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ESTUDIO DE LOS NIVELES DE ESTILO DE VIDA Y CONDICIÓN CARDIORRESPIRATORIA EN EMBARAZADAS, Y SU ASOCIACIÓN CON LA SINTOMATOLOGÍA DEL EMBARAZO Y LA CALIDAD DE VIDA.

STUDY OF LIFESTYLE AND CARDIORESPIRATORY FITNESS LEVELS IN PREGNANT WOMEN, AND THEIR ASSOCIATION WITH PREGNANCY SYMPTOMS AND QUALITY OF LIFE.

DEPARTAMENTO DE DEPORTE E INFORMATICA. SECCIÓN DE EDUCACIÓN FÍSICA Y DEPORTES.
FACULTAD DEL DEPORTE
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TESIS DOCTORAL CON MENCIÓN INTERNACIONAL

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MIGUEL ÁNGEL OVIEDO CARO

2017

A mi familia

DEPARTAMENTO DE DEPORTE E INFORMATICA. SECCIÓN DE EDUCACIÓN FÍSICA Y DEPORTES. FACULTAD DEL DEPORTE
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CERTIFICA:

Que la Tesis Doctoral titulada "Estudio de los niveles de estilo de vida y condición cardiorrespiratoria en embarazadas, y su asociación con la sintomatología del embarazo y la calidad de vida" que presenta D. **MIGUEL ÁNGEL OVIEDO CARO** al superior juicio del Tribunal que designe la Universidad Pablo de Olavide, ha sido realizada bajo mi dirección durante los años 2013-2017, siendo expresión de la capacidad técnica e interpretativa de su autor en condiciones tan aventajadas que le hacen merecedor del Título de Doctor, siempre y cuando así lo considere el citado Tribunal.

Fdo. Diego Munguía-Izquierdo

En Sevilla, 21 de Septiembre de 2017

El doctorando D. MIGUEL ÁNGEL OVIEDO CARO y el director de tesis Dr. D. DIEGO MUNGUÍA IZQUIERDO:

Garantizamos, al firmar esta Tesis Doctoral, que el trabajo ha sido realizado por el doctorando bajo la dirección del director de la tesis y hasta donde nuestro conocimiento alcanza, en la realización del trabajo, se han respetado los derechos de otros autores al ser citados, cuando se han utilizado sus resultados o publicaciones.

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PUBLICATIONS [PUBLICACIONES]

The present Doctoral Thesis is composed by research studies which have been published/submitted by the following research articles:

I. **Oviedo-Caro MA**, Bueno-Antequera J, Munguía-Izquierdo D. Spanish version of Pregnancy Symptoms Inventory: transcultural adaptation and reliability. J Matern Fetal Neonatal Med. 2017; 30(18):2185-2192.

II. **Oviedo-Caro MA**, Bueno-Antequera J, Munguía-Izquierdo D. Transcultural adaptation and psychometric properties of Spanish version of Pregnancy Physical Activity Questionnaire: The PregnActive project. Gaceta Sanitaria *In second revision.*

III. **Oviedo-Caro MA.** Apoyos y barreras para la actividad física durante el embarazo y madres con bebes. En *La promoción de la actividad física en la sociedad contemporánea*. Madrid, España: Díaz de Santos. *In press*

IV. **Oviedo-Caro MA**, Bueno-Antequera J, Munguía-Izquierdo D. Measuring sedentary behavior during pregnancy: comparison between self-reported and objective measures. Matern Child Health J. *In second revision.*

V. **Oviedo-Caro MA**, Bueno-Antequera J, Munguía-Izquierdo D. Estilo de vida activo en la etapa final de embarazo y su influencia en la salud mental percibida: The PregnActive project. *Submitted*

VI. **Oviedo-Caro MA**, Bueno-Antequera J, Munguía-Izquierdo D. Determinants and levels of health-related quality of life among pregnant women at midpregnancy: A cross-sectional study of The PregnActive Project. *Submitted*

VII. **Oviedo-Caro MA**, Bueno-Antequera J, Munguía-Izquierdo D. Pregnancy symptoms and their impact on health-related quality of life at midpregnancy: The PregnActive project. *Submitted*

ABSTRACT

Pregnancy represents a unique state in women's life characterized by profound anatomical, physiological, metabolic, social and psychological changes in order to meet the complex demands of fetal development and protection which are associated with impairments in health-related quality of life.

The overall objective of the present Doctoral Thesis has been to provide transcultural adapted and validated tools to assess pregnancy-related symptoms, physical activity and sedentary behaviors among Spanish pregnant women, as well to analyze the relationship between lifestyle, measured by physical activity and sedentary behavior, cardiorespiratory fitness, pregnancy-related symptoms, and health-related quality of life.

Healthy non high-risk pregnancy pregnant women were included in the study samples: Study I involved 280 pregnant women, Study II involved 208 pregnant women, Study IV involved 186 pregnant women, Study V involved 95 pregnant women at later pregnancy, Study VI involved 134 pregnant women at midpregnancy, and Study VII involved 155 pregnant women at midpregnancy. Pregnancy-related symptoms were measured by Pregnancy Symptoms Inventory. Lifestyle was measured objectively by multi-sensor body monitor Sensewear Armband Mini; and subjectively by Pregnancy Physical Activity Questionnaire and Sedentary Behavior Questionnaire. Cardiorespiratory fitness was measured by 6-minutes' walk test. Health-related quality of life was measured by SF-36.

The main findings from this Doctoral Thesis suggest: I) The PSI-S is a brief and reliable tool to assess the wide range of pregnancy-related symptoms. The most prevalent symptoms in Spanish pregnant women are urinary frequency, poor sleep, increased vaginal discharge and tiredness. II) The PPAQ-S is a brief tool with good reliability and ability to rank pregnant women, but poor validity compared with multi-sensor monitor. III) The main barriers to physical activity during pregnancy are related with temporal restrictions, pregnancy-related complaints, lack of information, advice and supports, no previous habits of physical activity, and difficulties to access to sports facilities. The main supports to physical activity are previous habits, adequate information and advice, flexible schedule, and environment with sports facilities. IV) The SBQ is a brief tool with good ability to rank pregnant women, but poor validity compared with multi-sensor monitor. Pregnant women spent approximately for the 64% of their waking hours in sedentary behaviors. Women aged ≥ 30 years, with a pre-pregnancy BMI > 25 kg/m2, with tertiary education, and in their third trimester of pregnancy are high-risk groups of high amount of sedentary time. V) An active lifestyle at later

pregnancy, determining as meeting physical activity recommendations, has a positive effect on MCS of HRQoL; and although does not avoid the apparition of psychological pregnancy-related symptoms, decreases their frequency and limitation on daily activities. VI) Younger age, a lower level of musculoskeletal symptoms, and a high level of cardiorespiratory fitness contribute to an increased PCS of HRQoL; while low levels of psychological and musculoskeletal symptoms and high levels of light-intensity physical activities contribute to an increased MCS of HRQoL at midpregnancy. VII) Pregnancy-related symptoms have a negative impact on pregnant women's HRQoL at midpregnancy. Back pain, a musculoskeletal symptom, and shortness of breath, a respiratory symptom, are the main determinants of the PCS of HRQoL; while psychological symptoms as feeling depressed and anxiety are the main determinants of the MCS of HRQoL.

The present Doctoral Thesis provides useful, validated and transcultural adapted Spanish versions of self-reported tools for assessing a wide range of pregnancy-related symptoms, physical activity and sedentary behavior patterns among pregnant women. The identification of the main determinants of health-related quality of life during pregnancy allows the establishment of early non-pharmacologic multidisciplinary interventions to ameliorate the decline of health-related quality of life caused by pregnancy.

RESUMEN

El embarazo representa un estado único en la vida de la mujer caracterizado por profundos cambios anatómicos, fisiológicos, metabólicos, sociales y psicológicos, con el objetivo de cumplir con las complejas demandas del desarrollo y la protección fetal, las cuales están asociadas con deficiencias en la calidad de vida relacionada con la salud.

El objetivo general de la presente Tesis Doctoral ha sido la aportación de herramientas adaptadas transculturalmente y validadas para la evaluación de la sintomatología del embarazo, la actividad física y el sedentarismo para embarazadas españolas, así como analizar la relación entre el estilo de vida, medido mediante la actividad física y el sedentarismo, la condición física cardiorrespiratoria, la sintomatología del embarazo, y la calidad de vida relacionada con la salud.

Embarazadas sanas con embarazos de bajo riesgo fueron incluidas en las muestras de estudio: Estudio I incluyó a 280 embarazadas, el Estudio II incluyó a 208 embarazadas, el Estudio IV incluyó a 186 embarazadas en la etapa central del embarazo, el Estudio V incluyó a 95 embarazadas en la etapa final del embarazo, el Estudio VI incluyó a 134 embarazadas en la etapa central del embarazo, y el estudio VII incluyó a 155 embarazadas en la etapa central del embarazo. Los síntomas del embarazo fueron medidos mediante el Cuestionario de Síntomas del Embarazo. El estilo de vida fue medido objetivamente mediante el monitor metabólico multisensor Sensewear Armband Mini; y subjetivamente mediante el Cuestionario de Actividad Física en el Embarazo y el Cuestionario de Comportamientos Sedentarios. La condición física cardiorrespiratoria fue medida mediante el Test de Caminar durante 6 minutos. La calidad de vida relacionada con la salud fue medida mediante el Cuestionario SF-36.

