Journal of Health and Social Sciences Advance Publication Online
Published Online February 28, 2020 doi10.19204/2020/thff12
The Italian Journal for Interdisciplinary Health and Social Development

ORIGINAL ARTICLE IN PUBLIC HEALTH

The effect of nutrition-related patterns on primary infertility among couples in Gaza Strip: A case-control study

Authors: Amal DHAIR[1], Maha NUBANI HUSSEINI[2], Yehia ABED[3]

Affiliations:

[1] *MPH, Deputy Head Health Center, Health Department, UNRWA, Gaza Strip, Palestine*

[2] *PhD, Faculty of Public Health, Al-Quds University, Jerusalem, Palestine*

[3] *Prof, Faculty of Public Health, Al-Quds University, Gaza Strip, Palestine*

Corresponding Author:

Dr. Amal Dhair, Deputy Head Health Center, Health Department, UNRWA, Gaza Strip, Palestine, E-mail: Amaldhair@yahoo.com

Abstract

Introduction: Nutritional health is one of the most controversial themes that had long been investigated against reproductive health. This study aimed to explore the relationship between different diet components and behaviour among infertile and fertile couples.

Methods: A case-control study was conducted in Gaza Strip with the participation of 160 infertile couples matched residentially with 160 fertile ones. Infertile couples were chosen from patients who were registered in five fertility centers from 2016 to 2018. Data were collected through a self-administered questionnaire extended by the WHO STEP wise diet questionnaire and analyzed through SPSS program version 22 by using descriptive analysis, independent T-test, cross-tabulation, and logistic regression.

Results: Our findings revealed that more infertile couples than fertile ones consume vegetables

for less than 4 days/week ($P = 0.001$, females and males), less than 3 servings in each of these days ($P < 0.001$, females and males), less than 5 total servings of fruits and vegetables ($P = 0.004$ females, $P = 0.010$ males) and more red meat in main meals ($P = 0.010$ females, $P = 0.042$ males). Regular consumption of sweets and/or chips, soda and/or canned juice and using vegetable oil rather than olive oil also provided significant positive association ($P = 0.031$, $P = 0.022$, $P = 0.020$ respectively). Adjusting covariates showed that 65% of the risk is reduced by consumption of vegetables for more than 3 days/week ($P = 0.007$) and 54% reduction is achieved with every additional serving of vegetables consumed per day ($P = 0.029$).

Conclusion: The study provides credible evidence for the importance of following healthy nutritional patterns that seems to offer remarkable protection against primary infertility.

KEY WORDS: Diet Behaviour; diet component; Gaza Strip; nutritional health; primary infertility.

Riassunto

Introduzione: La salute nutrizionale è uno dei temi più controversy che è stato a lungo indagato rispetto alla salute riproduttiva. Questo studio è finalizzato ad esplorare la relazione tra differenti component dietetiche ed il comportamento tra le coppie fertili ed infertili.

Metodi: Uno studio caso-controllo è stato condotto nella Striscia di Gaza con la partecipazione di 160 coppie infertile appaiate per residenza a 160 fertili. Le coppie infertile sono state scelte da pazienti registrati in 5 centri per la fertilità dal 2016 al 2018. I dati sono stati raccolti attraverso un questionario auto-somministrato esteso dal questionario relative alle abitudini alimentari dell'Organizzazione Mondiale della Salute con approccio STEPwise ed analizzati attraverso il software SPSS versione 22 attraverso statistiche descrittive, T-test di Student a campioni

indipendenti, analisi di tabulazione incrociata e regression logistica.

Risultati: I nostril risultati hanno rivelato che le coppie infertili consumano più delle coppie fertili verdure per meno di 4 giorni alla settimana ($P = 0.001$, femmine e maschi), meno di 3 portate in ciascuno di questi giorni ($P < 0.001$, femmine e maschi), meno di 5 porzioni totali di frutta e verdure ($P = 0.004$ femmine, $P = 0.010$ maschi) e più carne rossa ai pasti principali ($P = 0.010$ femmine, $P = 0.042$ maschi). Il regolare consumo di dolci e patatine, bibite gassate e/o succhi di frutta in scatola, l'uso di olio vegetale più che olio d'oliva ha fornito anche una significativa associazione positiva ($P = 0.031$, $P = 0.022$, $P = 0.020$ rispettivamente). Le covariate aggiustate hanno evidenziato che il 65% del rischio è ridotto con il consume di verdure per più di 3 giorni la settimana ($P = 0.007$) ed il 54% è ottenuto con ogni porzione addizionale di verdure consummate per giorno ($P = 0.029$).

