Scientific Research Publishing

Advances in Reproductive Sciences, 2026, 14(1), 50-60
https://www.scirp.org/journal/arsci
ISSN Online: 2330-0752
ISSN Print: 2330-0744

The Effects of Fytomax Women Antioxidant Supplements on Blastulation Rate

Lionel Wildy Moungala[1,2,3], Opheelia Makoyo[4,5], Reteno Retno[4], Aude Ozouaki[6]

[1]Androcryos Andrology Laboratory, Johannesburg, South Africa
[2]Department of Urology, University of Pretoria, Pretoria, South Africa
[3]Cryotech, Reprolife, Tokyo, Japan
[4]Department of Obstetrics and Gynaecology, Mother and Child University Hospital of Libreville, Libreville, Gabon
[5]Department of Obstetrics and Gynaecology, University of Health Science of Gabon, Libreville, Gabon
[6]IVF Laboratory Coordinator, SOS Medecin, Libreville, Gabon
Email: u12232310@tuks.co.za

How to cite this paper: Moungala, L.W., Makoyo, O., Retno, R. and Ozouaki, A. (2026) The Effects of Fytomax Women Antioxidant Supplements on Blastulation Rate. *Advances in Reproductive Sciences*, **14**, 50-60.
https://doi.org/10.4236/arsci.2026.141006

Received: January 16, 2026
Accepted: February 7, 2026
Published: February 10, 2026

Abstract

Embryo blastulation is a pivotal stage occurring during embryonic development. Blastulation can be affected by oxidative stresses, such as reactive oxygen species, that may damage embryo development. This study aimed at comparing the blastulation rate obtained from sub-fertile women, under antioxidant supplementation (Fytomax Women, KSMC Laboratory, PTY, LTD Belgium; http://www.ksmc.eu/), residing in Gabon, to the blastulation rate obtained through a systematic review and a meta-analysis of the literature search. Statistical analysis was performed using the MedCalc® statistical software. The main result of this study indicated a significantly ($p = 0.015$) higher blastulation rate in sub-fertile women under antioxidant supplement compared to the blastulation rate from the systematic review (68.00 ± 23 vs 50.04 ± 13). This current cohort study supports previous evidence suggesting that the antioxidant supplement, such as Fytomax Women, can improve selected reproductive outcomes in women undergoing ART.

Keywords

Antioxidant, Blastulation, Embryos, Fytomax Women, Gabon

1. Introduction

Blastulation is a critical stage in the development of an embryo, marking a critical transition from the morula cell to the blastocyst cell [1]. Generally, human blastocysts form on day 5 of the culture after fertilization; however, some embryos can take longer to get to this stage of development [2]. Delayed blastulation rate is

commonly associated with lower live birth rates in frozen cycles [3]-[5]. Previous research about time-lapse morphokinetics of embryos has indicated that the duration of first mitosis, the timing between first and second mitosis, and the duration between second and third mitosis are good indicators of the formation of blastocyst [6]. Oxidative stress (OS) is a condition characterized by the excess production of reactive oxygen species (ROS) [7] [8]. OS can decrease the ability of the embryo's antioxidant defense mechanisms to neutralize ROS [9]. ROS were found to induce mitotic arrest through delayed formation and abnormal function of the mitotic spindle and abnormal chromosome separation [10]. While several studies have investigated the effects of oral antioxidant supplementation on foetal development and clinical pregnancy rate [11]-[13], limited studies have investigated the impact of oral antioxidant supplements on blastulation rate.

Fytomax Women is (KSMC Laboratory, PTY, LTD Belgium; http://www.ksmc.eu/), also commercially available as Concept Max Women (KSMC Laboratory, PTY, LTD Belgium; http://www.ksmc.eu/) is a nutraceutical consisting of an exclusive combination of plant extracts with antioxidant and energy metabolism-improving properties such as Maca plant [14], Tribulus [15] [16] and *Vitex agnus-castus* [17] [18]. Additionally, Fytomax Women contains Vitamin C, Vitamin B3, Vitamin B5, Vitamin B9, Vitamin B12 and Vitamin E and Coenzymes Q10 [19]. Maca plant was found to improve oocyte maturation, total oocytes, and embryo grading [20], and improve *in vitro* fertilization rates by inducing an acrosome reaction in animal studies [21]. Several lines of evidence indicate the positive impact of vitamin C [22], vitamin B3 [23], vitamin B5 [24]-[27], vitamin B9 [28] [29], Vitamin B12 [30] [31], vitamin E [22] and Coenzymes Q10 [32], on human embryogenesis, embryonic DNA methylation, germline development, and animal blastocyst development rate. To address the knowledge gap, we aim to investigate whether Fytomax Women, registered in Gabon, could improve blastulation rate.