Los principales resultados de la esta Tesis Doctoral sugieren: I) La versión española del Cuestionario de Síntomas del Embarazo es una herramienta breve y fiable para evaluar un amplio rango de síntomas del embarazo. Los síntomas del embarazo más prevalentes en embarazadas españolas son la frecuencia urinaria, sueño alterado, secreción vaginal aumentada y cansancio. II) La versión española del Cuestionario de Actividad Física en el Embarazo es un cuestionario breve con una buena fiabilidad y habilidad para clasificar embarazadas, pero baja validez comparado con un monitor multisensor. III) Las principales barreras para la práctica de actividad física durante el embarazo se relacionan con restricciones temporales, afecciones de los cambios relacionados con el embarazo, falta de información, consejos y apoyos, no poseer hábitos previos de actividad física, y dificultad de

acceso a entornos facilitadores para la práctica. Los principales apoyos para la práctica de actividad física durante el embarazo son poseer hábitos de actividad física previos al embarazo, poseer información y apoyos, disponer de un horario flexible, y fácil acceso a entornos facilitadores para la práctica de actividad física. IV) El Cuestionario de Comportamientos Sedentarios es una breve herramienta con buena habilidad para clasificar a embarazadas, pero baja validez comparado con el monitor multisensor. Las embarazadas experimentan aproximadamente el 64% de sus horas despiertas en comportamientos sedentarios. Mujeres con edades ≥ 30 años, con un IMC pre embarazo > 25 kg/m2, con educación terciaria, y en su tercer trimestre de embarazo son identificadas como grupos de alto riesgo para grandes cantidades de tiempo sedentario. V) Un estilo de vida activo en la etapa final del embarazo, determinado por el cumplimiento de las recomendaciones de actividad física, posee un efecto positivo en el componente mental de la calidad de vida relacionada con la salud; y aunque no evita la aparición de síntomas psicológicos del embarazo, disminuye la frecuencia y limitación en las actividades diaria percibida por las embarazadas. VI) Una edad joven, un bajo nivel de síntomas músculo-esqueléticos, y un alto nivel de condición física cardiorrespiratoria contribuyen a un incremento del componente físico de la calidad de vida relacionada con la salud; mientras que bajos niveles de síntomas psicológicos y músculo-esqueléticos y altos niveles de actividad física de intensidad suave contribuyen a un incremento del componente mental de la calidad de vida relacionada con la salud en la etapa central del embarazo. VII) Los síntomas del embarazo tienen un impacto negativo en la calidad de vida relacionada con la salud en la etapa central del embarazo. El dolor de espalda, un síntoma músculo-esquelético, y la dificultad respiratoria, un síntoma respiratorio, son los principales determinantes del componente mental de la calidad de vida relacionada con la salud; mientras que los síntomas psicológicos como sentimientos depresivos y ansiedad son los principales determinantes del componente mental de la calidad de vida relacionada con la salud.

ABBREVIATIONS [ABREVIATURAS]

AUC	Areas under the curve
BMI	Body mass index
CCC	Concordance correlation coefficient
CRF	Cardiorespiratory Fitness
DM	Difference mean between methods
GPAQ	Global Physical Activity Questionnaire
HRQoL	Health-related quality of life
HT	Heterocedasticity analysis
IPAQ	International Physical Activity Questionnaire
LoA	Limits of agreement
MCS	Mental component summary of SF-36
METs	Metabolic equivalent
MVPA	Moderate-to-vigorous physical activity
PCS	Physical component summary of SF-36
PPAQ	Pregnancy Physical Activity Questionnaire
PPAQ-S	Spanish version of Pregnancy Physical Activity Questionnaire
PPearson	P value for Pearson correlation coefficient
PSI	Pregnancy Symptoms Inventory
PSI-S	Spanish version of Pregnancy Symptoms Inventory
SBQ	Sedentary Behavior Questionnaire
SD	Standard deviation
SF-36	Short-Form Health Survey 36
SPSS	Statistical Package for the Social Sciences
SWA	Sensewear Armand Mini
6-MWT	6-minutes' walk test

INTRODUCTION [INTRODUCCIÓN]

Definition

Pregnancy represents a unique state in women's life. This period of women's life begins from the first day of the last menstrual period, ending at birth, and usually lasts 40 weeks[1]. During pregnancy, maternal organism works on fetus development and protection, and also prepares itself for labour.

Women organism's adaptations during pregnancy.

Pregnancy is associated with profound anatomical, physiological, metabolic, social and psychological changes in order to meet the complex demands of fetal development and protection, and also to prepare the maternal organism for labour and breastfeeding[2]. Pregnancy-related changes start early in pregnancy and peak during the second trimester, after which they may remain constant or decrease towards term[2].

Anatomical adaptations during pregnancy.

The anatomical changes produced during pregnancy are characterized by an increase of body mass and abdominal growth resulted from fetus development, conception products (placental, amniotic fluid) and energy reserves required to guarantee the correct development of fetus[3] (De Miguel, 2001). In addition, women's organism is preparing to the labour, increasing the hip circumference by the expansion of the pubis symphisis, and softening the connective tissue by the action of relaxin hormone[4,5]. As consequences of the anatomical changes the center of gravity is forward displaced, producing lumbar hiperlordosis, hyperextension of knees and pronation of feet that affected both maternal posture and stability[6].

Physiologic adaptations during pregnancy.

The physiologic changes are oriented to allow the correct fetus development. In order to guarantee the placental circulation for supplying nutrients and oxygen to fetus, cardiovascular modifications are produced during pregnancy, such as the increase in plasma, red blood cell and total blood volume, the vasodilation produced by the effect of progesterone hormone, the reduction of peripheral vascular resistance, and the increase in stroke volume[7,8]. As a consequence of this increase of blood and stroke volume, cardiac output and heart rate at rest are increased[7,9].

Related with cardiovascular modifications, oxygen consumption, tidal volume and minute ventilation increase during pregnancy[10,11], without changes in forced vital capacity[12]. In addition, due to diaphragm elevation, ventilation during pregnancy is more costal than

abdominal and functional residual capacity decreased, appearing breathing difficulties, although without hipoxia[10]. In addition, the high levels of progesterone hormone involve hyperventilation[13].

Metabolic adaptations during pregnancy.

During pregnancy occurred several changes on metabolism. Basal metabolism is increased in consequence of the supplying nutrients and oxygen to fetus and the increased body mass derived to the fetus development and conception products[14,15]. Peripheral glucose use is decreased to prioritize the provision of glucose to fetus, and the protein and lipid synthesis is increased to attend the fetus development and guarantee the energy reserves required to the fetus growth[16,17].

Social and psychological adaptations during pregnancy.

Expecting a child supposes a modification of the social status of women, related to gender role socialization[18], and economic and vital environment. Pregnancy is a vulnerable period of psychological health, mainly motivated by the rapid fluctuation in hormone levels but also by the changes on social status, that increase the prevalence of mood disorders during this time[19]. These changes in social status may affect the social interactions of pregnant women in relation with changes in lifestyle. Emotional immaturity or economic dependency of pregnant women could aggravate the effects of pregnancy on the psychological status of pregnant women[20]. The mood disorders appeared during pregnancy usually are stationaries but could be translated on mental disorders as depression and anxiety that impair emotional functioning and social interactions[21].

Pregnancy-related symptoms

Related with the anatomical, physiological, metabolic, social and psychological changes, pregnancy involves the appearance of physical symptoms. Thirty-eight symptoms appeared during normal pregnancy have been described by scientific literature[22,23]. Between them, urinary frequency, tiredness, back pain and poor sleep were the most prevalent pregnancy-related symptoms reported by women[22,23].

The presence of pregnancy-related symptoms has been associated with impairment on women's health that limits the activities of daily life of women[24,25]. The majority of scientific literature analyzed the association between individual pregnancy-related symptoms and health impairments, but are needed studies that investigate the association between pregnancy-related symptoms and health taking into account the interaction between the wide range of pregnancy symptoms. In this sense is necessary the availability of transcultural adapted

versions of tools that assess a wide range of pregnancy-related symptoms[26] in order to possibility the development of studies focalizing in the relationships between pregnancy-related symptoms and health impairments [Study I].

Lifestyle during pregnancy

Daily activities of pregnant women are affected by the anatomical, physiologic and metabolic changes occurred during pregnancy. Activities such as sitting down, bending down to reach objects from the floor, going upstairs or driving present difficulties derived from the affection of posture and stability that produce the anatomical changes[24,27]. In addition, women select less-demanding activities during pregnancy in order to compensate for the increase in basal energy expenditure related with pregnancy[28,29].

Lifestyle, which involves physical activity and sedentary behavior patterns, has potential effects on women's health. Physical activity practice during pregnancy has potential benefits on women's health, such as a reduced risk of gestational diabetes mellitus[30] and preeclampsia[31], the reduction of the impairment caused by pregnancy symptoms[32,33], and the prevention of excessive weight gain[34,35].

Contrarily, a prevalence of sedentary behaviors on the lifestyle of pregnant women has been associated with adverse perinatal health outcomes including lower birth weight[36], abnormal glucose tolerance[37], risk for gestational diabetes mellitus[37], decreased insulin sensitivity and increased insulin secretion[38], and excessive gestational weight gain[35].

Although pregnant women with absence of medical or obstetrics complications are advised to accumulate at least 30 min of moderate intensity activity per day on most, if not all, days of the week[39] the percentage of pregnant women that meeting physical activity recommendation is low[40,41]. Contrarily, physical activity levels decrease during the course of pregnancy[42], increasing the time spent in sedentary activities[29]. The identification of the main barriers and enablers to physical activity practice during pregnancy is essential in order to establish strategies that lead the barriers and strengthen the enablers to guarantee physical activity practice during pregnancy [Study III].

In the assessment of physical activity, questionnaires are the most common methods used in epidemiologic and large population studies because their inherent characteristics. Most of physical activity questionnaires developed and validated in adults, such as IPAQ or GPAQ, emphasize on moderate and vigorous intensity sports, and fail to include household or childcare activities, which comprised a substantial proportion of physical activity during pregnancy[43]. This may result in a misclassification that limits their ability to estimate physical

activity and differentiate physical activity levels among pregnant women[44]. A specific tool assessing physical activity, including household and childcare activities, during pregnancy has been developed and validated, but the transcultural adaptation into Spanish and the validation of the Spanish version of this tool have not yet been carried out [Study II].

The increase of sedentary time along the course of the pregnancy is independent of meeting physical activity recommendations[45], requiring an exhaustive analysis of the lifestyle of pregnant women and their effect on pregnant women's health.

In addition, it is in the interest of public health to have an objective and self-reported diagnosis of sedentary time because such a diagnosis helps to characterize the patterns of sedentary behavior for developing intervention studies aimed at improving maternal and fetal outcomes. Sedentary behaviors is a unique set of behaviors with a range of potentially unique health consequences, as they influence obesity and other metabolic precursors of chronic diseases[46], requiring an assessment by specific tools, and not by physical activity questionnaire which inappropriately assess sedentary behavior as absence of physical activity[47]. Questionnaires that assess specific and multiple domain sedentary behaviors have been developed, as Sedentary Behavior Questionnaire[48], leading the limitation that single-item sitting time questions or physical activity questionnaire presented. But this tool has not yet been validated among pregnant women [Study IV].

The majority of studies objectively assessing sedentary behavior during pregnancy has used indirect estimations as the absence of physical activity or whole-body movements from accelerometers, which imply methodological errors[49]. Measuring sedentary behavior during pregnancy using tools that allow a direct estimation for multiple and consecutive 24-hour periods and lead the methodological limitations of indirect estimations, such as multi-sensor body monitor, are needed [Study IV].

Functional physical fitness during pregnancy

Physical fitness is defined as a state characterized by an ability to perform daily activities with vigor, and demonstration of traits capacities that are associated with low risk of premature development of hypokinetic diseases[50].