Conclusione: Lo studio fornisce credibile evidenza dell'importanza di seguire pattern nutrizionali salutary che sembrano offrire una rilevante protezione rispetto all'infertilità primaria.

TAKE-HOME MESSAGE: The study provides evidence on how increasing consumption of fruits and vegetables and reducing red meat and sweetened beverages would lower the risk of primary infertility. It offers an opportunity for directing public health policy towards the substantial role of public health education and promotion in terms of healthy diet components and behaviours, mainly during preconception lifetime period.

Competing interests: none declared

Cite this article as: Dhair A, Husseini MN, Abed Y. The effect of nutrition-related patterns on primary infertility among couples in Gaza Strip: A case-control study. [published online ahead of print February 28, 2020]. J Health Soc Sci. doi 10.19204/2020/thff12

DOI 10.19204/2020/thff12

Received: 8 February 2020 **Accepted:** 26 February 2020 **Published Online:** 28 February 2020

INTRODUCTION

Conception is considered a complex biological and physiological process that would be associated with interrelated, and at the same time, multidimensional lifestyle-related factors [1]. However, failure to conceive is considered one of the most distressful reproductive health conditions that is common globally but with higher rates in the developing countries [2]. The World Health Organization (WHO) recognizes infertility as a public health problem in terms of physical and mental health for both partners, although it is not recognized till couples determine to endure a child [3]. Accordingly, the WHO defined clinical primary infertility as a condition that refers to "inability to conceive despite cohabitation and exposure to risk of pregnancy for a period of 12 months or more in a sexually active non-contracepting, and non-lactating women 15 to 49-year-old" [4]. Being an important public health problem, many preventable risk factors had been identified [5]. Evidence suggests that preconception diet patterns may provide a significant effect on the conceiving ability of couples and are among the preventable risk factors that have been widely investigated, although the complete picture has not been clearly illuminated [6].

Literature demonstrated the importance of a balanced nutritional diet in both restoring fertility and ensuring an adequately successful conceiving process [7]. It is believed that consumption of vegetables rather than meat, decreasing sugar intake, eating diet rich in vitamins and using monosaturated fat rather than highly saturated one decrease the risk of ovulatory disorders among otherwise medically free females [8]. Some evidence suggested that increasing consumption of red meat may negatively affect the blastocyst formation during embryonic development and the process of zygote implantation [9, 10]. Also, increased saturated fat in diet may have a negative association with the sperm count, while consuming a lot of omega-3 polyunsaturated fat is related to higher rates of normal sperm morphology [11] and high rates of successful in-vitro fertilization among females [12].

For all these reasons and for the scarcity of research in this regard in Gaza Strip Palestine, this study was sought to examine the implications of various nutritional habits that couples might practice before or after marriage and the impact of such exposure on their conceiving ability. Additionally, to keep up with the contemporary pace, many people have recently changed their diet to follow the meat/sugar western food custom [7]. Not so much is known about the effect of such shift on the fertility status of the population and little, if any, research have been conducted in this setting. Therefore, the objective of this paper was to explore the impact of various diet-related patterns assumed by both females and males in Gaza Strip society on their fertility status and their relationship with primary infertility.

METHODS

Study design and procedure

The study was based on an observational analytic case-control study design that was conducted

in 2019 in Gaza Strip, Palestine. The study sample comprised of 160 couples known to be suffering from primary infertility and were compared to residentially matched 160 fertile couples, who had already experienced at least two normal pregnancies without assistive reproductive techniques. The use of an observational method in this study is believed to provide the desired results, as the study acquires multiple exposures to be observed that might be related to a single outcome under investigation. The analytic property assesses in determining the causal relationship between infertility and different variables included in this study.

Study participants and sampling

The total population with primary infertility in Gaza Strip, which is the target population, was estimated by the researcher according to the prevalence established and stated by the Palestinian Center Bureau of Statistics which is 15,048. Being a case-control study, it was more appropriate to use the following in calculating the sample size; a confidence level of 95%, a power of 80%, a ratio of cases to controls of 1 and a percentage of exposed controls of 50% as there is limited information about the exposure among the control group. With these findings, the researcher used epi-info 7 sample size statistical calculator and had 148 subjects for each group as the required sample size. In order to compensate missing or non-responding cases, the researcher increased the number of cases to 160 and accordingly increased the controls to 160 to have a total of 320 couples as a sample size for the study.

