

Comparison of Nutrition Practices, Knowledge and Exercise between Pregnant Women in China and Zambia

Nisile Kakongoma^{1*}, Annie Nambela², Sha Lu³, Wensheng Hu⁴, Lingya Fang¹

¹Department of Obstetrics, Zhejiang Chinese Medical University, Hangzhou Women's Hospital, Hangzhou, China

²Chingola District Health Office, Chingola, Zambia

³Prenatal Screening and Prenatal Diagnosis Center, Hangzhou Women's Hospital (Hangzhou Maternity and Child Health Care Hospital), Hangzhou, China

⁴Department of Obstetrics, Women's Hospital, Zhejiang University, Hangzhou, China

Email: *nisilenk@gmail.com

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Abstract

Purpose: The aim of this study is to compare how Chinese and Zambian pregnant women respond to nutrition and exercise. **Methods:** This is a cross-sectional study with data that was conducted in Chingola City, Zambia, and Hangzhou City, China, using an online survey between September 1, 2023 and February 28, 2024. The subjects were divided into two groups (the China group and the Zambia group) according to their nationality. **Results:** A total of 210 participants were included through a questionnaire survey, 104 from China and 106 from Zambia. In terms of nutrient supplementation and whether to choose takeout weekly, 100% of Chinese pregnant women chose yes, while 100% of Zambian pregnant women chose no ($P < 0.01$). Among the Chinese women, 78.8% ate vegetables daily, whereas 92.5% in the Zambia group ate vegetables daily ($P < 0.01$). The fruit consumption in the Chinese group was significantly higher than that in the Zambian group (91.3% vs. 71.7%, $P < 0.01$). The proportion of tea consumption in the China group was significantly lower than that in the Zambia group ($P < 0.01$), however, there was no significant difference in the proportion of coffee consumption ($P > 0.05$). The proportion of pregnant women in the China group choosing moderate or intense activities was higher than that in the Zambia group. In terms of daily exercise time, the proportion of Chinese pregnant women choosing 13 - 30 minutes or 30 - 60 minutes was significantly higher than that of Zambian pregnant women ($P < 0.01$). **Conclusion:** From the findings in our study, it can be observed that although pregnancy is an experience that many women may go through, lifestyle habits during pregnancy can vary from culture to

culture or ethnicity.

Keywords

Nutrition, Exercise, Pregnancy, China, Zambia

1. Introduction

The significance of nutrition and exercise during pregnancy has proven to be of critical importance for the best maternal and fetal outcomes, especially in developing nations [1]. The World Health Organization (WHO) stated in a release in 2023 that nutrition education and counseling might bring about desired gestational weight gain (*i.e.* neither insufficient nor excessive), reduce the risk of pregnancy-related anemia, lower the risks of preterm delivery and increased risk of low birth weight and small for gestational age infants [1] if put into practice. A healthy lifestyle including eating habits, enhances the success of achieving good pregnancy outcomes [1] and prevents conditions like gestational diabetes [2] [3]. It is, therefore, significant that foods rich in essential and polyunsaturated fats, carbohydrates rich in fiber and also vegetables be prioritized, especially in obese, overweight or diabetic women. Adequate intake of micronutrients including iron, calcium, folate and vitamin D is too important for pregnancy and breastfeeding to prevent neural tubal defects, preterm birth and low birth weight [4].

Moderate physical activity throughout pregnancy improves muscle tone and function, decreasing the risk of pre-eclampsia, gestational diabetes and postpartum overweight [5] [6]. In another release in October 2022, the WHO encouraged women without contraindication to do at least 150 minutes of moderate physical activities throughout the week, and should limit the amount of time being sedentary or inactive which in turn reduces the risks of pre-eclampsia, gestational hypertension, delivery and newborn complications including adiposity or macrosomia. Physical activity reduces sleep deprivation and poor cardiometabolic health. It also improves postpartum recovery time, and reduces the prevalence of depressive disorders.

However, different countries or regions have different attitudes towards nutrition and exercise, and pregnant women may have different behavioral attitudes towards nutrition and exercise. China and Zambia are both developing countries. Nevertheless, there is currently no research comparing the nutrition and exercise approaches of pregnant women between the two countries. We are very interested in this and plan on conducting related future studies.