Cardiorespiratory fitness (CRF) has been established as a determinant of individual physical work capacity, lower risk of all-cause of mortality and better physical health in adults[51]. In addition, CRF has a consistent positive association with health-related quality of life (HRQoL) in the general adult population[52].

During pregnancy, the aforementioned increase of body mass, the breathing difficulties due to diaphragm elevation, the hyperventilation appeared by progesterone effect, and the prioritization on gestational demands produces a reduction of work capacity of the aerobic system[53] and the consequent decline of cardiorespiratory fitness[54]. The reduction in physical activity practice taking place during pregnancy aggravates this decline of CRF[55].

Maintaining fitness levels during pregnancy helps the mother both physically and psychologically, alleviating discomforts, preparing the mother physically for labour, and promoting a speedier postpartum recovery[56]. In addition, cardiorespiratory fitness has a protective effect on established pregnancies[57]. Although physical functioning is known as the main aspect HRQoL that is affected by pregnancy[58] and although cardiorespiratory fitness has a consistent positive association with HRQoL in the general adult population[52], the associations between cardiorespiratory fitness levels and HRQoL during pregnancy remain unexplored [Study VI].

Health-related quality of life during pregnancy

Pregnant women perceived worse HRQoL compared to non-pregnant women of similar age[59], specifically in physical functioning, which is the main aspect of HRQoL affected by normal pregnancy[58,59]. In addition, HRQoL levels presented a decline during the course of normal pregnancies[60].

Individual pregnancy symptoms as incontinence[61], regurgitation[62], depression[21,63], anxiety[21], nausea and vomiting[64] or low back pain[65] have shown to be associated with low HRQoL levels. The majority of the scientific literature has been focused on individual symptoms and did not assess the associations between a wide range of pregnancy symptoms and HRQoL[22,23]. The study of the association between a wide range of pregnancy symptoms and HRQoL is necessary in order to have a diagnosis that help to develop strategies that ameliorate the decline on HRQoL caused by pregnancy course and specifically by pregnancy-related symptoms [Study VII].

Exercise and physical activity interventions have been revealed to improve pregnant women's HRQoL[60,66]. However, the associations between physical activity levels and HRQoL perceived by pregnant women are unclear[67–69]. The use of self-reported measures of physical activity in the scientific literature indicates the need to objectively measure physical activity to improve our understanding of the association between physical activity and HRQoL in pregnant women [Study V].

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AIMS

Overall:

The overall objective of the present Doctoral Thesis has been to provide transcultural adapted and validated tools to assess pregnancy-related symptoms, physical activity and sedentary behaviors among Spanish pregnant women, as well to analyze the relationship between lifestyle, measured by physical activity and sedentary behavior, cardiorespiratory fitness, pregnancy-related symptoms, clinical variables, and health-related quality of life.

Specifics:

- To transculturally adapt into Spanish and to analyze the reliability and operational qualities of the Pregnancy Symptoms Inventory; and to assess the prevalence of pregnancy symptoms on Spanish pregnant women (Study I).
- To transculturally adapt into Spanish and analyze the psychometric properties of the Pregnancy Physical Activity Questionnaire, validating it against multi-sensor body monitor (Study II).
- To identify the supports and barriers to physical activity practice during pregnancy (Study III).
- To quantify and compare the sedentary time estimated by the Sedentary Behavior Questionnaire and the sedentary time objectively measured by multi-sensor body monitor, and to assess sedentary behaviors levels comparing between sociodemographic and clinical variables (Study IV).
- To analyze the effect of active lifestyle on health-related quality of life and psychological pregnancy-related symptoms at later pregnancy; and analyze the association between psychological pregnancy-related symptoms and health-related quality of life (Study V).
- To assess the association of cardiorespiratory fitness, pregnancy symptoms, and objectively measured physical activity levels with health-related quality of life in pregnant women at midpregnancy; and establish health-related quality of life levels comparing between sociodemographic and clinical variables (Study VI).
- To analyze the association between pregnancy-related symptoms and health-related quality of life at midpregnancy; and to identify the pregnancy-related symptoms with the greatest impact on health-related quality of life (Study VII).

OBJETIVOS

General:

El objetivo general de la presente Tesis Doctoral ha sido la aportación de herramientas adaptadas transculturalmente y validadas para la evaluación de la sintomatología del embarazo, la actividad física y el sedentarismo para embarazadas españolas, así como analizar la relación entre el estilo de vida, medido mediante la actividad física y el sedentarismo, la condición física cardiorrespiratoria, la sintomatología del embarazo, variables clínicas, y la calidad de vida relacionada con la salud.

Específicos:

- Adaptar transculturalmente al castellano y analizar la fiabilidad y las cualidades operacionales del Cuestionario de Síntomas del Embarazo; y analizar la prevalencia de los síntomas del embarazo en embarazadas españolas (Estudio I).
- Adaptar transculturalmente al castellano y analizar las propiedades psicométricas del Cuestionario de Actividad Física en el Embarazo, validándolo frente a un monitor metabólico multisensor (Estudio II).
- Identificar los apoyos y barreras para la práctica de actividad física durante el embarazo (Estudio III).
- Cuantificar y comparar el tiempo sedentario estimado por el Cuestionario de Conductas Sedentarias y el tiempo sedentario objetivamente medido por un monitor metabólico multisensor, comparando entre variables clínicas y sociodemográficas (Estudio IV).
- Analizar el efecto de un estilo de vida activo en la calidad de vida relacionada con la salud y los síntomas psicológicos del embarazo en la etapa final del embarazo; y analizar la asociación entre los síntomas psicológicos del embarazo y la calidad de vida relacionada con la salud (Estudio V).
- Evaluar la asociación de la condición física cardiorrespiratoria, los síntomas del embarazo, y la actividad física objetivamente medida con la calidad de vida relacionada con la salud en embarazadas en la etapa central del embarazo; y establecer los niveles de calidad de vida relacionada con la salud comparando entre variables sociodemográficas y clínicas. (Estudio VI).
- Analizar la asociación entre los síntomas del embarazo y la calidad de vida relacionada con la salud en la etapa central del embarazo; e identificar los síntomas del embarazo con el mayor impacto en la calidad de vida relacionada con la salud (Estudio VII).

MATERIAL AND METHODS [MATERIAL Y MÉTODOS]

Recruitment of the participants and inclusion criteria:

Participants were recruited at their first prenatal care visit from health clinics of Sanitary Area of Seville, concretely eleven primary health care clinics and Utrera Hospital, and received detailed information about the study aims and protocol before to voluntarily give their written informed consent.

Inclusion criteria were to have a singleton non high-risk pregnancy, to be between 18 and 40 years old, and not to have illnesses or disabilities that affected their normal daily routine, and to be physically capable to exercise practice (measured by the Physical Activity Readiness Questionnaire).

Pregnant women who fulfilled inclusion criteria, provided informed consent, and completed the study protocol were included in the study samples: Study I involved 280 pregnant women, Study II involved 208 pregnant women, Study IV involved 186 pregnant women, Study V involved 95 pregnant women at later pregnancy, Study VI involved 134 pregnant women at midpregnancy, and Study VII involved 155 pregnant women at midpregnancy.

Ethical issues

The study protocol obtained ethical approval from the Medical Research Ethics Committee of the University Hospital Virgen del Rocio (Seville, Spain) in accordance with the Declaration of Helsinki, approval number 2014PI-066. In addition, ethical approval from the Vice Rectorate for Research of the University Pablo de Olavide (Seville, Spain) was obtained in accordance with the Declaration of Helsinki.

Outcomes

Sociodemographic characteristics.

Participants filled a complete self-reported sociodemographic questionnaire. Age, marital status, number of child, educational level, occupational status, type of occupation, and income level were assessed using this questionnaire.

Marital status was classified in single without couple, single with couple, married, separated or divorced, and widow. Educational level was classified in no studies, primary school, professional training, secondary school, university medium degree and university higher degree. Occupational status was classified in active, student, unemployed and sick leave from work.

Clinical characteristics.

Pre-pregnancy weight and height, number of previous pregnancy, previous pregnancy complications, type of previous delivery, weight and height at first prenatal care visit, smoking habits, chronic diseases diagnostic, and parental antecedents of chronic diseases were retrieved from pregnant women's medical record.

Anthropometry and body composition.

Anthropometrical characteristics, weight and height, were evaluated following the standard procedures (Lohman, 1988) using a calibrated digital scale (Tanita Corporation, Tokio, Japan) and a stadiometer (Seca 780, Hamburg, Germany), respectively. Body mass index (BMI) was calculated (kg/m2).

Skinfold thickness (biceps, triceps, subscapular and supra-iliac), previously used in pregnant women (Kannieappan, 2013), were measured to nearest millimeter using calipers (Holtain, Crymich, UK) on the right-hand side of the body by the same trained evaluator. The sum of the four skinfold thicknesses was used as an indicator of total body fat.

Lifestyle

Lyfestyle, comprising physical activity and sedentary behavior, was assessed subjectively by specific self-report tools and objectively by a multi-sensor body monitor.

- A multi-sensor body monitor, Sensewear Mini Armband (BodyMedia Inc., Pittsburgh, PA, USA) (SWA), which have been validated in pregnant women (Smith, 2012) was used to objectively assess lifestyle. This monitor includes sensors to measure energy expenditure by monitoring the heat flow from the body, skin temperature, galvanic skin responses and 3-axis accelerometer for motion detection. The multi-sensor body monitor was worn 8 completed days, including five weekdays and two weekend days, except during water-based activities like swimming or bathing. To be considered a completed day, the multi-sensor monitor was required to be carried for at least 95% of the entire day (1.368 minutes or longer). Participants were asked not to change their habitual lifestyle during the measurement period; in addition, to avoid any kind of immediate reactivity that may altered their habitual lifestyle, we removed from the analysis the first day of monitoring.

  The multi-sensor body monitor obtains a direct estimation of sedentary behavior according to METs for multiple and consecutive 24-hour periods, classifying the activity in four levels: sedentary activity (< 1.5 METs), light activity (1.5-2.9 METs), moderate activity (3.0 – 6.0 METs), and vigorous activity (> 6.0 METs).

We calculated the average daily time and the average weekly time spent in each intensity of activities. In addition, in order to assess the fulfillment of the physical activity recommendation we calculated the average daily and weekly time spent in moderate to vigorous activities in at least ten-minutes bouts. Categorical variables were created assessing the fulfillment of physical activity recommendations (at least five days with at least 30 minutes of moderate-to-vigorous physical activity) and sedentary behaviors recommendations (less than 8 hours/day of sedentary activities).