To define the sample frame, five fertility centers were randomly selected from total nine centers allocated in Gaza Strip. Then, multistage sampling technique was used to select the calculated sample of cases. The population frame selected for the study was demonstrated from the lists of patients registered for treatment in the fertility centers from January 2016 till December 2018. In

each center, the patients registered in the aforementioned period were classified into clusters according to their residency per governorate (list of patients per governorate). Finally, a 4th patient was chosen from each sub-cluster (North Gaza, Gaza, Middle Area, Khan Younis, and Rafah). Since the breakdown of total female population in reproductive age in GS, according to their area of residency in five governorates, is 88,042 in North Gaza, 155,385 in Gaza, 66,858 in Middle Area, 86,260 in Khan Younis and 55,630 in Rafah, that represent 19%, 34%, 15%, 20%, and 12% respectively, the number of patients extracted systematically from each cluster were governed by this distribution [13]. Correspondingly, we sought controls from Governmental primary health care clinics who approached for maternal and child health care services and who were congruent with the residency of the corresponding cases.

Study instruments and measures

A self-constructed face to face interviewed questionnaire was developed after reviewing the literature for infertility and other maternal health issues and that was formalized and constructed to comprehensively achieve the objectives of the study. The questionnaire was extended by the diet component of WHO STEP wise instrument [14]. After formalizing the instrument, it was reviewed by ten experts and further modification was performed upon their comments. As a final step, cognitive qualitative testing of the questionnaire was accomplished through iterative pilot work on members from the selected sample, after which the questions' format were optimized and the instrument was explored for its effectiveness and whether it fully achieved the purpose of the study.

In order to standardize the data collection process and to ensure reliability, participants were asked about the number of days in which they usually eat fruits or vegetables in a typical week.

The typical week demonstrates the week when the diet is not affected by cultural, religious or other events. Additionally, participants were asked also to provide information about the number of fruit or vegetable servings consumed in one of these days. According to WHO criteria, one typical fruit serving represents one medium-sized piece or half a cup of chopped, cooked, juiced or canned fruit that is equivalent to 80 grams weight. On the other hand, one typical vegetable serving represents one cup of raw green leafy vegetable as spinach or salad or half a cup of cooked or raw chopped vegetable as tomatoes, carrots, pumpkin, corn, cabbage, fresh beans, onion, etc., and that is equivalent to 80 grams weight [14]. The participants were aided with show cards "image assisted responses" to help the provision of the requested information.

Ethical aspects

In order to launch this study, academic approval from the School of Public Health at Al- Quds University was obtained after submitting the study proposal to the research committee for discussion. Subsequently, ethical approval was obtained from the ethical committee in Gaza Strip (Helsinki Committee, approval number PHRC/HC/548/19). In the perspective of commitment to research ethics, the researcher was committed to providing an informed consent along with each questionnaire and guaranteed that each participant was fully aware and fully acquainted with each section of the attached consent form, with their clear right to withdraw participation at any time. The consent explained the aim of the study with clarification about voluntary participation, along with making sure that confidentiality is highly implemented. Additionally, administrative approval was acquired from the director of Ministry of Health, as well as the specialists running the fertility centers for the purpose of having access to the institutions' database.

Data analysis

Descriptive analysis was used for continuous variables in the form of central of tendency (mean) and measures of variability (standard deviation), while categorical variables were presented as absolute frequencies. In order to evaluate the effect of the selected parameters under investigation on the risk of primary infertility occurrence, groups were categorized by sex in contingency tables and chi-square analysis was performed. Then to predict the estimated risk of each independent variable, binary logistic regression was conducted using the best fit model.

To maintain reliability, the data entry on an SPSS 22 set was performed on daily basis to allow reviewing the quality of data and if there is any invalid feedback to be refilled. Also, 5% of the entered data was refilled upon finishing the entry of the whole data to ensure proper filling.

RESULTS

Table 1 describes the characteristics of cases and controls stratified to both the female and male partner in each group. Analyzing data revealed that infertile couples aged less than 30 years (54% females, 29% males) are significantly more than those in the fertile group (44% females, 17% males). 33% of the infertile couples live in extended families compared to only 23% of their counterparts and from all 160 infertile couples, 70% were found as refugees while 59% only were recognized from the control group. No difference was detected in either education level or body mass index, while monthly earnings between 440 and 720 US dollars was significantly more among the control group.

Table 1. General characteristics of study population.

