

Wanda Forczek-Karkosz, PhD DsC
Department of Biomechanics
Faculty of Physical Education and Sport
University of Physical Education in Krakow
31-571 Krakow, Poland
Email: wanda.forczek@awf.krakow.pl

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Assessment of the PHD dissertation
presented by **Hongli Yu**

**PHYSICAL ACTIVITY AND HEALTH IN PREGNANCY
AND THE USE OF ONLINE TOOLS**

prepared in Gdansk University of Physical Education and Sport
supervised by **Anna Szumilewicz, assoc. prof. of GUPES**

The formal basis for the study is Resolution No. 4 of the Scientific Council of UPES in Gdansk of April 20, 2023 and the accompanying doctoral dissertation by Hongli Yu.

The doctoral dissertation submitted for evaluation is a scientific achievement in the form of a collection of published and thematically related scientific papers under the common title „Physical activity and health in pregnancy and the use of online tools”. The collection consists of four original articles of which the PhD Candidate is the first author:

1. **Yu, H.**; He, J.; Szumilewicz, A. Pregnancy activity levels and impediments in the era of COVID-19 based on the health belief model: A cross-sectional study. *Int. J. Environ. Res. Public Health* (2022) 19, 3283. <https://doi.org/10.3390/ijerph19063283>
MEiN points value: 140; IF: 4.614
2. **Yu, H.**; He, J.; Wang, X.; Yang, W.; Sun, B.; Szumilewicz, A. A comparison of functional features of Chinese and US mobile apps for pregnancy and postnatal care: A systematic app store search and content analysis. *Front. Public Health* (2022) 10, 1–12. <https://doi.org/10.3389/fpubh.2022.826896>
MEiN points value: 100; IF: 6.461

3. Yu, H.; He, J.; Li, K.; Qi, W.; Lin, J.; Szumilewicz, A. Quality assessment of pre- and postnatal nutrition and exercise mobile applications in the United States and China. *Front. Nutr.* (2023) 9:942331. <https://doi.org/10.3389/fnut.2022.942331>
MEiN points value: 70; IF: 6.590
4. Yu, H.; Santos-Rocha, R.; Radzimiński, Ł.; Jastrzębski, Z.; Bonisławska, I.; Szwarc, A.; Szumilewicz, A. Effects of 8-week online, supervised high-intensity interval training on the parameters related to the anaerobic threshold, body weight, and body composition during pregnancy: A randomized controlled trial. *Nutrients* (2022) 14, 5279. <https://doi.org/10.3390/nu14245279>
MEiN points value: 140; IF: 6.706

The submitted articles are original papers with a total score of: 450 MEiN points value and of 24.371 IF.

Research papers constituting the subject of the dissertation were evaluated by reviewers of the journals in which they were published. Therefore, I do not undertake to review them again, but I will evaluate the presented description, referring to the cognitive and application value of the results constituting its basis.

Formal assessment of the dissertation

Research by Hongli Yu addresses important aspects of physical activity and health support during pregnancy using online tools. The dissertation is based on the submitted and published 4 scientific papers. The manuscript contains eight parts numbered as follows: 1. List of papers; then the overall description of the study (p. 2-18) with: 2. Introduction; 3. Critical research gaps; 4. Research objectives; 5. The summary of the papers included in the dissertation; 6. Key results and conclusions from individual papers, followed by 7. Limitations of the studies and future research directions. This part is finished with 8. General conclusions from the dissertation. Then we can find References, List of tables and figures, an Abstract in English and Polish language, Statements of the authors' contribution, Curriculum vitae and four papers included in the dissertation. These studies allowed PhD Candidate to obtain new data on physical activity (PA) and health in pregnancy during the COVID-19 pandemic with the use of online tools defined as „*any program, app, or technology that can be accessed via an internet connection and enhance the access to information or service related to a healthy, active lifestyle during pregnancy*” [PhD thesis, p. 5].

In the opinion of the reviewer, the topic was formulated correctly and adequately to the content of the entire dissertation, an important condition of thematic linking of the published articles is also met, the PhD Student in her works explores the current level of PA among pregnant women, available apps and the impact of high intensity interval training, so called HIIT on the women's health. Studies in this area were especially desirable during the COVID-19 pandemic and its associated isolation periods. So considering the above, it should be assumed that the subject matter taken up by the PhD Candidate is original and cognitively important.