2. Methodologies

2.1. Cohort of Women under Fytomax Supplementation

A retrospective observational cohort analysis involving women who underwent IVF treatment with Fytomax Women (KSMC Laboratories, PTY, LTD Belgium; http://www.ksmc.eu/) supplementation was performed between January 2025 and August 2025. The study was done at the IVF Laboratory of Mere et Enfant—Fondation Jeanne Ebori Hospital (CHU-FJE) and the IVF Laboratory of SOS Medecin Clinic (IVF-SOS), both located in Libreville, Gabon. Data used for the retrospective cohort study were obtained from Women seeking IVF treatment for any indication, irrespective of the cause. Women using donor oocytes were excluded from the study.

For the purpose of the study, variables such as patients' age, number of oocytes produced, number of blastocysts formed and blastulation rate were evaluated. Blastulation was defined as the presence of a new blastocyst. This study was conducted in line with the Declaration of Helsinki for medical research. Permissions

to use data confidentially were obtained from both participating laboratories. No personal identification data such as name, ID or laboratory requisition number was extracted.

2.2. Systematic Review and Meta-Analysis of Blastulation Rate

A computer search about reported blastulation rate was conducted in PubMed, Google Scholar, Cochrane Library and searched from 2015 until August 2025. We included randomised controlled trials, retrospective cohort studies and prospective cohort studies. Additionally, review articles found by our search were analysed to identify additional studies listed in their reference lists. Women who underwent IVF treatment, irrespective of the cause, were included in our study. To align with the aim of this study, women undergoing IVF treatment using an egg donor were excluded from the analysis.

2.3. Statistical Analysis

Statistical analysis was performed using the MedCalc® statistical software version 19.5 (MedCalc Software Ltd., Ostend, Belgium; http://www.medcalc.org/; 2020). Descriptive statistics for variables were presented as sample size (N), mean ± SD, median and range for each variable. The Kolmogorov-Smirnov test was used to determine the distribution of all the data sets. Based on the distribution of data, parametric statistical analyses were applied. The t-test was used to evaluate the statistical differences between groups. The correlations were determined using the parametric Pearson correlation and expressed as r^2. For all statistical tests, a P-value of <0.05 was considered statistically significant.

3. Results

3.1. Study Selection and Characteristics of the Systematic Review

A comprehensive systematic search in the literature was performed across three major databases: PubMed, Google Scholar, and Cochrane Library. The preliminary search retrieved a total of 1344 records. After removing 731 non-relevant articles and 198 duplicates, 495 records remained for further screening. Titles and abstracts were then rigorously analysed before excluding 104 records that did not meet the inclusion criteria, 256 records involving animal studies, 9 records using egg donors and 33 records with outcomes not of interest. Consequently, 13 studies were found to meet the predefined inclusion criteria (**Figure 1**).

3.2. Summary Statistics of the Cohort Study and the Systematic Review

The distribution of data was evaluated using the Kolmogorov-Smirnov test. All parameters were normally distributed. Consequently, results will be interpreted using the mean and standard deviation. The summary statistics are highlighted in **Table 1**. A total of 30 records were obtained from patients under Fytomax Women (KSMC Laboratories, PTY, LTD Belgium; http://www.ksmc.eu/) supplementation,

and who had IVF treatment at the Laboratory of the CHU-FJE and the SOS-IVF Clinic, both located in Libreville, Gabon. The average age of the patients was 38 (±4.65) while the average age of women included in the systematic review and meta-analysis was 42.46 (±16.54). The blastulation rate of women in the study and in the systematic review was 68.00 (±23.85)% and 50.04 (±13.25)% respectively. Table 1 shows the number of oocytes retrieved (9.70 ± 5.26) and the number of blastocysts formed (6.13 ± 3.14) of women who had IVF treatment in Gabon and under the Fytomax Women (KSMC Laboratories, PTY, LTD Belgium; http://www.ksmc.eu/) supplement.