General characteristics	Cases		Controls		
	Females No (%)	Males No (%)	Females No (%)	Males No (%)	P-value
Number	160	160	160	160	

Age (< 30 years)	87 (54.4)	47 (29.4)	71 (44.4)	27 (16.9)	*0.004
Family type (extended)	53 (33.1)		33 (20.6)		*0.012
Refugee status	112 (70.0)		94 (58.8)		*0.036
Education					
(0-9 years)	7 (4.4)	22 (13.8)	10 (6.3)	28 (17.5)	0.147
(9-12 years)	59 (36.8)	55 (34.3)	62 (38.7)	63 (39.4)	0.211
(13+ years)	94 (58.8)	83 (51.9)	88 (55.0)	69 (43.1)	Ref.
Average monthly income (NIS)					
(≤ $440 / month)	127 (79.4)		118 (73.8)		0.188
($440 - $720 / month)	16 (10.0)		33 (20.6)		*0.007
(> $720 / month)	17 (10.6)		9 (5.6)		Ref.

* Significant at $P < 0.05$, Ref. = reference used to breakdown more than 2x2 contingency table

All 320 couples were inquired about their nutrition-related patterns in two forms; diet components and diet behaviour. Analyzing females' data showed that 30 (19%) infertile women consume vegetables in less than 4 days in a typical week compared to 11 (7%) from the control group ($P = 0.001$), and 108 (68%) eat less than 3 servings in one of these days compared to 72 (45%) women respectively ($P < 0.001$). Male partner in this study showed almost the same results, where 31 (19.4%) infertile men compared to 11 (7%) fertile men eat vegetables in only 3 days a week ($P = 0.001$), while 104 (63%) and 65 (41%) respectively consume less than 3 servings in each of these days ($P < 0.001$). No significant association was detected when examining fruit consumption alone with primary infertility in both women and men (Table 3). But when following the WHO criteria for recommended daily requirements of fruits and vegetables (total 5 servings of fruits and vegetables per day = 80 gr x 5 = 400 gr/day), results showed significant association among the two groups in this regard ($P = 0.004$ for females, $P = 0.010$ for males) (Table 2).

Table 2. WHO criteria for analysis of fruits and vegetable consumption.

WHO STEP wise diet variables		**Cases**	**Controls**	**P-value**
		No (%)	**No (%)**	
Female-Total servings/d 5 servings = 400 grams	< 5 servings	123 (76.9)	99 (61.9)	*0.004
	≥ 5 servings	37 (23.1)	61 (38.1)	
Mean		3.77	4.23	*0.007
SD		1.38	1.62	
Male-Total servings/d 5 servings = 400 grams	< 5 servings	116 (72.5)	94 (58.8)	*0.010
	≥ 5 servings	44 (27.5)	66 (41.3)	
Mean		3.90	4.38	*0.010
SD		1.60	1.71	

* Significant at $P < 0.05$; SD = Standard deviation

Moreover, a positive association was found between primary infertility in females and consuming sugary food and/or chips as regular snacks ($P = 0.031$), drinking soda and/or canned juice as a regular beverage ($P = 0.021$) and processing or cooking food with vegetable oil rather than olive oil ($P = 0.020$). No association was detected upon examining tea/coffee and natural juice as regular drinks ($P = 0.981$, $P = 0.426$, respectively). Furthermore, consuming only one meal per day ($P = 0.098$) and missing breakfast meal ($P = 0.247$) as a diet behaviour practiced by both women and men did not appear to be related to their fertility status. By adjusting the previously mentioned covariates, analysis showed that consumption of vegetables for more than 3 days/week reduce the risk of primary infertility by 65% (OR = 0.35, 95% CI 0.17 to 0.75), while 52% reduction of the risk was observed for every additional serving of vegetable consumed per day (OR = 0.48, 95% CI 0.24 to 0.93). Consuming soda and/or canned juice as regular beverage was twice more likely among infertile couples compared to those who used to drink tea/coffee, natural juice or even water (OR = 2.27, 95% CI 1.13 to 4.57) and regular intake of sweets and/or chips provided a 98% increased risk (OR = 1.98, 95% CI 1.06 to 3.68).

Results revealed that females and males as couples in this study population share quite the same nutritional patterns in terms of diet component and diet behaviour. Male partners showed a 65% reduced risk of primary infertility when consuming vegetables in more than 3 days a week (OR = 0.36, 95% CI 0.17 to 0.75) and 54% reduction of risk with every additional vegetable serving consumed per day (OR = 0.46, 95% CI 0.26 to 0.79).

Table 3. Distribution of study population according to diet components and diet behavior.