Conclusively, the findings in this study will increase our understanding of the lifestyle habits of the two groups, which will give a better and deeper understanding of the differences between Chinese and Zambian pregnant women. This will further increase the knowledge of physicians from both groups so that they can make improvements, adjustments, and timely interventions where needed.

2. Methods

2.1. Subjects

This is a cross-sectional study with data that was collected in Chingola City, Zambia, and Hangzhou City, China, using an online survey between September 1, 2023 and February 28, 2024. Participants were recruited from the two hospitals according to the following criteria: each individual 1) agreed to participate in the study and gave their informed consent; 2) was pregnant; 3) had no history of mental diseases. This was a study to explore potential differences between the two groups and there was no quantifiable hypothesis to test in advance. Thus, we referred to a rough estimation method with 5 - 10 times the number of variables to calculate the sample size [7]. A total of 11 variables were included in the study; therefore, the required sample size was 55 (11×5). Considering a sample loss of 20.0%, the minimum sample size required for this study was 69 participants. We recruited as many eligible subjects as possible. In total, 210 respondents who completed the questionnaire were included in the final analysis (we recorded a 100% response rate).

The subjects were divided into two groups (the China group and the Zambia group) according to their nationality. All the study procedures were approved by the ethics committee of Hangzhou Women's Hospital (Hangzhou Maternity and Child Health Care Hospital).

2.2. Questionnaire

Our questionnaire was developed to assess the similarities and differences in lifestyle habits during pregnancy between the two countries, which was designed based on existing literature ([Appendix](#)).

The questionnaire was structured into three parts: the first part consists of respondents' socio-demographic information which included nationality, age, gestational age, parity, married status, employment status, self-assessed income level and education. The second part was about nutrition and eating habits which included 9 yes or no questions: intake of pregnancy supplements, consumption of take-out meals weekly, daily consumption of breakfast, vegetables, and fruits. Tea and coffee consumption on a daily basis, proactively acquiring nutrition knowledge and putting the nutritional knowledge into practice. The third part was about exercise which had two main constructs: 1) type of exercise, ranging from no exercise, mild (e.g walking...), moderate (e.g climbing stairs/cycling/jogging/Yoga...) to intense (e.g running/swimming...) activities; 2) Daily time of exercise recorded in minutes, categorized as < 15 minutes, 15 - 30 minutes, 30 - 60 minutes, and >60 minutes.

We used Cronbach alpha to determine the reliability of the questionnaire. The value was 0.734, which indicated that the study questionnaire was reliable.

2.3. Data Analysis

All the questionnaires were evaluated by the same person who was not responsible

for either recruitment, allocation of randomization, or collection of completed questionnaires. Continuous data were compared using the independent samples t-test and analysis of variance. Chi-squared analysis was used for categorical variables. Our data were analyzed using the SPSS version 25.0 (SPSS, Armonk, NY, USA), and $P < 0.05$ was considered to indicate a significant difference. All tests were two-tailed analyses.

3. Results

3.1. Characteristics of the Study Population

As shown in **Table 1**, a total of 210 participants completed all the procedures in the study, 104 from China and 106 from Zambia. The age of the Chinese group was significantly higher than that of the Zambian group ($P < 0.01$). Compared with the Zambia group, the marriage rate, self-assessed income level and education level in the Chinese group were also significantly higher ($P < 0.01$). Overall, no significant differences were observed between the China group and Zambia group in terms of gestational age, parity, and employment status (**Table 1**).

3.2. Nutrition and Eating Habits

In terms of nutrient supplementation and whether to choose takeout weekly, 100% of Chinese pregnant women chose yes, while 100% of Zambian pregnant women chose no ($P < 0.01$) (**Table 2**).

Table 1. Participant demography.

Variables		China group (n = 104)	Zambia group (n = 106)	t/ χ^2	p
Age		31.30 \pm 4.93	26.62 \pm 5.83	6.28	<0.001**
Gestational age	<14 weeks	4 (3.8)	7 (6.6)	3.53	0.171
	14 - 28 weeks	66 (63.5)	54 (50.9)		
	\geq 28 weeks	34 (32.7)	45 (42.5)		
Parity	Nulliparous	24 (23.1)	36 (34.0)	3.05	0.081
	Multiparous	80 (76.9)	70 (66.0)		
Married	Yes	91 (87.5)	66 (62.3)	17.72	<0.001**
	No	13 (12.5)	40 (37.7)		
Employment status	Full time	37 (35.6)	30 (28.3)	1.28	0.260
	Unemployed	67 (64.4)	76 (71.7)		
	Below average	23 (22.1)	40 (37.7)		
Self-assessed income level	Similar to the average level	34 (32.7)	29 (27.4)	6.16	0.046*
	Above average	47 (45.2)	37 (34.9)		
Education	Less than senior middle school	13 (12.5)	26 (24.5)	59.52	<0.001**
	Senior middle school	14 (13.5)	57 (53.8)		
	Bachelor and more	77 (74.0)	23 (21.7)		

Note: * $p < 0.05$; ** $p < 0.01$.