- The Pregnancy Physical Activity Questionnaire was used to subjectively assess physical activity levels. This self-reported semiquantitative questionnaire was specifically designed and validates among pregnant women (Chasan-Taber, 2004), and reports the time spending in 32 activities categorized in five types of activity. Respondents are asked to select the category which best approximates the amount of time spent in each activity per day or week during the current trimester. The number of hours spent in each activity was multiplied by the activity intensity to arrive at a measure of average daily energy expenditure (MET-hours per day) attributable to each activity. Activities were categorized by intensity, type or as total activity.
- The Sedentary Behavior Questionnaire (Rosemberg et al., 2010) was used to assess self-reported sedentary behavior. This tool was designed to assess the amount of time spent doing 11 behaviours (watching television, sitting while eating, lying and resting, sitting while playing computer/video games, sitting while listening to music, sitting and talking on the phone, doing paperwork or office work, sitting and reading, playing a musical instrument, doing arts and crafts, sitting and driving/travelling in a car, bus, or train). Response options were “none”, “15 minutes or less”, “30 minutes”, “1 hour”, “2 hours”, “3 hours”, “4 hours”, “5 hours”, or “6 hours or more”. The time spent on each behavior was converted into hours, dividing by 60 (eg, a response of 15 minutes was recorded as 0.25 hours). Items were completed separately for weekdays and weekend days. For the total scores of sedentary behaviour hours per day for each item were summed separately for weekday and weekend days. To obtain weekly estimates, weekday hours were multiplied by 5 and weekend hours were multiplied by 2 and these were summed for total hours/week. Responses higher than 24 hours/day in the summary variables of total hours/day, were truncated to 24 hours/day (Rosemberg et al., 2010). None of pregnant women reach this amount of time.

Cardiorespiratory fitness.

Cardiorespiratory fitness was assessed using the 6-minutes' walk test (Rikli and Jones, 2001), a submaximal test with self-imposed pace previously used in pregnant women (Ramirez-Velez et al., 2011).

The distance covered along a 45.7 rectangular course in six minutes was used as a measurement of cardiorespiratory fitness. We used a 45.7-meter rectangular course delimited by cones, with 90 degree turn in order to minimize changes of rhythm compared with a straight corridor space with 180 degree turn. Pregnant women were encouraged to walk as far as possible without running or jogging. The same trained instructor explained the protocol giving a demonstration prior to start, supervised the test and recorded the distance covered to the nearest 0.1 m. Heart rate was controlled during the test and 2-min recovery period.

Pregnancy-related symptoms

Pregnancy-related symptoms were assessed using the Pregnancy Symptoms Inventory (Foxcroft, 2013). This self-reported tool assess how often symptoms occurred and what effect they had in the daily life of pregnant women within a total of 41 pregnancy symptoms.

Pregnancy symptoms assessed were: tiredness or fatigue, nausea, vomiting, reflux, constipation, hemorrhoids, dry mouth, food cravings, poor sleep, restless legs, leg cramps, snoring, urinary frequency, incontinence/leaking urine, increased vaginal discharge, thrush, changes in libido, painful veins in vagina, carpel tunnel (numb hands), sciatica/pain down the back of your legs, back pain, hip or pelvic pain, breast pain, headache, sore nipples, dizziness, fainting, heart palpitations, shortness of breath, taste/smell changes, forgetfulness, feeling depressed, anxiety, vivid dreams, altered body imaged, greasy skin/acne, varicose veins, brownish marks on face, itchy skin, changes in nipples, stretch marks, swollen hands of feet.

For each symptom pregnant women must choice between four options of prevalence (never/rarely/sometimes/often) and three options of limitation (not limited at all/limited a little/limited a lot). Additionally, we created summary scores quantifying the number of symptoms perceived sometimes and above among each category of pregnancy-related symptoms (Zib, 1999; Nazik and Eryilmaz, 2014).

Health-related quality of life

The Medical Outcome Study 36-item short form (SF-36) was used to assess HRQoL. This self-reported questionnaire offers a basic understanding of the health status, has a high internal consistency, reliability and validity (Vilagut et al., 2008), and their psychometric

properties have been analyzed satisfactorily among pregnant women (Jomeen and Martin, 2005). This tool contains eight domains which are summarized in a physical component summary (PCS) and mental component summary (MCS). The scores of SF-36 are transformed to a 0-to-100 scale, where the high score represent the best HRQOL. These two summary scales explain 80 to 85% of the variance in the eight domains (Vilagut et al., 2008). The mean score for the general population is 50, with a standard deviation of 10 points. A difference of half an SD or a five-point difference (domain scores) and two to three point difference (summary scores) are considered clinically relevant (Norman et al., 2003).

Design, participants, and methods.

The following table summarizes the information about methods of the research articles that are part of this Doctoral Thesis.

Table 1. Summary table of the methodology used in the current Doctoral Thesis.

Study	Design	Participants	Main variables studies	Methods
I. Spanish version of Pregnancy Symptoms Inventory: transcultural adaptation and reliability	Transcultural adaptation and reliability.	280 healthy pregnant women.	Pregnancy-related symptoms, anthropometry, clinical and sociodemographic variables.	Anthropometry, PSI.
II. Transcultural adaptation and psychometric properties of Spanish version of Pregnancy Physical Activity Questionnaire.	Transcultural adaptation, reliability and validity.	208 healthy pregnant women.	Subjectively and objectively measured physical activity, anthropometry, clinical and sociodemographic variables.	Anthropometry, PPAQ, Sensewear Armband Mini.
III. Apoyos y barreras para la actividad física durante el embarazo y madres con bebes	Review	-	Supports and barriers of physical activity.	PubMed/Medline and Web of Science databases.
IV. Measuring sedentary behavior during pregnancy: comparison between self-reported and objective measures.	Cross-sectional	186 healthy pregnant women.	Subjectively and objectively measured sedentary time, anthropometry, clinical and sociodemographic variables.	Anthropometry, SBQ, Sensewear Armband Mini.
V. Estilo de vida activo en la etapa final de embarazo y su influencia en la salud mental percibida	Cross-sectional	95 healthy pregnant women at later pregnancy.	Objectively measured physical activity, HRQoL, psychological pregnancy-related symptoms.	Sensewear Armband Mini, SF-36, PSI.

Study	Design	Participants	Main variables studies	Methods
VI. Determinants and levels of health-related quality of life among pregnant women at midpregnancy.	Cross-sectional	134 healthy pregnant women at midpregnancy.	HRQoL, CRF, pregnancy-related symptoms, physical activity, anthropometry, clinical and sociodemographic variables.	Anthropometry, SF-36, 6-MWT, PSI, Sensewear Armband Mini,
VI. Pregnancy symptoms and their impact on health-related quality of life at midpregnancy	Cross-sectional	155 healthy pregnant women at midpregnancy.	HRQoL, pregnancy-related symptoms, anthropometry, clinical and sociodemographic variables.	Anthropometry, SF-36, PSI.

PSI: Pregnancy Symptoms Inventory, PPAQ: Pregnancy Physical Activity Questionnaire, SBQ: Sedentary Behavior Questionnaire, HRQoL: Health-related quality of life, SF-36: Short-Form Health Survey 36, 6-MWT: 6-minutes' walk test.

Research Protocol

The research protocol and statistical analysis sections are presented specifically in each study, because of the different methodological design followed in them, as has been explained in Table 1.

RESULTS AND DISCUSSION [RESULTADOS Y DISCUSIÓN]

The Results and discussion section are presented in the form in which they have been published/submitted on research journals.

I. Pregnancy-related Symptoms

(Study I).

Spanish version of Pregnancy Symptoms Inventory: transcultural adaptation and reliability.

Oviedo-Caro MA, Bueno-Antequera J, Munguía-Izquierdo D.

J Matern Fetal Neonatal Med.

2017; 30(18):2185-2192.

Abstract:

Aim: To transcultural adapt and analyze the reliability of Spanish version of Pregnancy Symptoms Inventory and assess the prevalence of pregnancy symptoms in Spanish pregnant women.

Materials and methods: A subsample of 120 healthy pregnant women answered the Pregnancy Symptoms Inventory twice and a sample of 280 report the prevalence and limitation of pregnancy symptoms. The reliability was examined by means of per cent agreement and weighted Kappa coefficients. The prevalence of pregnancy symptoms was evaluated by the frequency of answers.

Results: Perfect and perfect-acceptable agreement was observed in 82% and 96% of the pregnant women. Weighted Kappa coefficients ranged from 0.589 to 0.889, indicating a good reliability. The most frequent symptoms perceived by Spanish pregnant women were urinary frequency, poor sleep, increased vaginal discharge and tiredness.

Conclusion: Spanish Pregnancy Symptoms Inventory is a brief, conceptually equivalent and satisfactory reliable tool that allows an early assessment of the wide range of pregnancy symptoms in the health care practices.

Keywords: Pregnancy Symptoms, Pregnancy discomfort, Health-Related Quality of Life, Prenatal care, Prenatal diagnosis.

Introduction

Pregnancy involves the appearance of physical symptoms that reflect the anatomical, physiological and psychological changes occurring during pregnancy, and affect pregnant women health-related quality of life [1,2]. Thirty-eight symptoms appeared during normal pregnancy have been described [3].

During pregnancy pharmacological treatment are limited due to their effects on the fetus development [4] and nonpharmacological methods may be useful to alleviate pregnancy symptoms discomforts [5]. An early detection of the appearance of pregnancy symptoms and the limitation on pregnant women daily life is essential to initiate an effective nonpharmacologic treatment. In this way, specific tool have been designed to quantify the prevalence, frequency and severity of several symptoms and have been used in pregnant women [6-14].

Lifestyle interventions have the potential to modify the frequency and severity of the pregnancy symptoms [15-16]. Most of the studies were focused on specific symptoms individually [17-18], but does not examine the range of potential symptoms during pregnancy [19].

The use of specific tools to assess the wide range of potential pregnancy symptoms may imply a large amount of time and could be exhausted for pregnant women. A valid and robust tool, Pregnancy Symptoms Inventory (PSI) [19], was developed to assess the wide range of pregnancy symptoms and to evaluate the impact of pregnancy interventions on the pregnancy symptoms.

Despite the large amount of Spanish-speaking people in the world [20], to our knowledge there is currently no available Spanish version of this tool. Consequently, the aim of this study was to transculturally adapt the PSI into Spanish, analyze the reliability and operational qualities of this tool, and assess the prevalence of pregnancy symptoms on Spanish pregnant women.