Diet variables		Females			Males		
		Cases	Controls	P-value	Cases	Controls	P-value
		No (%)	No (%)		No (%)	No (%)	
Diet components							
Eating fruits in a typical week (days/week)	< 3	66 (41.2)	78 (48.8)	0.178	63 (39.4)	78 (48.8)	0.091
	≥ 3	94 (58.8)	82 (51.2)		97 (60.6)	82 (51.2)	
Eating vegetables in a typical week (days/week)	< 4	30 (18.8)	11 (6.9)	*0.001	31 (19.4)	11 (6.9)	*0.001
	≥ 4	130 (81.2)	149 (93.1)		129 (80.6)	149 (93.1)	
Number of fruit servings per day	< 2	87 (54.4)	78 (48.8)	0.314	78 (52.3)	68 (45.9)	0.270
	≥ 2	73 (44.6)	82 (51.2)		71 (47.7)	80 (54.1)	
Number of vegetables servings per day	< 3	108 (67.5)	72 (45.0)	**<0.001	104 (63.1)	65 (40.6)	**<0.001
	≥ 3	52 (32.5)	88 (55.0)		59 (36.9)	95 (59.4)	
Most frequent snack	Sweets/Chips	37 (23.1)	22 (13.8)	*0.031			
	Fruits/Nuts/ Dairy	123 (76.9)	138 (86.2)				
Most frequent drink	Soda/Canned juice	46 (28.8)	24 (15.0)	*0.022			
	Tea/Coffee	63 (39.4)	72 (45.0)				

	Natural Juice	14 (8.8)	22 (13.8)				
	Water	37 (23.1)	42 (26.2)				
Oil used for cooking or processing food	Vegetable oil	139 (86.9)	123 (76.9)	*0.020			
	Olive oil	21 (13.1)	37 (23.1)				
Diet behavior							
Number of meals/ day	One	13 (8.1)	6 (3.8)	0.098	10 (6.2)	6 (3.8)	0.305
	Two or more	147 (91.9)	154 (96.2)		150 (93.8)	154 (96.2)	
Missing breakfast meal	Yes	45 (28.1)	36 (22.5)	0.247	42 (26.3)	34 (21.3)	0.293
	No	115 (71.9)	124 (77.5)		118 (73.8)	126 (78.8)	

* Significant at $P < 0.05$; ** Significant at $p < 0.001$

Stratifying the most frequent food components of the main meal consumed by couples in both groups is shown in Table 4.

While the main meals are usually formed of proteins, fats and carbohydrates, the components of the main meal in this study were divided into two groups and modified according to the study setting cuisine. Accordingly, results revealed that more infertile couples (16.3%) than fertile ones (11.9) declared consuming red meat as the most frequent food item, providing a statistically significant association between the two groups ($P = 0.042$). An apparent difference was also noticed regarding consuming white chicken (62.5%, 56.9% respectively), but the relationship did not approach a significant level. No relationship was detected when inquiring about seafood, beans, pasta, dairy products, rice or bread in the same regard.

Table 4. Distribution of study population by to the most frequent component of main meals.

Most frequent component of main meals - Couples	**Cases**	**Controls**	**P-value**
	No (%)	**No (%)**	

Red meat	26 (16.3)	19 (11.9)	*0.042
White chicken	100 (62.5)	91 (56.9)	0.059
Farm raised chicken	6 (3.8)	5 (3.1)	0.082
Seafood	17 (10.6)	24 (15.0)	0.630
Meals with neither meat nor chicken	11 (6.9)	21 (13.1)	Ref.
Beans	43 (26.9)	35 (21.9)	0.276
Pasta	23 (14.4)	17 (10.7)	0.266
Dairy products	19 (11.9)	24 (15.0)	0.651
Rice	49 (30.6	57 (35.6)	0.771
Bread	78 (48.8)	66 (41.3)	0.246
Vegetables	105 (65.6)	114 (71.3)	Ref.

* Significant at $P < 0.05$

DISCUSSION

In this study, we examined the relationship between primary infertility and different nutrition-related patterns assumed usually by couples in terms of diet components and diet behaviours. Adopting higher quantities and frequencies of vegetable and fruit containing diet was observed to be associated with a substantially lower risk of infertility in both females and males. We found that consumption of vegetables in less than 4 days a week and total servings of less than 3 in each of these days were more among infertile couples than controls. Moreover, we found that having red meat as the most frequent component of the main meals is significantly associated with primary infertility. Congruent with our results, epidemiological studies concluded that dietary components, where vegetables prevail animal proteins and where using monosaturated fat more than the trans-fat, provide women with a better chance for pregnancy than those whose meals are dominated with meat and highly saturated fatty acids [8]. Studies also observed that intake of red meat is inversely related to total sperm count [15, 16] and sperm morphology [17].