Table 2. Nutrition and eating habits.

Variables		China group (n = 104)	Zambia group (n = 106)	χ^2	<i>p</i>
Nutrients supplementation	Yes	104 (100.0)	0 (0.00)	210.00	<0.001**
	No	0 (0.00)	106 (100.0)		
Take out weekly	Yes	104 (100.0)	0 (0.00)	210.00	<0.001**
	No	0 (0.00)	106 (100)		
Have breakfast daily	Yes	96 (92.3)	89 (84.0)	3.48	0.062
	No	8 (7.7)	17 (16.0)		
Vegetable consumption daily	Yes	82 (78.8)	98 (92.5)	7.94	0.005**
	No	22 (21.2)	8 (7.5)		
Fruits consumption daily	Yes	95 (91.3)	76 (71.7)	13.40	<0.001**
	No	9 (8.7)	30 (28.3)		
Tea consumption daily	Yes	7 (6.7)	82 (77.4)	107.23	<0.001**
	No	97 (93.3)	24 (22.6)		
Coffee consumption daily	Yes	12 (11.5)	12 (11.3)	0.002	0.960
	No	92 (88.5)	94 (88.7)		
Proactively acquiring nutrition knowledge	Yes	50 (48.1)	63 (59.4)	2.72	0.099
	No	54 (51.9)	43 (40.6)		
Applying nutritional knowledge to practice	Yes	90 (86.5)	15 (14.2)	110.03	<0.001**
	No	14 (13.5)	91 (85.8)		

Note: * $p < 0.05$; ** $p < 0.01$.

There was a significant difference between the two groups in the vegetable consumption daily ($P < 0.01$). Among the Chinese women, 78.8% ate vegetables daily, whereas 92.5% in the Zambia group ate vegetables daily. The fruit consumption in the Chinese group was significantly higher than that of the Zambian group (91.3% vs. 71.7%, $P < 0.01$) (**Table 2**).

The proportion of tea consumption in the China group was significantly lower than that of the Zambia group ($P < 0.01$), however, there was no significant difference in the proportion of coffee consumption between the two groups ($P > 0.05$) (**Table 2**).

Although the proactively acquiring nutrition knowledge rate of the China group (48.1%) was lower than that of the Zambia group (59.4%), there was no significant difference between the two groups ($P > 0.05$) (**Table 2**). In terms of applying nutritional knowledge to practice, 86.5% of the Chinese group were able to practice their nutrition knowledge, which was significantly higher than that of the Zambia group (14.2%, $P < 0.01$) (**Table 2**).

3.3. Exercise

Despite the differences in exercise intensity between the two groups, the vast

majority of pregnant women chose mild activities (82.7% in the China group vs. 92.5% in the Zambia group). Among them, the proportion of pregnant women in the China group choosing moderate or intense activities was higher than that of the Zambia group (**Table 3**).

Table 3. Exercise status.

Variables	China group (n = 104)	Zambia group (n = 106)	χ^2	<i>p</i>	
Exercise intensity	Hardly ever	10 (9.6)	8 (7.5)	8.99	0.029*
	Mild activities	86 (82.7)	98 (92.5)		
	Moderate activities	7 (6.7)	0 (0.00)		
	Intense activities	1 (1.0)	0 (0.00)		
Exercise time daily (minutes)	<15	34 (32.7)	78 (73.5)	39.11	<0.001**
	15 - 30	59 (56.7)	20 (18.9)		
	30 - 60	9 (8.7)	4 (3.8)		
	> 60	2 (1.9)	4 (3.8)		

Note: **p* < 0.05; ***p* < 0.01.