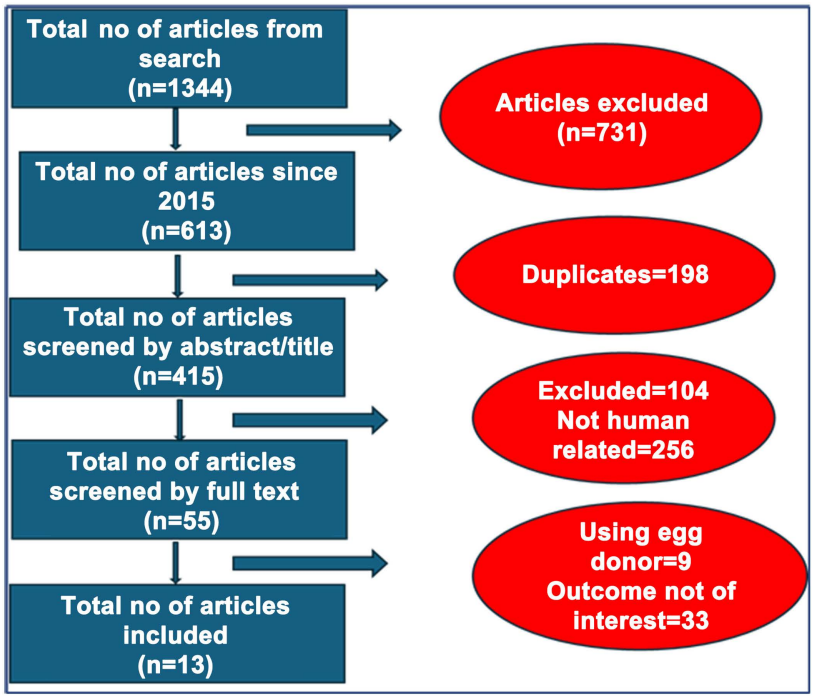

Figure 1. Diagrammatic illustration of the study selection process for systematic review and meta-analysis.

Table 1. Summary statistics of evaluated parameters.

Parameters	N	Mean	Median	SD	Minimum	Maximum
Age	30	38.00	38.00	4.65	30.00	49.00
Age (systematic review)	5999	42.46	35.70	16.54	33.50	72.00
Blastulation rate (%)	30	68.00	66.66	23.85	20.00	80.50
Blastulation rate (syst review) (%)	12112	50.04	48.10	13.25	30.90	75.60
No of oocytes retrieved	30	9.70	9.00	5.26	3.00	24.00
No of blastocysts formed	30	6.13	6.00	3.14	2.00	13.00

Figure 2 illustrates the age distribution amongst women who had IVF treatment in Gabon between January 2025 and August 2025. Most women are aged between 35 years and 40 years, with the youngest age reported to be 31 years.

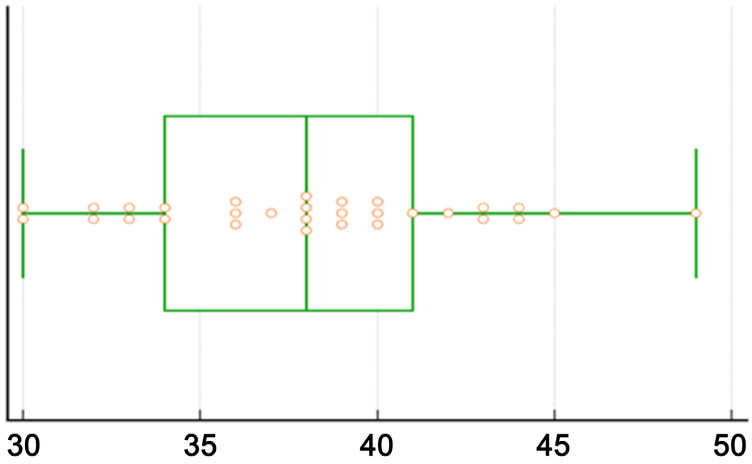

Figure 2. Age distribution of women using Fytomax Women during IVF cycle in Gabon.