In the same respect, a study that was conducted in Iran in 2011 claimed that the risk of asthenozoospermia is associated with the highest tertiles of processed meat consumption (OR: 2.05, 95% CI 1.09 to 2.26) [18]. Furthermore, evidence suggested that couples following Mediterranean food style have a better chance for successful IVF sessions than those relying on fast food western pattern [19–21].

Our observation revealed that regular tea and coffee consumption held no effect on the fertility status of couples. Supporting our results, a study that was conducted in the Denmark concluded that primary infertility was neither associated with tea, coffee and caffeine consumption nor with increasing number of daily coffee servings [22] Although the effect of specific nutrients and nutritional supplements on infertility is beyond the scope of this study, some studies claimed that healthy diet rich in fruits, vegetables, omega-3 fatty acids, some antioxidants, and other vitamins are associated with favorable semen parameters, while food rich in sugary beverages, coffee, alcohol, and total dairy products have detrimental effect [23]. However, recent studies that support our findings declared that there is no relationship between caffeine consumption and reduced fertility among couples [24–27]. To our own knowledge, only one study observed a significant relationship between caffeine consumption and risk of spontaneous abortion [28]. Nevertheless, the need for more in-depth investigation in this regard would provide further insight into the recommended daily amount of tea and coffee consumption for an individual to enjoy a healthy reproductive life.

It was also obvious from our findings that consumption of soda and canned juice as regular beverages held as twice more likely risk after controlling for all other risk factors. Literature review provided that consuming 1 to 3 servings of soda a day or 7 or more servings a week may

decrease the conceiving ability of men and women to a significant level [29, 30]. Men consuming ≥ 1.3 servings a day were found to have low sperm motility [31], and women consuming ≥ 3 servings a day are exposed to oocyte dysmorphism and mild effect on blastocyst formation, implantation and pregnancy rate [32].

Our findings also provided a 65% reduced risk of primary infertility with every additional day (more than 4 days per week) of vegetable consumption and a 54% reduced risk with every additional serving (more than 3 per day) for both males and females. This might indicate the need for formalizing, developing and integrating nutritional health programmes in national health strategies and at the health-policy level to an extent sufficient to be comprehensively endorsed to all aspects of food production and utilization. Also, to comprise nutritional health education and promotion in primary health care facilities, food standards in schools, fast food quality control and multisectoral coordination and capacity to ensure effective implementation. Furthermore, the close approximation of frequencies among females and males in the same group in this study is noticeably apparent. This could be because over time, most couples learn to share the same food custom and dietary behaviours that might become by time quite similar. Bearing in mind that, females are the ones who are responsible of preparing and processing food in any household setting in most Arab societies. So, efforts for providing females with adequate dietary education and the embodying of nutritional health into preconception care protocols may result in remarkably efficient and effective outcomes at both the individual and the family level.

Despite our efforts to control all confounding effects, the inverse association between various dietary components and behaviours and the reduced risk of primary infertility could still be partially related to other healthy reproductive behaviours attempted by couples. However, we

have used the same study base for both the cases and controls in order to minimize the effect of possible confounding factors. Moreover, being a retrospective study, recall biases were particularly expected especially when inquiring about events that occurred in the past, especially information related to daily routines. To obtain precise and accurate information, the participants were guided with show cards that illustrate different types of food items recommended and provided by the WHO guidelines for STEP wise questionnaire. Moreover, information was verified through a reliable third-party person or with other trustworthy sources, e.g. close relative, whenever possible.

CONCLUSION

The study supported that dietary patterns, postulated in terms of frequency and amount of fruits and vegetables consumed, are essential influencers of fertility among couples living in Gaza Strip and had almost 63% of the explanatory potential. The study concluded a recommended amount of at least two servings (80 gr each) of vegetables to be consumed for at least four days a week and at least five servings (total 400 gr) of total fruits and vegetables to be consumed per day. The study also supported the hazardous effect of frequent consumption of soda, juice containing food preservatives, sweetened snacks and/or chips on the fertility status of couples. Also, pertaining high saturated fatty acids in various food processing techniques attained among households, represented in vegetable oil rather than olive oil and the domination of red meat on most of the meals consumed during a typical week, held a significant risk on couples' fertility status. The provided evidence is quite sufficient to encourage nutritional health education and promotion that support healthy diet components and behaviours, and to be used in the public health arena in terms of formulating public health policies, developing educational health

programmes and enforcing nutritional health regulations on food manufacturing and consumption for the purpose of improving public reproductive health. It is also worth to mention that our results did not provide causality and further randomized trial would be needed for more scientifically evidenced recommendations.