Regarding daily exercise in minutes, a significantly higher proportion of Chinese pregnant women chose between 13 - 30 minutes or 30 - 60 minutes while a significantly lower proportion was recorded in the Zambian pregnant women (*P* < 0.01) (**Table 3**).

4. Discussion

From the findings in our present study, it can be observed that although pregnancy is a journey that many women may experience, lifestyle habits during pregnancy can vary from culture to culture or ethnicity, and outcomes are uncertain [8]. For China, our results show that close attention is paid with regard to proper nutrition including the intake of pregnancy supplements, and folic acid intake which has the likelihood of providing a protective barrier for the risk of gestational diabetes (GDM) [9] [10], as it is an increasing public health and worldwide concern, posing a threat to both fetal and maternal outcomes [11], and shows a significant difference in comparison to Zambia. Another significant difference that was observed was that the Chinese group consumed more takeaway meals during pregnancy. The benefits of prenatal exercise reduce gestational weight gain and the risk of GDM for overweight and obese women reinforcing the benefits of exercise during pregnancy [12]. After the two-child policy was implemented, GDM became an epidemic causing a health and economic burden in China [13]. However, the implementations of physical activity (PA) have shown great benefits in reducing gestational weight gain and the risk of GDM for overweight and obese women [14]. As observed from our results, there was a significant difference observed in the amount of time spent exercising between Chinese and Zambian

women.

Studies show that the lifestyle habits of pregnant women in Zambia are not sufficient, however, sub-Saharan Africa experiences similar responses due to the vulnerability that comes with pregnancy. Maternal mortality rates are closely linked to maternal nutrition among African women with causes including poor dietary nutrition quality and inadequate food intake [15]. Another study reported that the prevalence of iron deficiency anemia in Africa is the most common among pregnant women and has severe consequences on both the mother and fetus [16].

For pregnant women with no evidence of medical and obstetrical complications, they were encouraged to maintain an active lifestyle. Just like our study, a meta-analysis on African pregnant women and exercise showed that antenatal exercise in Africa is low in comparison to other continents [17]. In Zambia, pregnant women may not know the specific exercises suitable during antenatal and mostly depend on walking and daily household chores to compensate as a means of exercise during pregnancy [18]. A community based cross-sectional study, indicated inadequate practice of antenatal exercise [19], while another literature review showed that physical activity (PA) among African pregnant women is clearly low and there need to be interventions in order to improve and promote better health for the continent [20]. In South Africa, a study showed that the majority of women did not meet the recommended 150 minutes of moderate-intensity/light-intensity activity per week [21]. Women who participate in prenatal exercises may experience benefits including having calmer babies with enhanced mental and neurological functions and better adaptability to new environments [22]. Limited data access and knowledge about the benefits of physical activity (PA) during pregnancy and its contribution to adverse outcomes have also been shown to be a contributing factor in low-middle-income countries [23].

Due to the insufficient nutrition that take-out meals contain, Chinese women should be encouraged to consume less of these meals during pregnancy as 100% of them from our study did. It is imperative that Zambian women pay more attention to taking pregnancy supplements in order to ensure good pregnancy outcomes including proper growth of the baby and prevent conditions like neural tubal defects [24], iron deficiency anemia [25], pre-eclampsia and lower the risks of pre-term birth [26]. The Zambian women should also be admonished to eat more fruits, especially those that are a source of essential vitamins, fiber and folate. Moderation of tea consumption should be taken into consideration in relation to the effects of excess caffeine intake which include gestational weight gain (GWA) and small for gestational age (SGA) [27]. The results showed that a larger number of pregnant women in Zambia drink tea. While having nutrition knowledge is a good start for better nutrition, it is more important to put the knowledge into practice to ensure good health outcomes for both mother and baby. Therefore, the Zambia group should adhere to putting their nutrition knowledge into practice. The Zambia group also had low scores in relation to the average time of exercise, compared to the China group. Pregnant women should be encouraged to

understand the benefits of minimal exercises deemed fit for pregnancy such as walking, climbing stairs, cycling on a stationary bike, and swimming [28], as they may help with the management of anxiety [29], can be a conservative means of managing varicose veins, and deep vein thrombosis (DVT).