Materials and methods

Healthy singleton pregnant women, aged 18-45 years old, were recruited at the first visit from health clinics of the Sanitary Area of Seville (Spain). The exclusion criteria included physical illnesses or disabilities that affect normal daily routine and high risk pregnancy (i.e. diabetes or hypertension). A subsample of 120 and a total of 280 eligible Spanish pregnant women were recruited, after gave their informed consent, to analyze test retest reliability and prevalence of pregnancy symptoms,

respectively. The study protocol was performed in two stages: transcultural translation process from English to Spanish, and analysis of reliability, operational qualities and practical use of the Spanish version of the PSI (PSI-S). Ethical approval was obtained from the Medical Research Ethics Committee of the University Hospital Virgen del Rocio (Seville, Spain), approval number 2014PI-066.

As prescribed the scientific literature [21], the adaptation process for the PSI use the direct and reverse translation. Supplementary Figure S1 shows the steps followed in this process. Subsequently, individual interviews were conducted for the pregnant women to evaluate the understanding comprehensibility and feasibility of the questionnaire (cognitive debriefing), as described by previous studies [22]. The final version of the questionnaire is shown in the Appendix A.

Two face-to-face sessions, separately by an interval of 8 days, were performed to complete the study protocol. At first session, pregnant women completed the first PSI-S, sociodemographic and anthropometrical characteristics, weight and height were evaluated, following the standard procedures with calibrated digital scale and stadiometer (Tanita Corporation BC-420, Tokio, Japan). Body mass index (kg/m2) was calculated. In addition, pre-pregnancy BMI was calculated using the weight and height measuring by sanitary professional at first pregnancy visit. At the second session, the second PSI-S was completed.

Pregnancy Symptoms Inventory [19] is a 41-item Likert inventory that assesses how often symptoms occurred and what effect they had.

Statistical Analysis

Test-retest reliability of the PSI-S was examined by means of per cent agreement and weighted Kappa coefficients. For the analysis of per cent agreement, the difference between the first (T1) and second PSI-S (T2) administration was calculated. A difference (T2-T1) equal to 0 was considered ‘perfect’ agreement equivalent to the same test-retest answer, a difference of 0±1 and 0±2 was considered ‘perfect-acceptable’ and ‘moderate’ agreement, respectively. Linear Weighted K-coefficients [23] were calculated, which is more appropriate when dealing with ordered categorical data, because not only accounts for strict agreement (as does the ‘unweighted’ K), but also provides weighting to

adjacent categories. Pearson correlation coefficient was used as additional information to compare with original version.

To assess the prevalence of pregnancy symptoms, we calculated the frequencies of answer determined by the number of those women experiencing these symptoms, as explain in original version [19]. In addition, the prevalence of pregnancy symptoms was calculated across sociodemographic and clinical variables, as age, BMI, trimester of gestation, parity, occupational status and educational level, stratifying groups.

Date were analyzed using SPSS version 20.0 for windows (IBM Corporation, USA) with statistical significance set at $p<0.05$. Cohen's weighted K-coefficients were analyzed using STATA version 12 for windows (Statacorp, TX, USA).

Results

A previous sample of 16 pregnant women, with ages from 21 to 37 years, gestational ages between 9 and 35 weeks and all different education levels from no schooling to university education, was used for the transcultural translation process. Table 1 shows the sociodemographic characteristics of subsample and sample.

During the process of the direct and reverse translation, the range of difficulty for the translators varied between 1 and 3, whereas the conceptual equivalence varied between 8 and 10. Items of PSI with the greatest difficulty and/or the least conceptual equivalence and were discussed during the consensus meeting. Subsequently, the most problematic items were analyzed specifically in individuals interviews to rate the subjects' comprehension of the questionnaire (cognitive debriefing), as shown in Supplementary Table S1. Supplementary Table S2 shows the complete process of transcultural adaptation for the seven items, selecting the term with lower comprehension difficulty and higher conceptual equivalence. Respect to the degree of questionnaire acceptance and formality, the results showed that all pregnant women found the format comfortable and considered their comprehension of the items sufficient to allow them to suggest changes in specific items on the questionnaire.

Attending average frequency of perceived symptoms reported, perfect agreement was observed in 82% (range 63-98%) and perfect-acceptable agreement in 96% (range 89-100%) of the pregnant

women (Table 2). Respecting average perceived limitation reported, perfect agreement was observed in 84% (range 69-98%) and perfect-acceptable agreement in 97% (range 93-100%) of the pregnant women. Test-retest weighted K-coefficients ranged from 0.589 to 0.889 (P<0.001 for all) for frequency of perceived symptoms and from 0.576 to 0.869 (P<0.001 for all) for perceived limitation (Table 3).

Pearson's coefficients ranged from 0.619 to 0.943 (P<0.001 for all) for frequency of perceived symptoms, the majority of items (38 items) scoring upper than 0.700. Attending to perceived limitation, Pearson's coefficients ranged from 0.659 to 0.936 (P<0.001 for all), being the majority of items (35 items) higher than 0.700.

The mean time required to complete the PSI-S was 6 min 48 sec ± 3 min 54 sec per pregnant women (ranged 3 to 15 min). None of the pregnant women requested external help to complete the questionnaire. In some items any pregnant women did not responded it, so these items the percentage of prevalence was calculated displaying the denominator with the number of responders.

The top four of "often" reported symptoms were urinary frequency, poor sleep, increased vaginal discharge and tiredness. Table 4 shows the prevalence of self-reported pregnancy symptoms reported "often" and "sometimes".

Attending the limitation of the perceived symptoms on the activities of pregnant women daily life, the top four "limit a lot" symptoms were poor sleep, back pain, urinary frequency and tiredness. The total number responding to questions on "limit" is less than prevalence of symptoms because only those experienced that symptom were required to give an answer. Table 5 shows the prevalence of self-reported limitation on the activities of pregnant women daily life.

Focus on stratified subgroups, Supplementary Table S3 showed the prevalence of often self-reported pregnancy symptoms across clinical and sociodemographic variables. On BMI groups, anxiety and increased vaginal discharge substantially had higher prevalence in normal weight than overweight and obese pregnant women, and snoring had higher prevalence in overweight and obese than normal weight pregnant women. On age groups, greasy skin or acne and breast pain was more prevalent in young group than older group and snoring was more prevalent in older group than young group. On trimester of gestation groups, breast pain, taste/smell changes, nausea and changes on libido had

higher prevalence in second trimester group than third trimester group, opposite snoring had lower prevalence. On educational level, increased vaginal discharge was more prevalent on tertiary education group than non-tertiary group. On occupational status groups, reflux, sciatica, hip or pelvic pain, swollen hands or feet had higher prevalence in workers group than non-workers group. On parity groups, incontinence and anxiety had higher and lower prevalence, respectively, on multiparous group than nulliparous group.

Comment

This study provides an instrument with transcultural adaptation into Spanish conceptually equivalent to original version and good reliability. The urinary frequency, poor sleep, tiredness and back pain were four of the top five pregnancy symptoms with higher prevalence and limitation to daily activities on Spanish pregnant women.

On the adaptation process of PSI, no significant problems were found during the translation into Spanish or during the evaluation of the conceptual equivalence of the items, showing a good ability of pregnant women to comprehend the questionnaire. However, items with lower conceptual equivalence or higher difficulty was analyzed and discussed on cognitive test to improve the comprehension and reach a term with the best acceptance between pregnant women. Similar with the original version [19], the terms painful veins in vagina and brownish marks on face were discussed in this step of the process. The results showed that pregnant women found the format comfortable and comprehensible.

Reliability analysis showed, on average, that the agreements between both applications were perfect on most of pregnant women and perfect acceptable agreement on almost all pregnant women. This results indicate that this tool may be repeatable with a good capacity of detect changes on pregnant women perceived frequency of symptoms and perceived limitation on daily activities.

Attending weighted Kappa coefficients, this ranged from 0.589 to 0.889 for perceived frequency of symptoms and 0.576 to 0.869 for perceived limitation on daily activities, indicating a moderate to good agreement of both application of the questionnaire. We used Cohen's weighted Kappa coefficients due to is more appropriate when dealing with ordered categorical data, because not only accounts for strict agreement otherwise provides weighting to adjacent categories [23]. Nevertheless, in order to compare with the original version Pearson's correlation coefficients were also calculated

and show that the majority of items scored more than 0.700 in line, though slightly higher, than the original version [19]. Focus on perceived limitation to daily activities, items with lower reliability were anxiety, hip or pelvic pain, dry mouth, altered body image and changes in nipples. This may be due because the clinical characteristics of these symptoms, which the perception of them could be more steady or changeable in short-term.

Top and bottom five pregnancy symptoms with higher and lower prevalence reported as often by Spanish pregnant women were similar with the founded in the original version [19] and other studies [2,24], except dizziness which in original version was a higher prevalence [19]. Attending the prevalence of pregnancy symptoms reported as limit a lot, the top and bottom five symptoms with higher and lower prevalence were also similar with the founded in previous studies [2,19], except painful veins in vagina which was a higher prevalence in original version [19].

Focus on stratified groups, the majority of symptoms did not substantially differ between stratified groups. Substantially differences were found on snoring, anxiety, increased vaginal discharge and breast pain. Snoring was more prevalent in overweight, third trimester and older pregnant women, similar with previous studies [25,26] and indicating that the screening of this symptom need to be focalizing in this specific subgroups. On its behalf, anxiety was more prevalent on normal weight, similar with previous study [27] and nulliparous pregnant women, contrarily with previous study [7], suggesting that pregnant women with lower BMI have a high risk of suffering anxiety and may be caused by the physiological changes on body shape and weight that could be more pronounced on these subgroups, so specific studies to confirm this aspects are needed. Increasing vaginal discharge was more prevalent on normal weight and tertiary educational level pregnant women, from our knowledge there are no previous studies that analyze the prevalence of this symptom on these subgroups, so are needed studies that focalizing the attention on this aspect. In case of breast pain, this symptom was more prevalent in third trimester group, in line with previous studies [24] and young group, indicating that the maturity of female's physiology and the course of pregnancy influence the prevalence of this symptom.

This study presents several limitations, such as none of the participants were in the first trimester because the recruitment starts at the first visit of health clinics and pregnant women gave the written

informed consent at the second visit, placed in the second trimester. Future researches analyzing PSI properties should focus on first trimester pregnant women. Another limitation of this study is the exclusion of the high risk pregnant women and the participation only of pregnant who voluntarily gave their informed consent, which may have resulted in self-selection bias. In addition, stratified groups across clinical and sociodemographic variables present almost equal number of pregnant women in groups, except age group that have more pregnant women in older than younger group. This difference is explain because the median age of pregnant women on Spain was 32.4 years old [28], so the majority of Spanish pregnant women overtaken thirty years.