References

1. Piché ML, Babineau V, Robitaille J, Lachance É, Ruchat SM. Lifestyle-related factors associated with reproductive health in couples seeking fertility treatments: Results of a pilot study. Int J Fertil Steril. 2018;12(1):19–26. doi.org/10.22074/ijfs.2018.5135.

2. Rutstein SO, Shah IH. Infecundity, infertility, and childlessness in developing countries. Demographic and Health Surveys; 2004. Comparative reports No.: 9. doi.org/10.1039/b823331d.

3. WHO. Global prevalence of infertility, infecundity and childlessness; 2014 [cited 2019 March 19]. Available from https://www.who.int/reproductivehealth/topics/infertility/burden/en/.

4. Mascarenhas MN, Flaxman SR, Boerma T, Vanderpoel S, Stevens GA. National, regional, and global trends in infertility prevalence since 1990: A systematic analysis of 277 health surveys. PLoS Med. 2012;9(12):e1001356. doi.org/10.1371/journal.pmed.1001356.

5. Sudha G, Reddy KS. Causes of female infertiity: A cross-sectional study. Int J Latest Res Sci Technol. 2013;2(6):113–123. Available from http://www.mnkjournals.com/ijlrst.htm.

6. Gaskins AJ, Chavarro JE. Diet and fertility: A review. Am J Obstet Gynecol. 2018;218(4):379–389. doi.org/10.1016/j.ajog.2017.08.010.

7. Nazni P. Association of western diet & lifestyle with decreased fertility. Indian J Med Res. 2014;(1):78–81.

8. Chavarro JE, Rich-Edwards JW, Rosner BA, Willett WC. Diet and lifestyle in the prevention of ovulatory disorder infertility. Obstet Gynecol. 2007;110(5):1050–1058. doi.org/10.1097/01.AOG.0000287293.25465.e1.

9. Braga DP, Halpern G, Setti AS, Figueira RC, Iaconelli A, Borges E. The impact of food intake and social habits on embryo quality and the likelihood of blastocyst formation. Reprod Biomed Online. 2015;31(1):30–38. doi.org/10.1016/j.rbmo.2015.03.007.

10. Kazemi A, Ramezanzadeh F, Nasr-Esfahani MH. Relationship between dietary fat intake, its major food sources and assisted reproductive parameters. J Reprod Infertil. 2014;15(4):214–221.

11. Attaman JA, Toth TL, Furtado J, Campos H, Hauser R, Chavarro JE. Dietary fat and semen quality among men attending a fertility clinic. Hum Reprod. 2012;27(5):1466–1474. doi.org/10.1093/humrep/des065.

12. Moran LJ, Tsagareli V, Noakes M, Norman R. Altered preconception fatty acid intake is associated with improved pregnancy rates in overweight and obesewomen undertaking in Vitro fertilisation. Nutrients. 2016;8(1):10. doi.org/10.3390/nu8010010.

13. Palestinian Central Bureau of Statistics. Population, housing and establishments census;

2018. Report No.:23461.

14. World Health Organization. WHO STEPwise approach to surveillance (STEPS). [cited 2019 Augest 10]. Available from: http://www.who.int/chp/steps/en.

15. Afeiche MC, Williams PL, Gaskins AJ, Mendiola J, Jørgensen N, Swan SH, et al. Meat intake and reproductive parameters among young men. Epidemiology. 2014; 25(3):323–330. doi: 10.1097/EDE.0000000000000092.

16. Mendiola J, Torres-Cantero AM, Moreno-Grau JM, Roca M, Moreno-Grau S. Food intake and its relationship with semen quality: A case-contro study. Fertil Steril. 2009;91(3):812–818. doi: 10.1016/j.fertnstert.2008.01.020.

17. Afeiche M, Gaskins A, Williams P, Toth T, Wright D, Tanrikut C, et al. Processed meat intake is unfavorably and fish intake favorably associated with semen quality indicators among men attending a fertility clinic. J Nutr. 2014;144(7):1091–1098. doi: 10.3945/jn.113.190173.