3.3. Correlation Coefficient in the Cohort Study

The correlations and statistical significances between patient age, number of oocytes retrieved, number of blastocysts formed and blastulation rate are summarized in Table 2. Significant ($p < 0.05$) positive correlations were found between the number of blastocysts formed and number of oocytes retrieved ($r^2 = 0.663$; $p = 0001$) and blastulation rate ($r^2 = 0.382$; $p = 0.0371$). The current study did not find any significant positive correlations between the patient's age and blastulation rate.

Table 2. Pearson correlation coefficient between patient age and number of oocytes retrieved and blastocyst formation.

		Blastulation rate	Blastocyst formed	Oocytes retrieved
Age	r^2	0.264	0.217	0.041
	Significance Level P	0.1580	0.2504	0.8307
	n	30	30	30
Blastocystes formed	r^2	0.373	1	0.663
	Significance Level P	0.0421		0.0001
	n	30		30
Oocytes retrieved	r^2	0.382	0.663	1
	Significance Level P	0.0371	0.0001	
	n	30	30	

3.4. Blastulation Rates (Cohort Study vs Systematic Review)

A comparison between blastulation rate obtained from the cohort study and that from the systematic review was performed. Results, indicated in Table 3, showed a significantly ($p = 0.015$) higher blastulation rate in women under Fytomax Women (from the cohort) compared to blastulation rate from the systematic re-

view (68.00 ± 23 vs 50.04 ± 13). Figure 3 illustrates the differences between the blastulation rates.

Table 3. T-test for the comparison between blastulation rate obtained from the cohort and blastulation rate from the systematic review.

		Cohort Study	Systematic Review	P-Value
Blastulation rate	**Mean ± SD**	68.00 ± 23	50.04 ± 13	0.0150
	n	30	12 112	

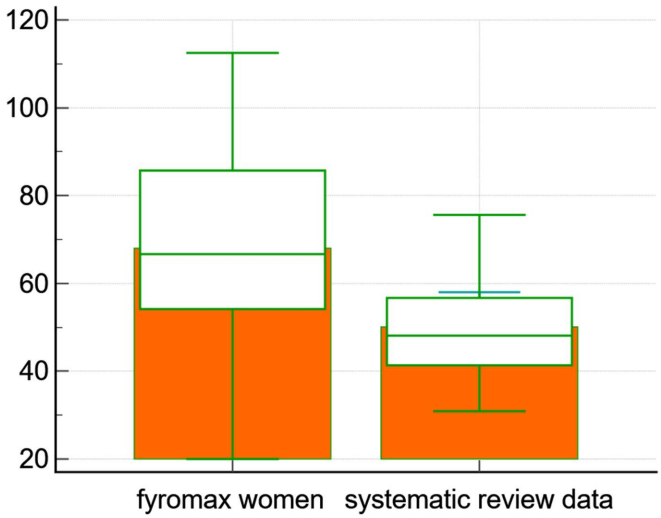

Figure 3. Box- and Whisker plot illustrating the differences between blastulation rate of women using Fytomax Women and bastulation rate reported in the literature.

4. Discussion

There is a significant emerging attention devoted to the potential benefits of supplementation using natural antioxidants on optimization of infertility treatments in assisted reproductive technologies [33]. The aim of this study was to evaluate the effects of a dietary supplement, Fytomax Women (KSMC Laboratories, PTY, LTD Belgium; http://www.ksmc.eu/), on blastulation rate.

Oocytes quality [34] and embryos viability [35] were found to have a significant impact on blastulation. Mitochondrial content [36] and excessive oxidative stress [33] are biomarkers of oocyte and embryo competencies. It was previously found that embryos with longer blastulation timing had higher mitochondrial content on day 6 [6]. The current study showed a significantly higher blastulation rate in women who had Fytomax Women supplement during IVF treatments. Fytomax Women has a synergistic composition combining standardized botanical extracts (Maca, Vitex, Tribulus) with mitochondrial-supportive micronutrients (zinc, selenium, coenzyme Q10, vitamins B9, B12, E) [19]. This combination is designed to support the ovarian microenvironment, improve mitochondrial energy production, and promote follicular health, all of which are essential for high-quality oocyte maturation [37]. A point to consider is the differences in sample size, a

factor that might be a limitation in the current analysis. In fact, the cohort analysis consisted of 30 women while the systematic review involved 12112 women. Having comparable sample sizes might have shown different results.