The systematic and rigorous process if the transcultural adaptation process was strength of this study, which allow discuss with pregnant women about the comprehensibility and feasibility of the items and the questionnaire. Another strength of this study is the utilization of various statistical tests to analyze the reliability of the questionnaire, which allow analyzing the reliability with recommended test for ordered categorical items and to compare with previous studies. The stratification of groups across clinical and sociodemographic variables imply the analysis of the prevalence of pregnancy symptoms which allow widen the knowledge of symptoms occurring during pregnancy.

Taking into account that self-report inventories are an easy administration, non-invasive and relatively inexpensive methods, PSI provides a brief and useful method to assess the wide range of pregnancy symptoms on clinical practices that may detect the symptoms perceived by pregnant women early and allow initiate the treatments or derived to specific health care providers. The existence of transcultural adaptation versions of PSI allow the utilization of this tool in multi-languages epidemiologic and large population studies assessing the prevalence of the wide range of pregnancy symptoms and the impact of interventions on pregnant women perceived health and quality of life.

In conclusion, Spanish Pregnancy Symptoms Inventory is a brief, conceptually equivalent and satisfactorily reliable tool that assesses the wide range of symptoms during pregnancy, allowing an early detection on clinical practices. The symptoms most prevalent and with higher limitation in Spanish pregnant women were urinary frequency, poor sleep, increased vaginal discharge and tiredness. The prevalence of pregnancy symptoms across clinical and sociodemographic stratified

groups, did not differ substantially except on anxiety, breast pain, snoring and increased vaginal discharge.

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Table 1. Demographic characteristics of : Total Sample (n=268) Subsample (n=110)

Variables		Mean (SD)	Mean (SD)
Age, years		32.5 (4.4)	31.8 (4.5)
Prepegnancy BMI, kg/m^2		24.8 (4.5)	23.7 (3.9)
		n (%)	n (%)
Age			
18-30 years old		73 (27.2)	38 (34.5)
31-44 years old		195 (72.8)	72 (65.5)
Trimester of gestation			
Second trimester		160 (59.7)	75 (68.2)
Third trimester		108 (40.3)	35 (31.8)
Prepregnancy BMI*			
<25 kg/m^2		164 (61.2)	75 (68.2)
>25 kg/m^2		104 (38.8)	35 (31.8)
Marital status			
Single without couple		3 (1.1)	1 (0.9)
Single with couple		81 (30.2)	36 (32.7)
Married		179 (66.8)	69 (62.7)
Divorced or separated		5 (1.9)	4 (3.6)
Parity			
0		137 (51.1)	68 (61.8)
1		115 (42.9)	36 (32.7)
>1		16 (6.0)	6 (5.5)
Highest level of education			
Non-Tertiary		150 (56.0)	64 (58.2)
Tertiary		118 (44.0)	46 (41.8)
Occupational status*			
Workers		122 (45.8)	52 (47.3)
Non-workers	Unemployed	75 (28.4)	32 (29.1)
	Sick leave from work	68 (25.8)	26 (23.6)

*Three student excluded of occupational status on total sample.
Abbreviations. BMI: Body Mass Index, SD: Standard Deviation

Table 2. Test-retest per cent agreement of PSI scores

	Frequency of perceived symptoms			Limitation of perceived symptoms		
Item	N	Perfect Agreement	Perfect-Acceptable Agreement	N	Perfect Agreement	Perfect-Acceptable Agreement
Average	110	82.0	96.0	97	84.0	97.4
Range	105-111	62.7-98.2	89.1-100	89-99	69.1-98.0	92.7-100
Tiredness or fatigue	111	73.0	92.8	99	78,8	97,0
Nausea	111	89.2	99.1	98	86,7	94,9
Vomiting	111	88.3	96.4	99	88,9	97,0
Reflux	105	82.9	95.3	93	84,9	96,8
Constipation	111	75.7	95.5	99	81,8	99,0
Hemorrhoids	110	94.5	98.1	98	92,9	99,0
Dry mouth	111	75.7	94.6	97	79,4	97,9
Food cravings	111	78.4	98.2	98	83,7	98,0
Poor sleep	111	71.2	92.8	97	69,1	94,9
Restless legs	110	83.6	95.5	98	78,6	97,0
Leg cramps	108	81.5	97.2	96	84,4	96,9
Snoring	110	86.4	98.3	98	85,7	96,9
Urinary frequency	110	82.7	97.3	97	79,4	99,0
Incontinence/leaking urine	111	88.3	97.3	98	88,8	97,0
Increased vaginal discharge	108	78.7	97.2	93	83,9	100
Thrush	111	95.5	99.1	99	93,9	99,9
Changes in libido	109	80.7	96.3	94	85,1	95,7
Painful veins in vagina	110	98.2	98.2	98	98,0	99,0
Carpel tunnel (numb hands)	111	86.5	95.5	99	87,9	97,0
Sciatica	111	82.0	97.3	99	83,8	95,0
Back pain	110	67.3	95.5	97	72,2	95,9
Hip or pelvic pain	111	75.7	94.6	96	76,0	92,7
Breast pain	111	71.2	91.9	98	78,6	97,0
Headache	111	72.1	94.6	97	74,2	92,7
Sore nipples	109	86.2	98.2	94	89,4	100
Dizziness	108	79.6	98.1	96	79,2	93,8
Fainting	108	97.2	99.1	96	97,9	97,9
Heart palpitations	109	84.4	95.4	96	85,4	96,9
Shortness of breath	111	77.5	94.6	99	79,8	97,0
Taste/smell changes	111	75.7	91.0	99	82,8	98,0
Forgetfulness	111	87.4	99.1	99	88,9	97,0
Feeling depressed	111	75.7	96.4	97	80,4	97,9
Anxiety	111	83.8	95.5	97	82,5	95,9
Vivid dreams	109	83.5	100	96	86,5	99,0
Altered body image	108	80.6	92.7	94	79,8	97,9
Greasy skin/acne	108	89.8	98.1	94	89,4	99,0
Varicose veins	111	87.4	95.5	98	90,8	99,9
Brownish marks on face	111	92.8	98.2	98	92,9	99,0
Itchy skin	110	71.8	92.7	96	79,2	99,0
Changes in nipples	110	62.7	89.1	93	74,2	97,9
Stretch marks	110	87.3	95.4	97	88,7	99,0
Swollen hands or feet	105	81.9	96.2	89	84,3	97,8

Abreviations. PSI: Pregnancy Symptoms Inventory

Table 3. Test-retest Cohen's K of PSI prevalence scores

	Frequency of perceived symptoms			Limitation of perceived symptoms		
Item	N	Weighted Kappa	r Pearson	N	Weighted Kappa	r Pearson
Average	110	0.748	0.811	97	0.735	0.789
Range	105-111	0.589-0.889	0.619-0.943	89-111	0.576-0.869	0.659-0.936
Tiredness or fatigue	111	0.641	0.682	99	0,733	0,787
Nausea	111	0.889	0.943	98	0,810	0,851
Vomiting	111	0.775	0.837	99	0,821	0,892
Reflux	105	0.780	0.805	93	0,776	0,792
Constipation	111	0.774	0.866	99	0,776	0,845
Hemorrhoids	110	0.838	0.844	98	0,748	0,728
Dry mouth	111	0.724	0.809	97	0,642	0,659
Food cravings	111	0.765	0.849	98	0,699	0,697
Poor sleep	111	0.677	0.735	97	0,668	0,763
Restless legs	110	0.763	0.800	98	0,689	0,779
Leg cramps	108	0.790	0.863	96	0,773	0,824
Snoring	110	0.840	0.903	98	0,731	0,761
Urinary frequency	110	0.668	0.694	97	0,715	0,770
Incontinence/leaking urine	111	0.828	0.870	98	0,818	0,858
Increased vaginal discharge	108	0.797	0.874	93	0,778	0,843
Thrush	111	0.853	0.884	99	0,869	0,936
Changes in libido	109	0.792	0.861	94	0,782	0,811
Painful veins in vagina	110	0.745	0.783	98	0,662	0,800
Carpel tunnel (numb hands)	111	0.752	0.811	99	0,770	0,822
Sciatica	111	0.818	0.889	99	0,808	0,853
Back pain	110	0.694	0.809	97	0,730	0,828
Hip or pelvic pain	111	0.722	0.810	96	0,653	0,696
Breast pain	111	0.692	0.771	98	0,681	0,692
Headache	111	0.672	0.769	97	0,691	0,769
Sore nipples	109	0.829	0.897	94	0,831	0,883
Dizziness	108	0.647	0.713	96	0,661	0,738
Fainting	108	0.589	0.619	96	0,658	0,662
Heart palpitations	109	0.725	0.777	96	0,697	0,748
Shortness of breath	111	0.689	0.761	99	0,730	0,821
Taste/smell changes	111	0.707	0.790	99	0,766	0,838
Forgetfulness	111	0.828	0.906	99	0,779	0,814
Feeling depressed	111	0.679	0.761	97	0,705	0,775
Anxiety	111	0.696	0.729	97	0,658	0,725
Vivid dreams	109	0.754	0.855	96	0,679	0,706
Altered body image	108	0.672	0.741	94	0,613	0,697
Greasy skin/acne	108	0.846	0.892	94	0,766	0,809
Varicose veins	111	0.807	0.868	98	0,839	0,896
Brownish marks on face	111	0.859	0.908	98	0,814	0,846
Itchy skin	110	0.655	0.730	96	0,752	0,842
Changes in nipples	110	0.601	0.694	93	0,576	0,660
Stretch marks	110	0.774	0.799	97	0,782	0,836
Swollen hands or feet	105	0.787	0.873	89	0,749	0,796

Table 4. Prevalence of self-reported pregnancy symptoms reported often of sometimes