18. Eslamian G, Amirjannati N, Rashikhan B, Sadeghi MR, Hekmatdoost A. Intake of food groups and idiopathic asthenozoospermia: A case-control study. Hum Reprod. 2012;27(11):3328–3336. doi.org/10.1093/humrep/des311.

19. Vujkovic M, De Vries JH, Lindemans J, MacKlon NS, Van Der Spek PJ, Steegers EA, et al. The preconception Mediterranean dietary pattern in couples undergoing in vitro fertilization/intracytoplasmic sperm injection treatment increases the chance of pregnancy. Fertil Steril. 2010;94(6):2096–2101. doi.org/10.1016/j.fertnstert.2009.12.079.

20. Toledo E, Lopez-Del Burgo C, Ruiz-Zambrana A, Donazar M, Navarro-Blasco Í, Martínez-González MA, et al. Dietary patterns and difficulty conceiving: A nested case-control study. Fertil Steril. 2011;96(5):1149–1153. doi.org/10.1016/j.fertnstert.2011.08.034.

21. Karayiannis Di, Kontogianni MD, Mendorou C, Mastrominas M, Yiannakouris N. Adherence to the Mediterranean diet and IVF success rate among non-obese women attempting fertility. Hum Reprod. 2018;33(3):494–502. doi.org/10.1093/humrep/dey003.

22. Soylu L, Jansen A, Juul KE, Kesmodel US, Frederiksen k, Kjar SK, et al. Coffee, tea and caffeine consumption and risk of primary infertilty in women: A Danish cohort study. Acta Obstet Gynecol Scand. 2018;97(5):570–576. doi.org/10.1111/aogs.13307.

23. Salas-Huetos A, Bulló M, Salas-Salvadó J. Dietary patterns, foods and nutrients in male fertility parameters and fecundability: A systematic review of observational studies. Hum Reprod Update. 2017;23(4):371–389. doi.org/10.1093/humupd/dmx006.

24. Ricci E, Vigano P, Cipriani S, Somigliana E, Chiaffarino F, Bulfoni A, et al. Coffee and caffeine intake and male infertility: A systematic review. Nutr J. 2017;16:37. doi.org/10.1186/s12937-017-0257-2.

25. Karmon AE, Toth TL, Chiu YH, Gaskins AJ, Tanrikut C, Wright DL, et al. Male caffeine and alcohol intake in relation to semen parameters and in vitro fertilization outcomes among fertility patients. Andrology. 2017;5(2):354–361. doi: 10.1111/andr.12310.

26. Lyngsø J, Ramlau-Hansen CH, Bay B, Ingerslev HJ, Hulman A, Kesmodel US.

Association between coffee or caffeine consumption and fecundity and fertility: A systematic review and dose-response meta-analysis. Clin Epidemiol. 2017;9:699–719. doi.org/10.2147/CLEP.S146496.

27. Chavarro JE. Is coffee bad for reproduction? Maybe not, after all. Fertil Steril. 2019;12(1):39–40. doi.org/10.1016/j.fertnstert.2019.04.033.

28. Gaskin AJ, Rich-Edwards JW, Williams, Toth TL, Missmer SA, Chavarro JE. Pre-pregnancy caffeine and caddeinated beverage intake and risk of spontaneous abortion. Eur J Nutr. 2018;57(1):107–117. doi: 10.1007/s00394-016-1301-2.

29. Hatch EE, Wise LA, Mikkelsen EM, Christensen T, Riis AH, Sørensen HT, et al. Caffeinated beverage and soda consumption and time to pregnancy. Epidemiol. 2012;23(3):393–401. doi.org/10.1097/EDE.0b013e31824cbaac.

30. Hatch EE, Wesselink AK, Hahn KA, Michiel JJ, Mikkelsen EM, Sorensen HT, et al. Intake of sugar-sweetened beverages and Ffecundability in a North American preconception cohort. Epidemiol 2018;29(3):369–378. doi.org/10.1097/EDE. 0000000000000812.

31. Chiu YH, Afeiche MC, Gaskins AJ, Williams PL, Mendiola J, Jørgensen N, et al. Sugar-sweetened beverage intake in relation to semen quality and reproductive hormone levels in young men. Hum Reprod. 2014;29(7):1575–1584. doi: 10.1093/humrep/deu102.

32. Setti AS, Braga DPAF, Halpern G, Figueira RCS, Laconelli A, Borrged E. Is there an association between artificial sweetener consumption and assisted reproduction

outcomes? Reprod Biomed Online. 2018;32(2):145–153. doi:10.1016/j.rbmo.

2017.11.004.