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Asian Pacific Journal of Reproduction

journal homepage: www.apjr.netOriginal research <http://dx.doi.org/10.1016/j.apjr.2015.06.010>

Reviewing reports of semen volume and male aging of last 33 years: From 1980 through 2013

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ARTICLE INFO

Article history:

Received 27 Feb 2015

Received in revised form 10 Apr 2015

Accepted 15 Apr 2015

Available online 24 July 2015

Keywords:

Age

Infertility

Semen

Sperm

Volume

ABSTRACT

Since several decades numerous experimental and epidemiological experiments tend to establish that in humans the semen volume declines with progression of age. This literature review is intended to report the association between male age and semen volume. Review of English language-published research over the last 33 years, from January 1, 1980, up to December 31, 2013, has been conveniently constructed using MEDLINE database. Studies with inadequate numbers of subjects and case reports were excluded. Among the methodologically stronger studies, declines in semen volume of 3%–22% were likely when comparing 30-year-old men to 50-year-old men. The report suggests that increased male age is associated with a decline in semen volume, *i.e.* there has been a genuine diminution in semen volume over the past 33 years. As male fertility is to some extent correlated with semen volume the results may reflect an overall reduction in male fertility.

1. Introduction

During the last few decades there has been uprising debate regarding the issue of declining semen parameters which are generally considered to be a proxy measure of male fertility. Changes in semen quality can occur after occupational and environmental exposure to toxic agents [1] or from the predictor factors of the host, such as age [2]. The weight of evidences primarily from the clinical studies suggest that age is associated with diminished semen volume [3]. Also, men at older ages (e.g. ≥ 50 years) were under-represented in many clinical studies, which restricted statistical strength and prevented unveiling of the exact form of relationship between age and semen volume. In addition, potential confounders that might explain changes with age, such as smoking history or duration of abstinence, were hardly ever taken under consideration [4]. The deterioration of semen qualities was first reported in 1974 by Nelson and Bunge [5]. In 1992, Carlsen *et al.* [6] reported a global decline in semen qualities between 1938 and 1990. Swan *et al.* [7] published a reanalysis of the studies included by Carlsen *et al.* [6] In that investigation, they have found significant declines in semen quality in the United States,

Europe, and Australia, but no such decline in non-Western countries. The similar declines were also proclaimed by numerous other studies [7,8]. A thorough dive into diverse studies from specific cites reveals evidences of declines in semen volume but a worldwide decline has not been demonstrated. It is definitely arduous to execute a systematic, scientific study regarding the decline in human semen quality. Thus, this review has been intended to build-up a substantial idea regarding alterations in semen volume in human with increase in age by picking the scattered reports of last 33 years.

2. Methods of literature review

Research articles on humans published in English from January 1, 1980, through December 31, 2013 have been included in this report. The data for this review were obtained from extensive search using Medical Subject Headings (MeSH) of electronic databases which included Medline, Elsevier, Medscape, and PubMed. Relevant literature on the effect of age on the semen volume and its impact on future natural and assisted conception cycles were retrieved. Data of the subjects with normal semen analysis or clinical problems have been excluded. Studies with insufficient numbers of subjects ($n < 20$), case reports, case series, and anecdotal data were excluded. In each case sperm volume and its outcome were evaluated. Analytic epidemiological studies were emphasized. In results section the relative changes in the outcome with age were represented.

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Peer review under responsibility of Hainan Medical College.

Table 1

Male age and semen volume (data from 1980 to 2013).