Oxidative stress can damage essential cellular components such as lipids content, DNA, and proteins during embryonic development [38]. Although oxidative stress was found to increase with maternal age [39], the current study showed that several women aged 40 and above achieved either a high oocyte-to-embryo conversion ratio or a clinical pregnancy, with one 44-year-old patient presenting a 100% blastulation rate. These results support the hypothesis that Fytomax Women may help counterbalance age-related reproductive decline, potentially by mitigating oxidative stress, one of the main contributors to impaired mitochondrial function and reduced oocyte quality.

While the weight of evidence suggests a negative correlation between maternal age and number of oocytes retrieved and viable embryos obtained [40]-[42], interestingly, the current study did not find any significant correlation between maternal age and number of oocytes retrieved and viable embryos. This result may indicate a stabilizing effect of the Fytomax Women formulation. However, this observation requires cautious interpretation due to the limited sample size and the absence of key hormonal parameters such as Anti-Müllerian hormone and Follicle-stimulating hormone.

5. Conclusion

The current study demonstrated that blastulation rate can be significantly improved by the addition of antioxidant supplementation such as Fytomax Women. This cohort study provides encouraging evidence that Fytomax Women may improve selected reproductive outcomes in women undergoing ART, notably by enhancing blastulation rates and facilitating clinical pregnancies, even in older age groups. However, these results warrant the design of a prospective, randomized controlled trial to validate the observed effects in a larger, multicentric population. Collaboration with fertility centers in Africa could provide the necessary clinical scale and diversity. Until such studies are completed, Fytomax Women may be cautiously integrated as an adjunct nutritional strategy in selected ART patients, under medical supervision and within individualized fertility protocols.

Limitations, Reasons for Caution

Since the data in this cohort study originates only from 2 fertility clinics in Gabon, further evaluations using comparable sample sizes and including more IVF centres are necessary to support the findings. Additionally, the limitations of this study included a lack of matching of factors such as male factors, infertility, reproductive hormones results, Body Mass Index, diet, stress and medicine use.

Acknowledgements

The authors would like to thank the IVF laboratory staff of the CHU-FJE and the

IVF-SOS clinic.

Conflicts of Interest

The authors declare no conflict of interest related to the content of this manuscript.

References

[1] Dettlaff, T.A., Ginsburg, A.S. and Schmalhausen, O.I. (1993) Embryonic Development. In: Dettlaff, T.A., Ginsburg, A.S. and Schmalhausen, O.I., Eds., *Sturgeon Fishes*, Springer, 49-154. https://doi.org/10.1007/978-3-642-77057-9_3

[2] Nguyen, E.B., Jacobs, E.A., Summers, K.M., Sparks, A.E., Van Voorhis, B.J., Klenov, V.E., *et al.* (2021) Embryo Blastulation and Quality between Days 5 and 6 of Extended Embryo Culture. *Journal of Assisted Reproduction and Genetics*, **38**, 2193-2198. https://doi.org/10.1007/s10815-021-02156-7

[3] Barrenetxea, G., de Larruzea, A.L., Ganzabal, T., Jiménez, R., Carbonero, K. and Mandiola, M. (2005) Blastocyst Culture after Repeated Failure of Cleavage-Stage Embryo Transfers: A Comparison of Day 5 and Day 6 Transfers. *Fertility and Sterility*, **83**, 49-53. https://doi.org/10.1016/j.fertnstert.2004.06.049

[4] Desai, N., Ploskonka, S., Goodman, L., Attaran, M., Goldberg, J.M., Austin, C., *et al.* (2016) Delayed Blastulation, Multinucleation, and Expansion Grade Are Independently Associated with Live-Birth Rates in Frozen Blastocyst Transfer Cycles. *Fertility and Sterility*, **106**, 1370-1378. https://doi.org/10.1016/j.fertnstert.2016.07.1095