While a one-size-fits-all approach may work globally, it is important to put into consideration individualistic factors that may affect the mothers' overall nutritional status. Our study used nutrition guidelines related to maternal nutrition and lifestyle habits during pregnancy. Despite the limitations of studies and inconsistent existing recommendations, some research work has shown that personalized nutrition offers women the opportunity to improve their health by using strategic uniquely tailored plans to meet their nutritional needs. More personalized approaches have the potential to optimize mothers and their offsprings health outcomes more appropriately to their nutrition needs during and after pregnancy [30].

Future studies can be more involving and diverse in that research work should not just be left for the senior health care practitioners but, young health care providers should be encouraged to actively participate with access to proper funding that would bring about the desirable results.

We recommend developing countries involve the governments and health care policymakers to support various nutrition and lifestyle interventions so that researchers can invest their time in conducting thorough research and provide timely interventions with decisions that stem from well-informed quality and empirical evidence. The governments and healthcare policymakers should aim to provide more recommendations, improve nutrition education, and develop novel approaches to improve consistent adherence to dietary and lifestyle interventions.

Several study limitations must be considered. First, the sample size was small, and it could have been expanded further. Second, although both China and Zambia are developing countries, Zambia's income level is lower than China's. Considering the different cost levels in the two countries, we did not use specific "household income" when collecting data before. Instead, we asked the subjects to evaluate the relationship between their household income level and the social average level, which may better assess the potential impact of socioeconomic level in this study. Third, our questionnaire design only includes yes/no options and does not include measurement of dietary intake. Nonetheless, this study is a preliminary exploration, and more detailed studies are needed in the future regarding this topic.

In conclusion, from the findings in our present study, it can be observed that although pregnancy is an experience that many women may go through, lifestyle habits during pregnancy can vary from culture to culture or ethnicity.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Aoyama, T., Li, D. and Bay, J.L. (2022) Weight Gain and Nutrition during Pregnancy: An Analysis of Clinical Practice Guidelines in the Asia-Pacific Region. *Nutrients*, **14**, Article No. 1288. <https://doi.org/10.3390/nu14061288>
- [2] Machairiotis, N., Vasilakaki, S., Minns, L. and Malakasis, A. (2021) Nutrients That Modulate Gestational Diabetes Mellitus: A Systematic Review of Cohort Studies Jan 2019-Jan 2020. *International Journal of Clinical Practice*, **75**, e14033. <https://doi.org/10.1111/ijcp.14033>
- [3] Wu, S., Jin, J., Hu, K., Wu, Y. and Zhang, D. (2022) Prevention of Gestational Diabetes Mellitus and Gestational Weight Gain Restriction in Overweight/Obese Pregnant Women: A Systematic Review and Network Meta-Analysis. *Nutrients*, **14**, Article No. 2383. <https://doi.org/10.3390/nu14122383>
- [4] Gernand, A.D., Schulze, K.J., Stewart, C.P., West, K.P. and Christian, P. (2016) Micronutrient Deficiencies in Pregnancy Worldwide: Health Effects and Prevention. *Nature Reviews Endocrinology*, **12**, 274-289. <https://doi.org/10.1038/nrendo.2016.37>
- [5] Mate, A., Reyes-Goya, C., Santana-Garrido, Á. and Vázquez, C.M. (2020) Lifestyle, Maternal Nutrition and Healthy Pregnancy. *Current Vascular Pharmacology*, **19**, 132-140. <https://doi.org/10.2174/1570161118666200401112955>
- [6] Gallo-Galán, L.M., Gallo-Vallejo, M.A. and Gallo-Vallejo, J.L. (2022) Ejercicio físico y embarazo. Medicina basada en la evidencia (MBE). *Medicina de Familia. SEMERGEN*, **48**, 423-430. <https://doi.org/10.1016/j.semerg.2022.02.008>
- [7] Ni, P., Chen, J.L. and Liu, N. (2010) The Sample Size Estimation in Quantitative Nursing Research. *Chinese Journal of Nursing*, **45**, 378-380.
- [8] Goldstein, R.F., Abell, S.K., Ranasinha, S., Misso, M.L., Boyle, J.A., Harrison, C.L., et al. (2018) Gestational Weight Gain across Continents and Ethnicity: Systematic Review and Meta-Analysis of Maternal and Infant Outcomes in More than One Million Women. *BMC Medicine*, **16**, Article No. 153. <https://doi.org/10.1186/s12916-018-1128-1>
- [9] Xu, T., He, Y., Dainelli, L., Yu, K., Detzel, P., Silva-Zolezzi, I., et al. (2017) Healthcare Interventions for the Prevention and Control of Gestational Diabetes Mellitus in China: A Scoping Review. *BMC Pregnancy and Childbirth*, **17**, Article No. 171. <https://doi.org/10.1186/s12884-017-1353-1>
- [10] Chen, H., Hu, Y., Li, Y., Zhou, W., Zhou, N., Yang, H., et al. (2022) Association of Folic Acid Supplementation in Early Pregnancy with Risk of Gestational Diabetes Mellitus: A Longitudinal Study. *Nutrients*, **14**, Article No. 4061. <https://doi.org/10.3390/nu14194061>
- [11] Lu, W. and Hu, C. (2022) Molecular Biomarkers for Gestational Diabetes Mellitus and Postpartum Diabetes. *Chinese Medical Journal*, **135**, 1940-1951. <https://doi.org/10.1097/cm9.0000000000002160>
- [12] Du, M., Ouyang, Y., Nie, X., Huang, Y. and Redding, S.R. (2018) Effects of Physical Exercise during Pregnancy on Maternal and Infant Outcomes in Overweight and Obese Pregnant Women: A Meta-Analysis. *Birth*, **46**, 211-221. <https://doi.org/10.1111/birt.12396>
- [13] Juan, J. and Yang, H. (2020) Prevalence, Prevention, and Lifestyle Intervention of