Country	Population	Sample size	Male age definition (range/mean/group)	Semen volume, mL	Direction of effect with increasing age	Ref no.	Year
Israel	Infertility clinic	555	A. 31 (0.2); B. 54 (4.2)	30% decrease from A to B	↓ (P < 0.0005)	[9]	1982
Germany	Volunteers responding to advertisement	43	A. 29 (3.2); B. 67 (7.8)	A. 4.0 (1.7); B. 3.2 (1.9)	↓ (NS)	[10]	1982
Paris	Semen donors	809	A. 21–25; B. 26–30; C. 31–35 D. 36–40; E. 41–45; F. 46–50	A. 3.2 (1.6); B. 3.7 (1.2); C. 3.6 (1.3) D. 3.6 (2.1); E. 3.6 (1.7); F. 3.1 (2.1)	↔ (NS)	[11]	1983
Italy	Volunteers	445	A. <40; B. 40–60; C. >60	Gradual decrease after age 40	↓	[12]	1985
China	Family planning clinic	1239	19–53	No correlation with age	↔	[13]	1985
Israel	Sperm donors with counts >200 × 10 ⁶ /mL	1299	A. 34.6 (6.4); B. 35.2 (9.4); C. 38.4 (12.5)	A. ≥6; B. 1–5; C. <1	↓	[14]	1990
U.S.A.	Sperm donors	1283	34.3 (0.2)	0.15% decrease per year of age	↓ (P < 0.001)	[15]	1996
Spain	Assisted conception	345	A. ≤30; B. 31–40 C. 41–50; D. 51–64	A. 3.1 (0.6); B. 2.6 (1.4) C. 2.3 (2.0); D. 2.2 (0.9)	↓ (NS)	[16]	1996
Germany	Infertility clinic	78	A. <30 (matched by year of attendance) B. <30 (matched by wives' ages) C. >50	A. 4.1 (1.6) C. 3.2 (1.9)	↓ (NS)	[17]	1996
Germany	Older men planning further children	64	A. 32.2; B. 50.3	A. 3.2 (1.5); B. 3.2 (1.7)	↔ (NS)	[18]	1996
U.K.	Sperm donors	577	18–53	0.01% increase per year of age	↑ (NS)	[19]	1996
Belgium	Sperm donors	416	No age data	Volume increased slightly	↑ (NS)	[20]	1996
Greece	Infertility clinic	2385	25–59	No significant drop in semen volume	↔	[21]	1996
U.S.A.	Tertiary University centre	510	No age data	No change in semen volume	↔	[22]	1996
Australia	Volunteers	689	No age data	No decrease in semen volume	↔	[23]	1997
Denmark	Fertility clinic	1055	No age data	No decrease in semen volume	↔	[24]	1997
Denmark	Fertility clinic	8608	No age data	No decrease in semen volume	↔	[25]	1997
Sweden	Infertility clinic	718	21–54	Age correlation with volume (r = 0.06)	↔	[26]	1997
Italy	Infertility clinic	3203	25–50	No alteration with age	↔	[27]	1998
U.S.A.	Assisted conception	821	A. ≤39; B. 40–49; C. ≥50	A. 2.7 (0.1); B. 2.5 (0.1); C. 2.1 (0.2)	↓ (P < 0.05)	[3]	1998
Spain	Infertility lab	20411	31.9 (5.4); 15–74	0.5% decrease per year of age	↓ (P < 0.001)	[28]	1999
U.S.A.	Andrology lab	2065	33.6 (5.8); 19–67	Age correlation with volume (r = 0.04)	↓ (NS)	[29]	1999
Germany	Infertility clinic	3437	19–63	Age-dependent decrease in semen volume	↓	[30]	1999
Norway	Volunteers	5180	No age data	Decline in semen volume	↓	[31]	1999
Slovenia	Volunteers	2343	No age data	No decrease in semen volume	↔	[32]	1999
Denmark & Finland	Comparative clinical study	632	A. 20–35 (Danish); B. 22–47 (Finnish)	High volume was observed in B than A	↑ (P < 0.01)	[33]	2000
Korea	Andrology lab	22,249	21–40	No decrease in semen volume	↔	[34]	2000
Japan	Andrology lab	711	>20	No decrease in semen volume	↔	[35]	2001
Germany	Infertility clinic	3698	19–63	Age-dependent decrease in semen volume	↓ (P < 0.001)	[36]	2002
Germany	Infertility lab	200	A. 21–25; B. >50	29% decrease in Group B than A	↓ (P < 0.0005)	[37]	2002
U.S.A.	Cohort study	97	22–80	0.03 mL decrease per year of age	↓ (P < 0.01)	[38]	2003
Australia	Prostate cancer project	567	52–79	Age-dependent decrease in semen volume	↓ (P < 0.001)	[39]	2004
Brazil	Infertility patients	889	A. ≤45; B. >45	0.01 mL decrease per year of age	↓	[40]	2005
U.S.A.	Andrology lab	1174	>45	Age-dependent decrease in semen volume	↓	[41]	2006
India	Andrology lab	368	25–59	Age-dependent decrease	↓	[42]	2006
U.S.A.	Infertility clinic	388	>45	Age-dependent decrease in semen volume	↓	[43]	2007
Australia	Infertility clinic	225	>30	Decreased volume with low sperm count	↓	[44]	2009
Germany	Fertility centre	320	A. <30; B. 30–35; C. 36–39; D. >40	No alteration observed	↔ (NS)	[45]	2009
Korea	Andrology lab	1139	A. 19–27; B. >54	Age-dependent decrease in semen volume	↓	[46]	2010

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