[5] Haas, J., Meriano, J., Laskin, C., Bentov, Y., Barzilay, E., Casper, R.F., *et al.* (2016) Clinical Pregnancy Rate Following Frozen Embryo Transfer Is Higher with Blastocysts Vitrified on Day 5 than on Day 6. *Journal of Assisted Reproduction and Genetics*, **33**, 1553-1557. https://doi.org/10.1007/s10815-016-0818-x

[6] Ho, J.R., Arrach, N., Rhodes-Long, K., Salem, W., McGinnis, L.K., Chung, K., *et al.* (2018) Blastulation Timing Is Associated with Differential Mitochondrial Content in Euploid Embryos. *Journal of Assisted Reproduction and Genetics*, **35**, 711-720. https://doi.org/10.1007/s10815-018-1113-9

[7] Hong, Y., Boiti, A., Vallone, D. and Foulkes, N.S. (2024) Reactive Oxygen Species Signaling and Oxidative Stress: Transcriptional Regulation and Evolution. *Antioxidants*, **13**, Article 312. https://doi.org/10.3390/antiox13030312

[8] Jones, D.P. (2006) Redefining Oxidative Stress. *Antioxidants & Redox Signaling*, **8**, 1865-1879. https://doi.org/10.1089/ars.2006.8.1865

[9] Fathollahipour, S., Patil, P.S. and Leipzig, N.D. (2018) Oxygen Regulation in Development: Lessons from Embryogenesis Towards Tissue Engineering. *Cells Tissues Organs*, **205**, 350-371. https://doi.org/10.1159/000493162

[10] Wang, G., Dong, Q., Bai, Y., Yuan, J., Xu, Q., Cao, C., *et al.* (2017) Oxidative Stress Induces Mitotic Arrest by Inhibiting Aurora A-Involved Mitotic Spindle Formation. *Free Radical Biology and Medicine*, **103**, 177-187. https://doi.org/10.1016/j.freeradbiomed.2016.12.031

[11] Rizk, B., Sinha, P., Mulekar, M.S. and Agarwal, A. (2021) Oral Supplementation with a Combination Antioxidant Formulation Improves Clinical Pregnancy Rate. *Fertility and Sterility*, **116**, e249-e250. https://doi.org/10.1016/j.fertnstert.2021.07.669

[12] Sebastiani, G., Navarro-Tapia, E., Almeida-Toledano, L., Serra-Delgado, M., Paltrinieri, A.L., García-Algar, Ó., *et al.* (2022) Effects of Antioxidant Intake on Fetal Devel-

opment and Maternal/neonatal Health during Pregnancy. *Antioxidants*, **11**, Article 648. https://doi.org/10.3390/antiox11040648

[13] Obeagu, I., Obeagu, G.U., Ezeonwumelu, J.O.C., Alum, E.U. and Ugwu, O.P. (2023) Antioxidants and Pregnancy: Impact on Maternal and Fetal Health. *Newport International Journal of Biological and Applied Sciences*, **4**, 17-25. https://doi.org/10.59298/nijbas/2023/1.3.11111

[14] Fei, W., Zhang, J., Yu, S., Yue, N., Ye, D., Zhu, Y., *et al.* (2022) Antioxidative and Energy Metabolism-Improving Effects of Maca Polysaccharide on Cyclophosphamide-Induced Hepatotoxicity Mice via Metabolomic Analysis and Keap1-Nrf2 Pathway. *Nutrients*, **14**, Article 4264. https://doi.org/10.3390/nu14204264

[15] Kaya, E., Aydın, T. and Sağlamtaş, R. (2024) Evaluation of Antioxidant Activities and Inhibition Effects of *Tribulus terrestris* L. Extracts on Some Metabolic Enzymes. *South African Journal of Botany*, **170**, 156-162. https://doi.org/10.1016/j.sajb.2024.05.031

[16] Zheleva-Dimitrova, D., Obreshkova, D., Paraskev, O., Nedialkov, T. and Nedialkov, P.T. (2013). Antioxidant Activity of *Tribulus terrestris*—A Natural Product in Infertility Therapy. *International Journal of Pharmacy and Pharmaceutical Sciences*, **4**, 508-511.