- Gestational Diabetes Mellitus in China. *International Journal of Environmental Research and Public Health*, **17**, Article No. 9517. <https://doi.org/10.3390/ijerph17249517>
- [14] Zhou, Y., Guo, X., Mu, J., Liu, J., Yang, H. and Cai, C. (2022) Current Research Trends, Hotspots, and Frontiers of Physical Activity during Pregnancy: A Bibliometric Analysis. *International Journal of Environmental Research and Public Health*, **19**, Article No. 14516. <https://doi.org/10.3390/ijerph192114516>
- [15] Lartey, A. (2008) Maternal and Child Nutrition in Sub-Saharan Africa: Challenges and Interventions. *Proceedings of the Nutrition Society*, **67**, 105-108. <https://doi.org/10.1017/s0029665108006083>
- [16] Obeagu, E.I., Ali, A.A., Onwuasoanya, U.F., Ngwoke, A.O., Vandu, D.C., Obeagu, G.U., et al. (2023) Anaemia among Pregnant Women: A Review in Africa. *IDOSR Journal of Scientific Research*, **8**, 58-61. <https://doi.org/10.59298/idosr/2023/10.2.6004>
- [17] Geda, Y.F., Mohammed, S.J., Berhe, T.M., Chibsa, S.E., Sahle, T., Lamiso, Y.Y., et al. (2023) Do Pregnant African Women Exercise? A Meta-Analysis. *PLOS ONE*, **18**, e0289421. <https://doi.org/10.1371/journal.pone.0289421>
- [18] Nkhata, L.A., Munalula-Nkandu, E. and Shula, H. (2015) Exercise Practice among Women Attending Antenatal Care at the University Teaching Hospital in Lusaka, Zambia. *Science Journal of Public Health*, **3**, 361-365. <https://doi.org/10.11648/j.sjph.20150303.19>
- [19] Beyene, M.M., Shimbire, M.S., Ukke, G.G., Gebremichael, M.A. and Gurara, M.K. (2022) Factors Associated with Antenatal Exercise in Arba Minch Town, Southern Ethiopia: A Community-Based Cross-Sectional Study. *PLOS ONE*, **17**, e0260840. <https://doi.org/10.1371/journal.pone.0260840>
- [20] Okafor, U.B. and Goon, D.T. (2020) Physical Activity and Exercise during Pregnancy in Africa: A Review of the Literature. *BMC Pregnancy and Childbirth*, **20**, Article No. 732. <https://doi.org/10.1186/s12884-020-03439-0>
- [21] Okafor, U.B. and Goon, D.T. (2020) Physical Activity Level during Pregnancy in South Africa: A Facility-Based Cross-Sectional Study. *International Journal of Environmental Research and Public Health*, **17**, Article No. 7928. <https://doi.org/10.3390/ijerph17217928>
- [22] Emon Umoe, D., Esienumoh, E., Regina E., E., Nwkwue C., N. and Mathias, A. (2020) Perception of Prenatal Exercise and Its Perceived Outcome among Pregnant Women Attending Antenatal Clinic at the University of Calabar Teaching Hospital. *Global Journal of Health Science*, **12**, 157-165. <https://doi.org/10.5539/gjhs.v12n8p157>
- [23] Okafor, U.B. and Goon, D.T. (2020) Developing a Physical Activity Intervention Strategy for Pregnant Women in Buffalo City Municipality, South Africa: A Study Protocol. *International Journal of Environmental Research and Public Health*, **17**, Article No. 6694. <https://doi.org/10.3390/ijerph17186694>
- [24] Sharman Moser, S., Rabinovitch, M., Rotem, R., Koren, G., Shalev, V. and Chodick, G. (2019) Parity and the Use of Folic Acid Supplementation during Pregnancy. *BMJ Nutrition, Prevention & Health*, **2**, 30-34. <https://doi.org/10.1136/bmjnph-2019-000024>
- [25] Georgieff, M.K., Krebs, N.F. and Cusick, S.E. (2019) The Benefits and Risks of Iron Supplementation in Pregnancy and Childhood. *Annual Review of Nutrition*, **39**, 121-146. <https://doi.org/10.1146/annurev-nutr-082018-124213>
- [26] Hofmeyr, G.J., Lawrie, T.A., Atallah, Á.N. and Torloni, M.R. (2018) Calcium

