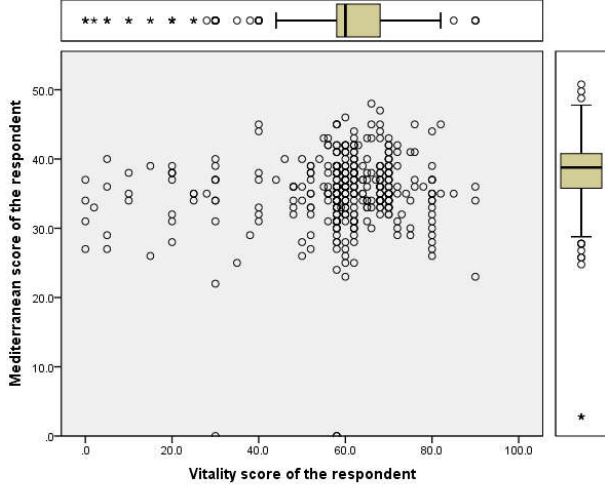


Fig 4 Correlation of Med diet score with sperm vitality.

Disclosure of conflict of interest- There is no conflict of interest amongst the authors

Ethical approval- Since this was an observational study conducted as part of treatment of IVF in our institute, ethical approval was not taken.

## DISCUSSION

The gold standard for evaluation of male infertility is through semen analysis (sperm count, motility and morphology). Though data from semen analyses have been conflicting but have nonetheless created increasing concern<sup>[10]</sup>.

Because of changing dietary habits in the past several decades globally, the increase in male infertility has often been linked to lifestyle and dietary factors, amongst many other modifiable factors. In our part of the country diet pattern consists of mostly fats and rare vegetable and fruits. Therefore, we had positive correlation with Meddiet score and semen parameters. Since, Med diet is also characterized by a high intake of fruits, vegetables, legumes and whole grains, and a low intake of meat and saturated fatty acids, adherence to the Med diet has been shown to confer multiple health benefits<sup>[11]</sup>, and a recent study among 215 healthy male university students showed that higher adherence to a 'Mediterranean' pattern identified by PCA was positively associated with total sperm count<sup>[5],[6]</sup>. Some studies with higher adherence to a 'Prudent' dietary pattern, bearing close resemblance to the Mediterranean

pattern, is associated with higher total sperm count and motility<sup>[6],[7]</sup>.

The favorable effect(s) of the Med diet on semen parameters may be mediated by various mechanisms. The Med diet is naturally high in nutrients with favorable anti-inflammatory properties and low in pro-inflammatory nutrients. Inflammation may affect reproduction through anatomical or functional alteration of the male accessory gland, and/or direct negative effects on the spermatozoa<sup>[12]</sup>. The association between adherence to the Med diet and semen quality could also be mediated through an increased intake of omega-3 fatty acids found in fish.

Compared with other cells or tissues, sperms and testicular cells have a higher concentration of long-chain (LC-) polyunsaturated fatty acids (PUFAs), particularly docosahexanoic acid (DHA). The increase in DHA levels in the sperm membrane during sperm maturation suggests that testes have high levels of active fatty acid metabolism, resulting in the preferential accumulation of LC-PUFAs due to efficient metabolism of PUFAs into the long-chain metabolites. Furthermore, seafood is characterized by a high proportion of fat-soluble vitamins which play a crucial role in fertilization<sup>[13]</sup>. Med diet is a dietary pattern low in saturated and trans-fatty acids, which have been shown to adversely affect semen quality<sup>[14]</sup>. The Med diet is also characterized by high intakes of fruits and vegetables rich in antioxidants, such as beta-carotene and vitamins E and C, which have been suggested to improve semen quality. C arotenoid intake, for example, has been associated with higher sperm motility in young healthy males<sup>[15]</sup>. In our study, longer study period could have demonstrated higher impact of med diet on semen parameters because of longer and stronger adherence.

## CONCLUSION

Greater adherence to this traditional diet was associated with a lower likelihood of having an abnormal semen profile, which suggests that dietary modifications and compliance to the Med diet may help improve semen parameter. Whether the beneficial effect of the Med diet on semen parameters translates into a higher probability of successful conception remains to be elucidated.

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