[17] Sultan Aslantürk, Ö. and Aşkın Çelik, T. (2013) Antioxidant Activity and Anticancer Effect of *Vitex agnus-castus* L. (Verbenaceae) Seed Extracts on MCF-7 Breast Cancer Cells. *Caryologia*, **66**, 257-267. https://doi.org/10.1080/00087114.2013.850797

[18] Azzouni, D., Alaoui Mrani, S., Bahij, F., Zejli, H., Alanazi, M.M., Fadili, D., *et al.* (2025) Comprehensive Phytochemical, Antioxidant, and Antibacterial Analysis of *Vitex agnus-castus* L. Essential Oil (VACEO): Insights from ADMET and Molecular Docking Studies. *Pharmaceuticals*, **18**, Article 462. https://doi.org/10.3390/ph18040462

[19] KSMC Laboratory (2025) Belgium. https://www.ksmc.eu/fytomax-women-conceptmax-women.html

[20] Aveen, R. (2021) Fertilization and Embryonic Development after Oral Administration of *Lepidium meyenii* (Maca) and *Glycyrrhiza glabra* Crude Aqueous Extract in Mice. Ph.D. Thesis, University of Baghdad.

[21] Aoki, Y., Tsujimura, A., Nagashima, Y., Hiramatsu, I., Uesaka, Y., Nozaki, T., *et al.* (2018) Effect of *Lepidium meyenii* on *in Vitro* Fertilization via Improvement in Acrosome Reaction and Motility of Mouse and Human Sperm. *Reproductive Medicine and Biology*, **18**, 57-64. https://doi.org/10.1002/rmb2.12251

[22] Wang, X., Falcone, T., Attaran, M., Goldberg, J.M., Agarwal, A. and Sharma, R.K. (2002) Vitamin C and Vitamin E Supplementation Reduce Oxidative Stress-Induced Embryo Toxicity and Improve the Blastocyst Development Rate. *Fertility and Sterility*, **78**, 1272-1277. https://doi.org/10.1016/s0015-0282(02)04236-x

[23] Clagett-Dame, M. and Knutson, D. (2011) Vitamin A in Reproduction and Development. *Nutrients*, **3**, 385-428. https://doi.org/10.3390/nu3040385

[24] DiTroia, S.P., Percharde, M., Guerquin, M., Wall, E., Collignon, E., Ebata, K.T., *et al.* (2019) Maternal Vitamin C Regulates Reprogramming of DNA Methylation and Germline Development. *Nature*, **573**, 271-275. https://doi.org/10.1038/s41586-019-1536-1

[25] Chu, M., Yao, F., Xi, G., Yang, J., Zhang, Z., Yang, Q., *et al.* (2021) Vitamin C Rescues *in Vitro* Embryonic Development by Correcting Impaired Active DNA Demethylation. *Frontiers in Cell and Developmental Biology*, **9**, Article 784244. https://doi.org/10.3389/fcell.2021.784244

[26] Minor, E.A., Court, B.L., Young, J.I. and Wang, G. (2013) Ascorbate Induces Ten-Eleven Translocation (Tet) Methylcytosine Dioxygenase-Mediated Generation of 5-Hydroxymethylcytosine. *Journal of Biological Chemistry*, **288**, 13669-13674. https://doi.org/10.1074/jbc.c113.464800

[27] Yin, R., Mao, S., Zhao, B., Chong, Z., Yang, Y., Zhao, C., *et al.* (2013) Ascorbic Acid Enhances Tet-Mediated 5-Methylcytosine Oxidation and Promotes DNA Demethylation in Mammals. *Journal of the American Chemical Society*, **135**, 10396-10403. https://doi.org/10.1021/ja4028346

[28] Greenberg, J.A., Bell, S.J., Guan, Y. and Yu, Y.H. (2011) Folic Acid Supplementation and Pregnancy: More Than Just Neural Tube Defect Prevention. *Reviews in Obstetrics and Gynecology*, **4**, 52-59.

[29] Von Fraunhofer, J.A. (2019) Vitamin B9 and Health. *Dental Science*, **18**, 1331-1335.

