



RESEARCH PAPER

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Impact of body mass index on semen parameters in male infertility patients in west of Algeria

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Abstract

Body mass index (BMI) is a risk factor that influences semen quality and reduces male fertility. The aim of this study was to determine the impact of BMI on semen parameters in infertile men. A total of 446 infertile men, the study population was divided into four groups depending on their BMI, underweight (<18.5 kg/), normal weight ($18.5-24.99$ kg/m²), overweight $25-29.99$ kg/m², and obese >30.0 kg/. Semen parameters (PH, volume, concentration, total semen count, vitality, morphology and motility) were compared across the four BMI groups. The mean of age was 41.91 ± 6.39 , the mean infertility duration was 4.92 ± 3.28 , 351, (78.7%) had primary infertility and 95(21.3%) had secondary infertility. The mean BMI was 29.38 ± 4.85 and the most of patients 45.2% were obese. This study has found evidence of an association between BMI and semen parameters (sperm concentration, total sperm count, motility, and vitality) and no correlation between semen volume, morphology and BMI. This study shows as expected that obesity and overweight do have a negative impact on male infertility and as a consequence they should be taken in consideration when treating couple who suffer from infertility especially if the male partner has a BMI higher than 25. More studies in our region are needed in order to asses the other effect obesity has on the hormonal profile and the efficient of the treatment used.

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Introduction

In recent decades, the incidence of obesity has dramatically increased to become a true global epidemic (Andersen, 2000). It affects the majority of nations, regardless of their level of development (Deurenberg, 2003).

Algeria is not spared by this scourge of modern times, according to the world health statistics 2012, 24.3% of Algerian women aged 20 years and over are obese against 10.4% of Algerian men obese (WHO, 2013).

Obesity is considered a major health problem (WHO, 2000). It is a complex, multifactorial disease that develops from the interaction between genotype and the environment. It is characterized by an excess of adipose tissue (Kopelman, 2000), (Kantachuvessiri, 2005).

The most commonly used measurement for determining obesity is the body mass index (BMI), which is calculated as the weight in kilograms divided by the square of height in meters (WHO, 2000). Obesity is linked to human fertility.

The effect of obesity on male reproduction has been less well studied than those on female reproduction, but there is growing body of male reproduction (Filer, 2009).

To our knowledge no researches have looked at the relationship between BMI and fertility in male patient in our region, this study was then done to assess the impact of obesity and overweight on semen parameters in infertile men, and to see how many infertile male have a high BMI.

Material and methods

This study included men who attended for infertility evaluation during the period from November 2016 to May 2017, in medically assisted procreation service hospital of 1st November –Oran- west of Algeria. A total of 446 infertile men was consulted, the study population was divided into four groups depending on their BMI, underweight (<18.5 kg/m²), normal

weight (18.5-24.99 kg/m²), overweight 25-29.99 kg/m²), and obese >30.0 kg/m². Semen parameters (PH, volume, concentration, total semen count, vitality, morphology and motility) were compared across the four BMI groups.

Statistical analyses

The data collected during the research were analyzed using the statistical software (SPSS version 22). To report the results we used a descriptive analysis method, calculating the means and standard deviations for the continuous data, the means were then compared using the Student's Test, for the nominal data we calculated the percentages of the different categories. Differences in patient BMI according to different variables were assessed using the ANOVA test.

We evaluated the impact of the different BMI determined on Semen parameters using the Pearson correlation. The result is reported in the form of histograms, sectors and tables. These statistical tests were considered significant if $p < 0.05$.

Results

The result showed that the most represented age group is 41 – 50 years old (45, 1%) with the mean age of 41.91 ± 6.39 (years) (Fig. 1).

According to the reason for consultation we found that 78.7% of our patients have primary infertility. And 21.3% have secondary infertility (Fig. 2).

The results showed that the mean BMI of infertile men in our study was 29.38 ± 4.85 Kg / m², and the most of patients 45.2% were obese (Fig. 3).

Table 1 demonstrates the value of semen parameters in studies patients according to their BMI. The results showed that there was evidence of an association between BMI and semen parameters (sperm concentration, total sperm count, motility, and vitality) and no statistical significant relationship was found between Semen volume, morphology and BMI (Table 1).

Table1. Semen characteristics compared for males among BMI groups.