Item	N	Often	Sometimes	Total
Urinary frequency	267	65.2	23.2	88.4
Poor sleep	268	34.3	34.7	69.0
Increased vaginal discharge	265	34.3	29.8	64.1
Tiredness or fatigue	268	29.5	44.0	73.5
Back pain	268	23.1	29.5	52.6
Changes in nipples	266	22.9	29.7	52.6
Constipation	268	17.2	22.0	39.2
Reflux	266	16.9	20.7	37.6
Breast pain	268	14.6	23.1	37.7
Taste/smell changes	268	14.2	17.9	32.1
Swollen hands or feet	266	11.3	15.0	26.3
Sciatica/pain down the back of your legs	268	11.2	22.8	34
Hip or pelvic pain	267	11.2	21.3	32.5
Itchy skin	266	10.5	19.9	30.4
Changes in libido	265	9.4	26.8	36.2
Nausea	268	9.3	10.8	20.1
Leg cramps	267	8.6	22.5	31.1
Carpel tunnel (numb hands)	268	8.6	13.1	21.7
Snoring	268	8.2	13.1	21.3
Restless legs	267	7.9	18.0	25.9
Headache	267	7.9	23.2	31.1
Shortness of breath	267	7.9	15.4	23.3
Dry mouth	268	7.8	21.3	29.1
Varicose veins	268	7.8	11.6	19.4
Sore nipples	267	6.4	13.5	19.9
Greasy skin/acne	266	6.0	8.6	14.6
Stretch marks	267	5.6	13.5	19.1
Altered body image	263	5.3	11.0	16.3
Incontinence/leaking urine	268	5.2	18.3	23.5
Anxiety	268	4.5	9.3	13.8
Vomiting	268	4.1	6.7	10.8
Hemorrhoids	267	4.1	10.9	15.0
Food cravings	268	4.1	28.4	32.5
Forgetfulness	267	4.1	12.4	16.5
Feeling depressed	267	3.7	15.7	19.4
Brownish marks on face	268	3.7	8.6	12.3
Vivid dreams	267	3.4	12.4	15.8
Thrush	268	2.6	6.3	8.9
Heart palpitations	267	2.6	14.6	17.2
Dizziness	266	1.5	12.8	14.3
Painful veins in vagina	268	1.1	1.1	2.2
Fainting	267	0.4	1.1	1.5

As the number of women responding questions varied, the denominator is displayed for each symptom (N)

Table 5. Prevalence of self-reported limitation to activities of daily living

Item	N	Limit a lot	Limit a little	Total prevalence
Poor sleep	253	21.7	39.9	61.6
Back pain	252	19.8	32.9	52.7
Urinary frequency	255	18.8	43.5	62.3
Tiredness or fatigue	254	18.5	47.6	66.1
Sciatica/pain down the back of your legs	254	14.2	23.2	37.4
Headache	253	11.1	20.9	32.0
Hip or pelvic pain	251	9.6	18.3	27.9
Shortness of breath	251	8.0	19.5	27.5
Nausea	257	7.4	14.4	21.8
Vomiting	257	6.6	8.6	15.2
Swollen hands or feet	250	6.4	14.8	21.2
Incontinence/leaking urine	252	6.0	13.5	19.5
Reflux	254	5.9	23.2	29.1
Carpel tunnel (numb hands)	257	5.8	10.9	16.7
Dizziness	252	5.6	16.7	22.3
Taste/smell changes	255	5.1	12.5	17.6
Feeling depressed	251	4.8	13.9	18.7
Constipation	256	4.3	17.2	21.5
Leg cramps	254	4.3	18.5	22.8
Increased vaginal discharge	249	4.0	22.5	26.5
Restless legs	256	3.9	15.6	19.5
Anxiety	252	3.6	13.9	17.5
Itchy skin	251	3.6	17.1	20.7
Thrush	256	3.5	6.3	9.8
Changes in libido	251	3.2	17.9	21.1
Varicose veins	253	2.4	8.3	10.7
Fainting	254	2.0	1.6	3.6
Altered body image	246	2.0	6.9	8.9
Changes in nipples	250	2.0	15.6	17.6
Heart palpitations	255	1.6	12.9	14.5
Stretch marks	253	1.6	5.9	7.5
Hemorrhoids	255	1.2	5.9	7.1
Breast pain	252	1.2	17.5	18.7
Forgetfulness	252	1.2	12.7	13.9
Dry mouth	251	0.8	8.4	9.2
Food cravings	252	0.8	4.8	5.6
Snoring	251	0.8	5.2	6.0
Sore nipples	252	0.8	10.3	11.1
Greasy skin/acne	249	0.8	7.6	8.4
Brownish marks on face	254	0.8	3.9	4.7
Painful veins in vagina	257	0.4	0.8	1.2
Vivid dreams	251	0.0	6.4	6.4

As the number of women responding questions varied. the denominator is displayed for each symptom (N).
Women who did not experience a symptom did not answer limit question.

Table S1: Questions arising in the process of direct and reverse translation and raised on the cognitive test

Items	Detected Problem	Consensus Term
Item 10 Dry Mouth	The conceptual equivalence between dry mouth and "boca seca" or "sequedad bucal" was raised	Boca seca, because of its lower comprehension difficulty following the results of the cognitive test.
Item 16 Urinary Frequency	The conceptual equivalence between urinary frequency and "Micción frecuente" or "Frecuencia urinaria" was raised	Aumento de la frecuencia urinaria, because of lower comprehension difficulty and its more common use following the results of the cognitive test
Item 21 Painful veins in vagina	The conceptual equivalence between urinary frequency and "Venas dolorosas en la vagina" or "Varices en la vagina" was raised	Varices en la vagina, because of its more common use in Spanish following the results of the cognitive test
Item 28 Irritation nipples	The conceptual equivalence between sore nipples and "Irritamiento de los pezones" or "Pezones irritados" was raised	Pezones irritados, because of its lower comprehension difficulty following the results of the cognitive test
Item 32 Shortness of breath	The conceptual equivalence between urinary frequency and "Falta de aliento" or "Dificultad respiratoria" was raised	Dificultad respiratoria, because of its lower comprehension difficulty following the results of the cognitive test
Item 37 Vivid dreams	The conceptual equivalence between vivid dreams and "sueños vividos" or "sueños reales" was raised	Sueños reales, because its more common use following the results of the cognitive test
Item 41 Brownish marks on face	The conceptual equivalence between brownish marks on face and "marcas amarronadas en la cara" or "manchas marrones en la cara" was raised	Marcas marrones en la cara, because its more common use following the results of the cognitive test

Table S2: Examples of the complete process of transcultural adaptation

Phase	Item 10	Item 16	Item 21	Item 28	Item 32	Item 37	Item 41
Original version	Dry Mouth	Urinary Frequency	Painful veins in vagina	Sore nipples	Shortness of breath	Vivid dreams	Brownish marks on face
Direct translation A	Boca seca	Micción frecuente	Venas dolorosas en la vagina	Irritamiento en los pezones	Falta de aliento	Sueños vividos	Marcas marrones en la cara
Equivalence	9	8	8	8	9	10	10
Difficulty	2	3	2	3	2	2	2
Direct translation B	Sequedad bucal	Frecuencia urinaria	Varices en la vagina	Pezones Irritados	Dificultad respiratoria	Sueños reales	Manchas marrones en la cara
Equivalence	9	9	9	9	10	9	9
Difficulty	1	2	2	1	2	2	2
First consensus version	Sequedad bucal	Aumento de la frecuencia urinaria	Venas dolorosas en la vagina	Irritamiento de los pezones	Dificultad respiratoria	Sueños vividos	Manchas marrones en la cara
Reverse translation	Dryness of the mouth	Increase in the urinary frequency	Painful veins in the vagina	Irritation of nipples	Lock of breath	Vivid dreams	Blemishes on face
Second consensus version	Two options suggested to pregnant women in the cognitive test: Sequedad bucal. Boca seca.	Two options suggested to pregnant women in the cognitive test: Aumento de la frecuencia urinaria. Micción frecuente.	Two options suggested to pregnant women in the cognitive test: Venas dolorosas en la vagina. Varices en la vagina.	Two options suggested to pregnant women in the cognitive test: Irritamiento de los pezones Pezones. Irritados.	Two options suggested to pregnant women in the cognitive test: Dificultad respiratoria. Falta de aliento.	Two options suggested to pregnant women in the cognitive test: Sueños vividos. Sueños reales.	Two options suggested to pregnant women in the cognitive test: Manchas amarrones en la cara. Marcas amarrones en la cara.
Cognitive Test	Most of pregnant women (8/16) preferred the option "boca seca". One pregnant women didn't found differences between both terms. *Sequedad bucal*: They attributed higher comprehension difficylty. *Boca seca:* They attributed lower comprehension difficulty.	Most of pregnant women (15/16) preferred the option *"aumento de la frecuencia urinaria". Aumento de la frecuencia urinaria:* They attributed lower comprehension difficulty. *Micción frecuente:* They attributed higher comprehension difficlty	Most of pregnant women (12/16) preferred the option *"varices en la vagina". Venas dolorosas en la vagina:* This term has a higher comprehension difficulty. *Varices en la vagina:* This term has a lower comprehension difficulty and is more common in Spanish	Most of pregnant women (12/16) preferred the option *"pezones irritados"* to *"irritamiento de los pezones". Pezones irritados:* They attributed lower comprehension difficulty. *Irritamiento de los pezones:* They attributed higher comprehension difficulty.	Most of pregnant women (14/16) preferred the option "*Dificultad respiratoria ". Falta de aliento:* They attributed higher comprehension difficulty *Dificultad respiratoria :* They attributed lower comprehension difficulty	Most of pregnant women (13/16) preferred the option *"sueños reales". Sueños vividos:* They didn't recognize the use of this term *Sueños reales:* They recognized the use of this term more usual.	Most of pregnant women (10/16) preferred the option "*marcas marrones". Marcas marrones:* The recognized the use of this term more usual. *Manchas marrones:* The use of this term is less usual.
Final Version	Boca seca	Aumento de la frecuencia urinaria	Varices en la vagina	Pezones Irritados	Dificultad respiratoria	Sueños reales	Marcas marrones en la cara

Table S3. Prevalence of self-reported pregnancy symptoms often reported by stratified groups.