Content-related evaluation

Overall the manuscript is clearly written, with a broad review of the literature (74 items as a whole) and easy to follow. The order of the subsequent sections is good. However, it would be suggested to divide the manuscript into two parts: summary (1-8 sections) and appendix. The problems discussed in the „Introduction“ are supported by well-chosen literature, creating a cohesive whole. The gaps in the literature are clearly highlighted in the section „Critical research gaps“. They provide the basis for overall and specific „Research objectives“. However, it would be worth placing a subsequent section „Methods“ with a description of the procedures and tools used in the studies. The most important findings of the research are briefly described in „The summary of the papers included in the dissertation“ and presented in 2 tables and 6 figures. Conclusions are preceded with limitations that indicate that there is still something to be understood, which is important for the process of summarizing the results and drawing conclusions. The reviewer does appreciate the final general conclusions, however it would be advisable to add a section „Discussion“, in which the Candidate could confront her results with the literature and conduct a broad discussion/ polemic with other authors bearing in mind the controversies regarding the subjects of the investigation.

Pregnancy causes several changes in a future mother in order to adapt her body to constantly increasing needs of the fetus [Segal & Chu 2015]. Therefore it is of vital importance to provide a special care to gravidas both in terms of professional support and helpful information about the healthy lifestyle through available sources. According to recent studies, maternal physical activity is recognized as a crucial factor in the healthy life of pregnant women and babies. However, as literature revealed, pregnant women avoid or reduce PA. There are different reasons of such situation identified in the dissertation, e.g.: *„a lack of desire to be active, unawareness of the value of prenatal physical activity, lack of knowledge how to exercise safely etc... and -what is emphasized - isolation periods following COVID-19 that introduced various dilemmas related to prenatal physical activity“* [PhD dissertation, p. 2]. The fact is that *„The conventional model of healthcare services has been changed in recent years [31]. More people consult health and lifestyle information via mobile applications (apps), which have the potential to significantly improve current therapy and minimize reliance on professional team health services [32, 33]“* [PhD dissertation, p. 3]. Especially such an approach occurred to be helpful during the COVID 19 pandemic. Although the apps are generally effective in promoting maternal and newborn physical health, because of their variety, they differ significantly in quality. Therefore looking for such solutions, new users do not know which app is of high-quality. Then the question is what kind of physical activity is safe for the future mother. As the PhD Candidate rightly wrote *„the question is not "if" but "how" pregnant women should exercise“* [PhD dissertation, p. 5]. All the above issues are the subject of the submitted manuscript.

What is the level of prenatal physical activity (PPA) in women? What are the barriers that discourage gravidas from taking up PA? How to increase the level of PPA?

The answers to these questions one can find in **Paper 1**. Here the PhD Candidate carried out research with the use of the online questionnaire based on the health belief model (HBM) and the international prenatal physical activity questionnaire to determine the health belief level (HBL) and physical activity among Chinese women who were nonpregnant

nulliparous, pregnant nulliparous, and pregnant parous. Then she examined the demographic factors and health belief model (HBM) dimensions associated with the prenatal physical activity which allowed our Candidate to predict the characteristics of PPA in subgroups in order to determine the best way to increase the level of prenatal physical activity considering diverse needs of pregnant women.

Then, what is the quality of pre- and postnatal health care mobile apps?

In **Paper 2**, Hongli Yu analyzed the features and functions of mobile apps for pregnancy to postpartum care available in China and the United States, two of the largest app markets using the Mobile Application Rating Scale (MARS). Its employment allowed to objectively assess the quality of the applications in four dimensions, including: engagement, functionality, aesthetics, and information quality; and to provide suggestions for future development and usage of mobile apps for pregnancy to postpartum care of mothers and children.

The objective of **Paper 3** was to describe and analyze the characteristics and functional modules of pregnancy to postpartum nutrition and physical activity (N&PA) apps in the United States and China, and to evaluate comprehensively the overall quality of pregnancy to postpartum N&PA mobile apps. Finally the Candidate investigated the connection between app quality rating and user rating.