Semen parameters	BMI groups				P
	<18.5	18.5-24.99	25.00-29.99	>30.00	
PH	7,00±1,41	7,86±,82	7,88±,80	7,85±,81±	0.503
Semen volume	2,45±,49	2,97±1,28	3,11±1,51	2,98±1,80	0.824
Sperm concentration	51,60±39,32	42,38±28,18	46,80±35,49	27,30±30,46	<0.001
Total sperm count	136,14±121,85	118,95±92,62	128,38±107,83	69,11±81,55	<0.001
Sperm motility after 1 hour					<0.001
Progressive	15,50±5,1	24,71±4,1	24,34±2,4	14,43±1,43	0.024
Slow progressive					
Non-progressive	23,00±7,07	18,79±10,11	19,22±9,83	15,89±11,51	0.274
Immobile	20,00±2,00	15,90±1,90	15,78±5,7	14,28±4,8	
	41,50±17,68	40,76±20,48	40,18±21,26	53,58±25,09	<0.001
Sperm motility after 4 hour					<0.001
Progressive	4,50±,71	14,00±14,53	13,54±12,07	7,25±10,19	0.012
Slow progressive	10,73±2,14				
Non-progressive		10,00±8,28	13,18±9,33	14,32±10,17	0.204
Immobile	12,55±9,63	14,00±2,83	13,97±10,19	14,25±9,70	
	13,20±9,94	71,50±2,12	60,29±18,22	61,71±53,80	0.263
Morphology					0.358
Normal	16,00±7,07	34,99±25,74	38,03±27,99	33,42±28,61	0.471
Abnormal	84,00±7,07	67,00±28,33	61,89±27,93	65,30±29,38	
Vitality					<0.001
Spz alive	64,00±24,04	68,17±18,49	69,74±19,58	56,72±24,30	<0.001
Spz dead	36,00±24,00	31,69±18,63	30,26±19,58	42,09±24,06	

Discussion

Four hundred and forty six males participated in the study, after the subjects were classified into four groups based on BMI. Among 446 infertile men, 02 found with BMI <18,5 kg/m², 72 with BMI 18.5-24,99 kg/m², 149 with BMI 25-29,99 kg/m² and 184 were found with BMI >30 kg/m². When the mean semen parameter values of each BMI group were compared, our results showed no significant relationship between the BMI and semen volume (P=0.824). Similar to our results, a meta-analysis of 31 relevant studies showed no significant relationship between BMI and semen volume (MacDonald *et al.*, 2010). On the other side Chavarro *et al.* (2010) (Chavarro *et al.*, 2010) reported a lower semen volume in obese men. Concerning PH, our results showed no significant relationship between the BMI and PH semen (P=0.503).

In our study, sperm concentration and total sperm count in infertile men showed a significant correlation with BMI (P<0.001). Similar to our results, Jensen *et al.* (2004) reported a 21.6 and 23.9% significant reduction in sperm concentration and total sperm count, respectively, in men with BMI >25 compared with those classified as normal. Other studies (Hammoud *et al.*, 2008) (Martini *et al.*, 2012), (Braga, 2012). Reported a negative relationship between sperm count and total count and BMI. Sperm motility of the study population showed that the mean total motility, progressive and slow progressive grades of motility (after 1 hour and 4 hour) were significantly correlated with BMI (P<0.001). Similar associations were recorded previously (Kort *et al.*, 2006), (Qin *et al.*, 2007), (Hammoud *et al.*, 2008), (Martini *et al.*, 2012), (Braga, 2012), (Sermondade *et al.*, 2012). Other

studies (Fejes *et al.*, 2006), (Kort *et al.*, 2006) reported a negative relationship between obesity and BMI and sperm motility. Some studies (7; 15) failed to report any association between BMI and sperm total motility. Also, (MacDonald *et al.* 2010) in their metanalysis, did not reach a significant correlation between sperm motility and BMI. In addition, our

results showed a significant statistical relationship between immobile grades of motility (after 1hour) and BMI. Similar associations were recorded in nine morbidly obese patients (Martini *et al.*, 2010) found a significant increase in the percentage of non-motile spermatozoa (45.7 ± 5.5 , $n=9$ in men with $BMI \geq 40$ vs 33.3 ± 1.5 , $n=146$ in men with $30 \leq BMI < 40$, $P < 0.024$).