[30] Sapehia, D., Mahajan, A., Srinivasan, R. and Kaur, J. (2023) Pre-Natal Dietary Imbalance of Folic Acid and Vitamin B12 Deficiency Adversely Impacts Placental Development and Fetal Growth. *Placenta*, **132**, 44-54. https://doi.org/10.1016/j.placenta.2023.01.003

[31] Pepper, M.R. and Black, M.M. (2011) B12 in Fetal Development. *Seminars in Cell & Developmental Biology*, **22**, 619-623. https://doi.org/10.1016/j.semcdb.2011.05.005

[32] He, X., Chen, H., Liao, M., Zhao, X., Zhang, D., Jiang, M., *et al.* (2024) The Role of CoQ10 in Embryonic Development. *Journal of Assisted Reproduction and Genetics*, **41**, 767-779. https://doi.org/10.1007/s10815-024-03052-6

[33] Voros, C., Athanasiou, D., Papapanagiotou, I., Mavrogianni, D., Varthaliti, A., Bananis, K., *et al.* (2025) Cracking the Code of Oocyte Quality: The Oxidative Stress Link to IVF Success. *International Journal of Molecular Sciences*, **26**, Article 6377. https://doi.org/10.3390/ijms26136377

[34] Borges Junior, E., Setti, A., Braga, D., Del Collado, M., Guilherme, P., Fjeldstad, J., *et al.* (2025) P-192 AI-Driven Oocyte Assessment for Predicting Blastulation and High-Quality Blastocyst Development in Severe Male Factor Infertility. *Human Reproduction*, **40**, deaf097.501. https://doi.org/10.1093/humrep/deaf097.501

[35] Moustafa, S.M., Rosen, E.M., Boylan, C. and Mersereau, J.E. (2020) Time to Blastulation Is Superior to Individual Components of Embryo Grading for Live-Birth Prediction. *F&S Reports*, **1**, 243-248. https://doi.org/10.1016/j.xfre.2020.09.016

[36] May-Panloup, P., Boguenet, M., El Hachem, H., Bouet, P. and Reynier, P. (2021) Embryo and Its Mitochondria. *Antioxidants*, **10**, Article 139. https://doi.org/10.3390/antiox10020139

[37] Chakri, K. (2025) Managing Director KSMC Laboratory. Personal Communication.

[38] Divvela, S.S.K., Gallorini, M., Gellisch, M., Patel, G.D., Saso, L. and Brand-Saberi, B. (2025) Navigating Redox Imbalance: The Role of Oxidative Stress in Embryonic Development and Long-Term Health Outcomes. *Frontiers in Cell and Developmental Biology*, **13**, Article 1521336. https://doi.org/10.3389/fcell.2025.1521336

[39] Imanparast, F., Hashemi, B., Mokhtari, F., Mohaghegh, P., Azar, F.F. and Mehvari, F. (2024) The Effect of Mother's Age on the Neonatal Cord Serum's Oxidative Stress Index and Maternal and Neonatal Outcomes: A Case Control Study. *BMC Pregnancy and Childbirth*, **24**, Article No. 61. https://doi.org/10.1186/s12884-023-06239-4

[40] Vermey, B.G., Chua, S.J., Zafarmand, M.H., Wang, R., Longobardi, S., Cottell, E., *et al.* (2019) Is There an Association between Oocyte Number and Embryo Quality? A Systematic Review and Meta-Analysis. *Reproductive BioMedicine Online*, **39**, 751-763. https://doi.org/10.1016/j.rbmo.2019.06.013

[41] Cimadomo, D., Fabozzi, G., Vaiarelli, A., Ubaldi, N., Ubaldi, F.M. and Rienzi, L. (2018) Impact of Maternal Age on Oocyte and Embryo Competence. *Frontiers in Endocrinology*, **9**, Article 327. https://doi.org/10.3389/fendo.2018.00327

[42] Orvieto, R., Nayshool, O., Cohen, L., Yung, Y., Aizer, A., Saar, E.G., *et al.* (2025) Impact of Aging on Gene Expression in Human Oocytes: A Comparative Analysis of Young and Older Patients. *Reproductive Biology and Endocrinology*, **23**, Article No. 111. https://doi.org/10.1186/s12958-025-01449-1