Are all kinds of physical activity safe for future mothers and her children? What are the effects of online, supervised HIIT intervention on the parameters related to the exercise capacity and anaerobic threshold, body weight, and body composition in pregnant women?

These problems are addressed in **Paper 4**, where the Authors employed either an 8-week high intensity interval training [HIIT] program (HIIT group) or a comparative 8-week educational program (EDU group). Before and after the intervention all participants underwent cardiopulmonary exercise test up to refusal using a cycle ergometer with an electronically regulated load (Viasprint 150P; Bitz, Germany) and a pulmonary gas analyzer (Oxycon Pro; Erich Jaeger GmbH, Hoechberg, Germany). Additionally, before and after the HIIT and EDU interventions, the bioimpedance method with the InBody 720 equipment was used to record and analyze the body composition, including body weight, body mass index, total fat mass percentage and total fat-free mass percentage.

Summarizing the research results, numerous and adequate statistical procedures were used in the analyses, which made it possible to draw interesting conclusions. I highly appreciate the quality of these tools.

The PhD Candidate is aware of the limitations of the approaches implemented in the investigations in terms of the study samples (e.g. *„willing and available population from central and western regions of China“*) as well as study design (e.g. *cross-sectional*) and she suggests improvement for future studies.

The general conclusions presented by the PhD Student summarizing the four publications of the cycle correspond to the research objectives set out in the thesis and carry a specific practical dimension, and the totality of achievements confirms the scientific maturity of the PhD Candidate.

The reviewer greatly appreciates the Candidate's contribution to the scientific papers. Yu Hongli is the first author of all publications and has provided statements showing that her participation consisted in research designing, elaborating the results and preparing the texts of the publications. In the case of publication 1, the participation of the PhD Student is 65%, publication 2 - 70%, publication 3 - 65%, publication 4 - 30%. Statements of the co-authors confirming the above participation are also attached.

Additionally, what needs to be emphasized and what is enclosed in the Candidate's CV, she is a co-author of four other scientific papers and was involved in three scientific projects.

Final remarks

I definitely agree with the Candidate that submitted dissertation can be important for popularizing a healthy, active life among pregnant women. Thanks to the results following individual papers, the Authors recognized pro-health behaviors of pregnant women due to the wide range of online surveys. This may be useful for the individualization of strategies supporting physical activity in groups of women with different models of health behavior and with different socio-geographical characteristics.

Therefore I would like to get answers considering the following issues:

Due to the fact there is no „Discussion” section, I would like to ask the PhD Candidate about example of practical solutions that could enhance different groups of women to increase their level of prenatal physical activity, bearing in mind the main factors that hinder taking up health behaviors in pregnant women, mentioned in „Introduction”.

Current research recommends physical activity during pregnancy for women who were habitually engaged in vigorous-intensity aerobic activity or who were physically active before pregnancy [ACOG 2020, WGO 2020]. Considering HIIT, there are not so many studies about its effects in the pregnant population, however the interest of researchers is growing. So, taking into account the fact that pregnancy is very individual and the reactions of the organism during this periodx to physical training could be very different as well as awareness of the women's body varies significantly, what should be emphasized in the online prenatal HIIT protocol to be sure that it is safe for the user?

Final conclusion

The PhD dissertation submitted for my review is a very interesting and original work, scientifically justified and practically useful. I appreciate the presented findings that broaden the scientific knowledge in the field of research on physical activity and health support during pregnancy with the use of online tools. The quoted comments do not diminish the undoubted value of Ms. Hongli Yu's dissertation.

In my opinion, this thesis meets all statutory requirements in formal and substantive terms, which qualifies Ms. Hongli Yu for the award of a doctoral degree in the field of health and medical sciences, in the discipline of physical culture sciences.

I therefore request the High Scientific Council of the Academy of Physical Education and Sport in Gdansk to admit Ms. Yu Hongli to further stages of the doctoral procedure. Additionally I recommend the thesis to be awarded with distinction.


Wanda Forczek-Karkosz