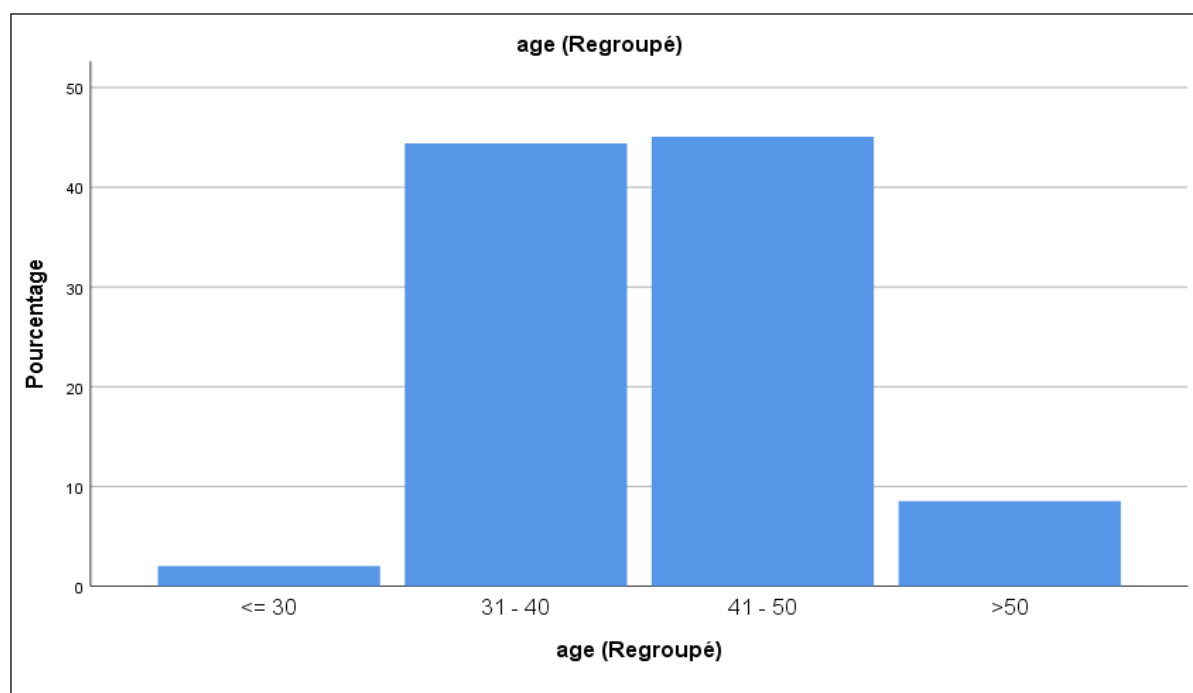


Fig. 1. Frequency distribution for the age of patients.

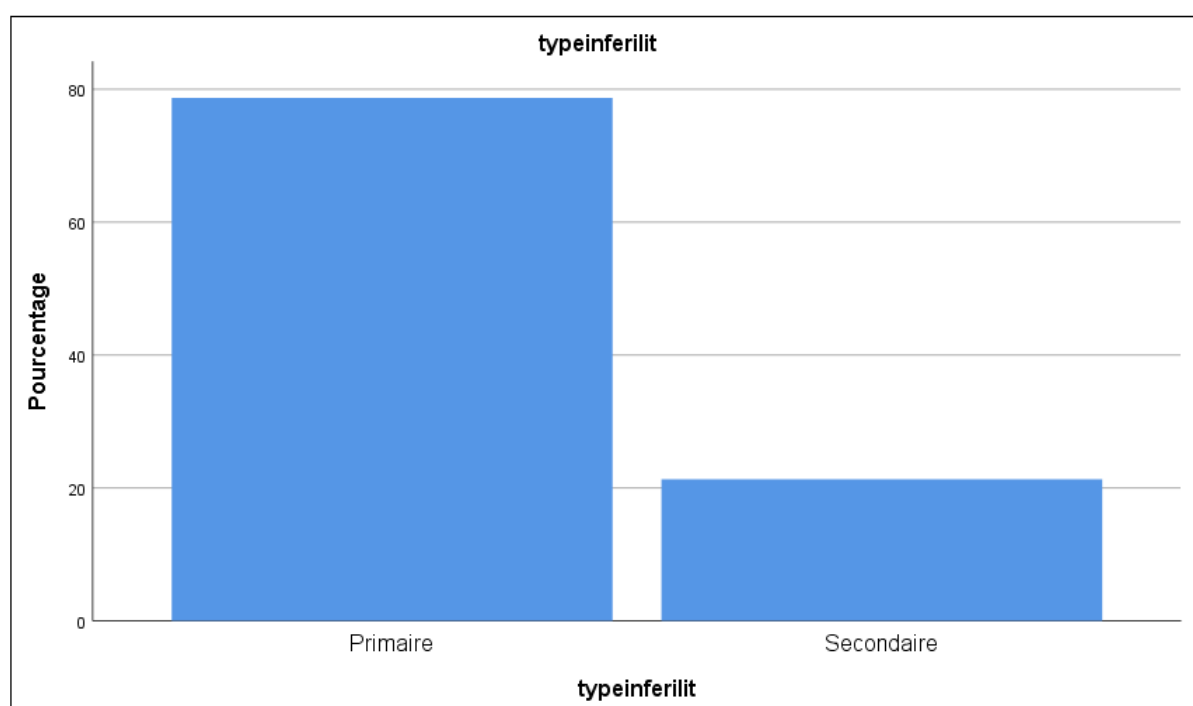


Fig. 2. Distribution of patients by type of infertility.