- Supplementation during Pregnancy for Preventing Hypertensive Disorders and Related Problems. *Cochrane Database of Systematic Reviews*, **2018**, CD001059. <https://doi.org/10.1002/14651858.cd001059.pub5>
- [27] Jasim, S.K., Al-Momen, H. and Alqurishi, A.K. (2021) Effects of Excessive Tea Consumption on Pregnancy Weight Gain and Neonatal Birth Weight. *Obstetrics & Gynecology Science*, **64**, 34-41. <https://doi.org/10.5468/ogs.20157>
- [28] Cooper, D.B. and Yang, L. (2023) Pregnancy and Exercise. StatPearls. <https://www.ncbi.nlm.nih.gov/books/NBK430821/>
- [29] Singh, B., Olds, T., Curtis, R., Dumuid, D., Virgara, R., Watson, A., *et al.* (2023) Effectiveness of Physical Activity Interventions for Improving Depression, Anxiety and Distress: An Overview of Systematic Reviews. *British Journal of Sports Medicine*, **57**, 1203-1209. <https://doi.org/10.1136/bjsports-2022-106195>
- [30] Raetz, J., Wilson, M. and Collins, K. (2019) Varicose Veins: Diagnosis and Treatment. *American Family Physician*, **99**, 682-688.

Appendix: The Questionnaire Used in the Study

Maternal health quality questionnaire

Name: _____	Gestational age: ____ weeks ____ days
Age: _____	last menstrual period: ____ Y ____ M ____ D

Parity: <input type="checkbox"/> Nulliparous <input type="checkbox"/> Multiparous	Married: <input type="checkbox"/> Yes <input type="checkbox"/> No
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Nationality: <input type="checkbox"/> China <input type="checkbox"/> Zambia	Employment status: <input type="checkbox"/> Full time <input type="checkbox"/> Unemployed
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Education:	What do you think of your family's income level?
<input type="checkbox"/> Less than senior middle school	<input type="checkbox"/> Below average
<input type="checkbox"/> Senior middle school	<input type="checkbox"/> Similar to the average level
<input type="checkbox"/> Bachelor and more	<input type="checkbox"/> Above average

A-nutrition and eating habits

1. Do you regularly take nutrient supplementation during pregnancy? Yes No
2. Do you eat take out every week? Yes No
3. Do you have breakfast every day? Yes No
4. Do you eat vegetables every day? Yes No
5. Do you eat fruits every day? Yes No
6. Do you drink tea every day? Yes No
7. Do you drink coffee every day? Yes No
8. Do you actively acquire knowledge of nutrition? Yes No
9. Do you put the nutrition knowledge you know into practice? Yes No

B-exercise status

1. How is your exercise intensity?
 Hardly ever
 Mild activities (e.g walking...)
 Moderate activities (e.g climbing stairs/cycling/jogging/Yoga...)
 Intense activities (e.g running / swimming...)
2. What is your average daily exercise time? (minutes)
 <15
 15 - 30
 30 - 60
 >60

Investigator: _____	Date: _____
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