Concerning Sperm morphology, We did not observe a significant correlation between BMI and sperm morphology. Same results were reported by other studies (Hammoud *et al.*, 2008a), (Chavaroo *et al.*, and 2010), (MacDonald *et al.*, 2010). However, Hofny

et al., (2010) stated a significant positive correlation between BMI and abnormal sperm morphology. Alsoothers studies reported abnormal sperm morphology in obese men (Hofny *et al.*, 2010, Hakonsen. *et al.*, 2011).

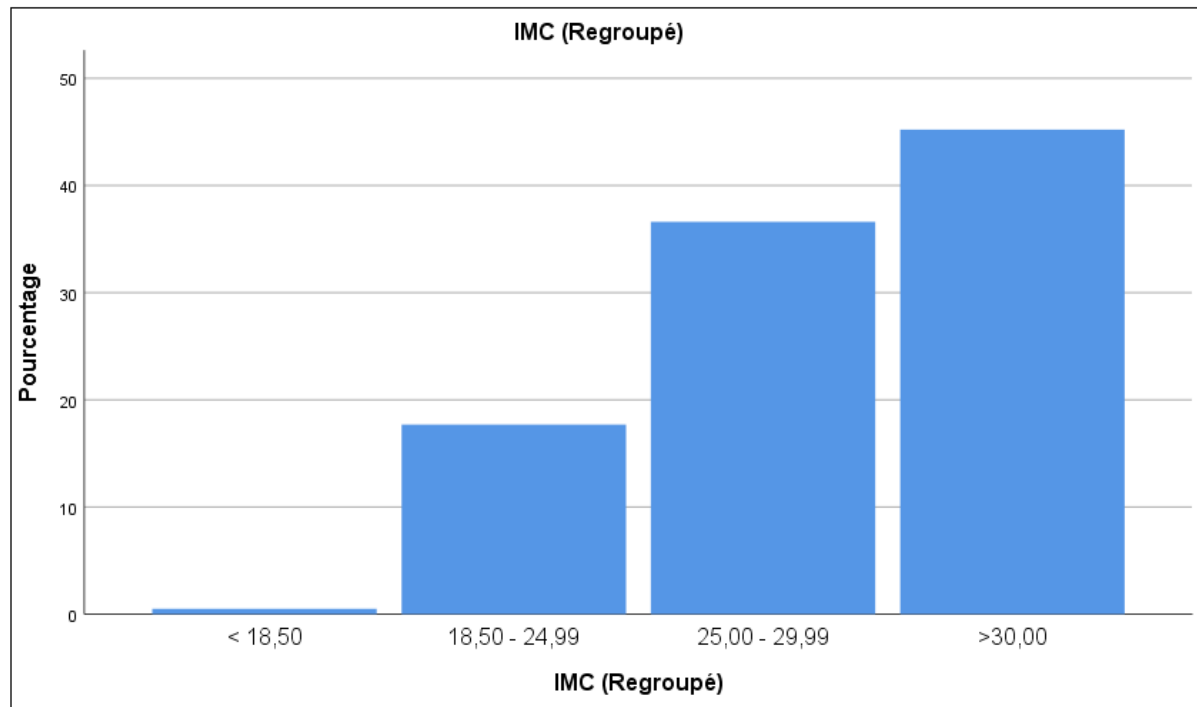


Fig. 3. Frequency distribution for body mass index.

Vitality is the percentage of live spermatozoa, the WHO proposes to evaluate this factor when the motility of progressive spermatozoa is less than 40% (WHO, 2002), she finds her interest in measuring mobility because an immobile spermatozoa is not necessarily dead..our results shouwed a significant correlation between vitality and BMI ($P < 0.001$).

Conclusion

The general profile of infertility is polymorphous. The male causes are often multifactorial and are represented by a quantitative and/or a qualitative abnormality of the sperm. In conclusion, this study has found evidence of an association between BMI and semen parameters (Sperm concentration, Total sperm count, motility, and vitality), BMI is a risk factor that influences semen quality and reduces male fertility for that it is suggested to reduce weight in obese males to prevent hormone imbalance which may indirectly lead to sub-fertility.

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