Stratified groups	BMI		Age		Trimester		Educational Level		Laboral Status		Parity	
Items	<25 (164)	≥25 (104)	20-30 (73)	31-44 (195)	Second (160)	Third (108)	Tertiary (118)	Non-tertiary (150)	Workers (122)	Non-workers (143)	0 (137)	≥1 (131)
Tiredness or fatigue	26.8	33.7	27.4	30.3	28.1	31.5	28.8	30.0	26.2	32.9	23.4	35.9
Nausea	6.1	14.4	12.3	8.2	13.1	3.7	6.8	11.3	9.0	9.1	9.5	9.2
Vomiting	1.2	8.7	5.5	3.6	5.6	1.9	1.7	6.0	1.6	6.3	3.6	4.6
Reflux	15.3	19.4	9.9	19.5	10.1	26.9	16.2	17.4	11.6	20.4	17.8	16.0
Constipation	21.3	10.6	21.9	15.4	17.5	16.7	16.9	17.3	17.2	16.1	17.5	16.8
Hemorrhoids	5.5	1.9	1.4	5.1	2.5	6.5	6.0	2.7	5.0	3.5	2.2	6.1
Dry mouth	7.3	8.7	9.6	7.2	8.1	7.4	7.6	8.0	3.3	11.9	8.0	7.6
Food cravings	5.5	1.9	6.8	3.1	5.0	2.8	1.7	6.0	4.9	3.5	5.8	2.3
Poor sleep	36.0	31.7	34.2	34.4	28.8	42.6	33.1	35.3	27.9	39.2	34.3	34.4
Restless legs	8.0	7.7	6.9	8.2	6.3	10.2	6.8	8.7	5.7	9.9	5.9	9.9
Leg cramps	9.8	6.8	11.0	7.7	6.9	11.2	5.1	11.4	6.6	10.6	7.4	9.9
Snoring	3.7	15.4	1.4	10.8	4.4	13.9	10.2	6.7	4.9	11.2	8.0	8.4
Urinary frequency	70.1	57.3	72.2	62.6	61.6	70.4	58.5	70.5	58.7	70.6	65.4	64.9
Incontinence/leaking urine	3.7	7.7	6.8	4.6	5.6	4.6	2.5	7.3	1.6	8.4	0.7	9.9
Increased vaginal discharge	42.6	21.4	36.6	33.5	28.0	43.5	42.4	27.9	33.6	35.7	35.6	33.1
Thrush	1.8	3.8	1.4	3.1	3.1	1.9	1.7	3.3	2.5	2.1	2.9	2.3
Changes in libido	8.7	10.6	11.3	8.8	13.3	3.7	11.1	8.1	8.3	10.6	8.2	10.7
Painful veins in vagina	1.2	1.0	1.4	1.0	0.6	1.9	0.8	1.3	0.8	1.4	0.0	2.3
Carpel tunnel	6.7	11.5	8.2	8.7	8.8	8.3	6.8	10.0	8.2	9.1	7.3	9.9
Sciatica	12.8	8.7	17.8	8.7	8.8	14.8	9.3	12.7	4.9	16.8	10.2	12.2
Back pain	27.4	16.3	26.0	22.1	18.8	29.6	22.0	24.0	18.0	28.0	20.4	26.0
Hip or pelvic pain	12.9	8.7	19.2	8.2	6.9	17.6	13.6	9.4	6.6	14.1	12.5	9.9
Breast pain	14.0	15.4	24.7	10.8	21.3	4.6	12.7	16.0	14.8	14.0	14.6	14.5
Headache	6.1	10.6	15.1	5.2	10.7	3.7	5.1	10.1	9.1	7.0	7.3	8.5
Sore nipples	4.9	8.7	15.1	3.1	8.2	3.7	5.1	7.4	5.8	7.0	6.6	6.2
Dizziness	1.8	1.0	1.4	1.5	1.9	0.9	0.8	2.0	1.6	1.4	0.7	2.3
Fainting	0.6	0.0	0.0	0.5	0.6	0.0	0.8	0.0	0.8	0.0	0.0	0.8
Heart palpitations	4.3	0.0	5.6	1.5	2.5	2.8	2.5	2.7	2.5	2.1	4.4	0.8
Shortness of breath	8.0	7.7	11.1	6.7	5.0	12.1	11.0	5.4	4.1	11.2	5.9	9.9
Taste/smell changes	12.2	17.3	17.8	12.8	20.0	5.6	11.9	16.0	13.9	14.0	15.3	13.0
Forgetfulness	3.0	5.8	6.8	3.1	5.0	2.8	4.2	4.0	4.1	4.2	5.1	3.1
Feeling depressed	3.1	4.8	8.2	2.1	3.1	4.6	2.5	4.7	0.8	4.9	4.4	3.1
Anxiety	7.3	0.0	9.6	2.6	3.1	6.5	5.1	4.0	1.6	5.6	7.3	1.5
Vivid dreams	3.7	2.9	2.8	3.6	1.9	5.6	6.0	1.3	1.7	4.2	4.4	2.3
Altered body image	5.6	5.0	5.7	5.2	5.7	4.7	6.8	4.1	3.3	6.5	6.1	4.6
Greasy skin/acne	6.8	4.8	18.1	1.5	6.9	4.7	3.4	8.1	5.7	6.4	8.1	3.8
Varicose veins	8.5	6.7	5.5	8.7	6.3	10.2	8.5	7.3	8.2	7.7	8.0	7.6
Brownish marks on face	4.9	1.9	0.0	5.1	1.3	7.4	5.9	2.0	4.9	2.8	3.6	3.8
Itchy skin	9.2	12.6	5.5	12.4	10.6	10.4	8.5	12.2	9.1	12.0	11.1	9.9
Changes in nipples	22.7	23.3	27.8	21.1	24.5	20.6	19.7	25.5	16.7	28.0	25.7	20.0
Stretch marks	3.1	9.6	8.2	4.6	5.0	6.5	4.2	6.7	2.5	8.5	5.8	5.4
Swollen hands or feet	10.4	12.6	11.1	11.3	8.2	15.7	12.0	10.7	6.6	15.5	12.5	10.0

As the number of women responding questions varied. the denominator is displayed for each symptom (N)

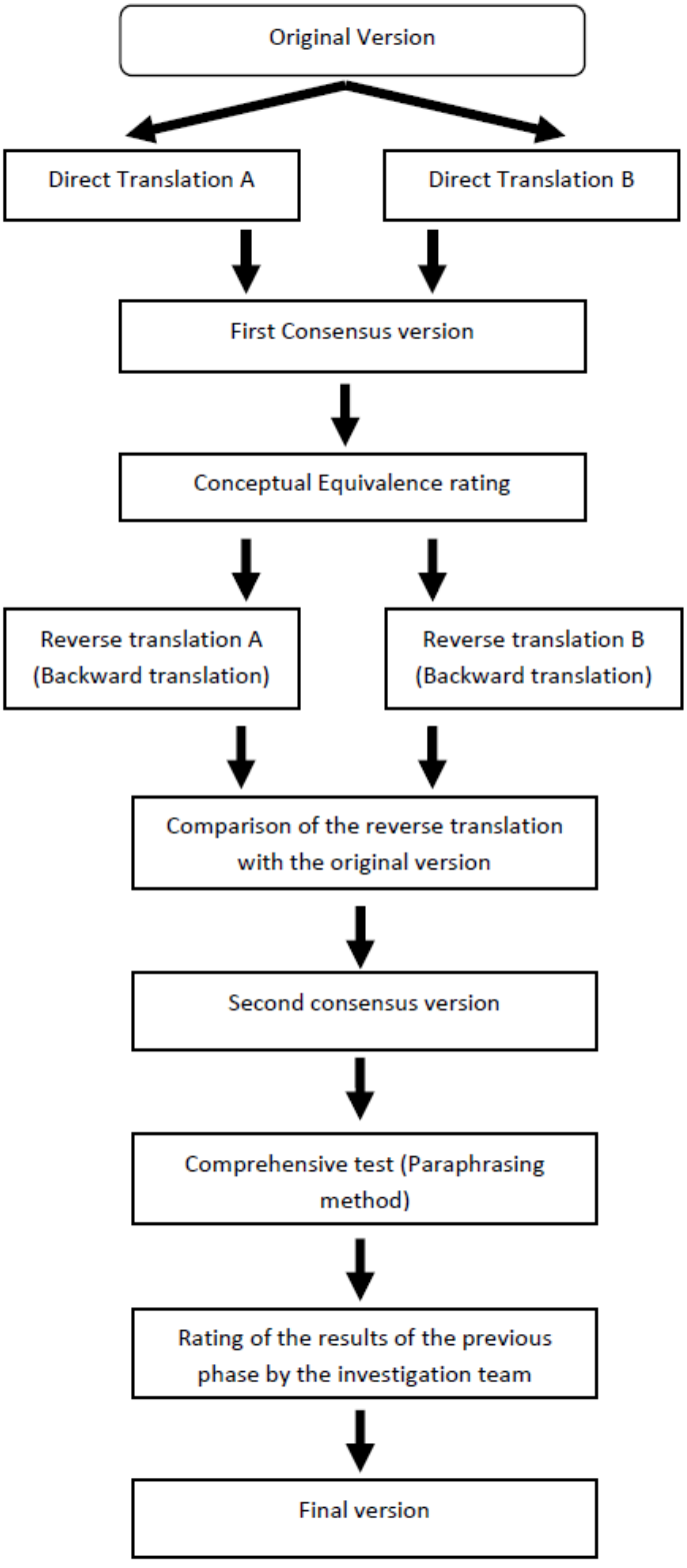

Figure S1. Stages in the adaptation process of the Pregnancy Symptoms Inventory to Spanish.

II. Lifestyle during pregnancy.

(Studies II, III, and IV).

II

Transcultural adaptation and psychometric properties of Spanish version of Pregnancy Physical Activity Questionnaire: The PregnActive project.

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In second revision

Abstract

Objective: To transculturally adapt into Spanish and analyze the psychometric properties of Spanish version of Pregnancy Physical Activity Questionnaire.

Methods: A subsample of 109 healthy pregnant women answered the Spanish version of Pregnancy Physical Activity Questionnaire twice and a sample of 208 wore the multi-sensor monitor at least 7 valid days. The reliability (Intraclass correlation coefficient), concordance (Concordance correlation coefficient), correlation (Pearson correlation coefficient), agreement (Bland-Altman plots) and relative activity levels (Jonckheere-Terpstra test) between both administration and methods were examined.

Results: Intraclass correlation coefficients were good for all categories except transportation. A low but significant correlation was found for total activity (light and above) whereas no correlation was found for other intensities. Relative activity levels showed a significant linear trend for increasing total activity between both methods.

Conclusions: Spanish version of Pregnancy Physical Activity Questionnaire is a brief and easily interpretable questionnaire with good reliability and ability to rank individuals, and poor validity compared with multi-sensor monitor. The use of Pregnancy Physical Activity Questionnaire provides information of pregnancy-specific activities in order to establish physical activity levels of pregnant women and adapt health promotion interventions.

Keywords: Exercise, Life Style, Pregnancy, Surveys and Questionnaires, Health.

Introduction

Physical activity during pregnancy has potential benefits in pregnant women's health, such as reduced risk of gestational diabetes mellitus and preeclampsia, and prevention of excessive weight gain and weight retention[1–3]. Similarly, inactivity during pregnancy has been associated with adverse perinatal outcomes[4–6]. Pregnant women with absence of medical or obstetrics complications, are advised to accumulate at least 30 min of moderate intensity activity per day on most, if not all, days of the week[7].

Valid and reliable methods to measure the duration, frequency and intensity of physical activity during pregnancy are needed to provide information in order to establish health promotion strategies that prevent excessive weight gain and improve pregnant women's health. Questionnaires are the most common methods used in epidemiologic and large population studies because its inherent characteristics as easy administration, non-invasive and relatively inexpensive. Several physical activity questionnaires have been developed and validated in adults. Most of them emphasize on moderate and vigorous intensity sports, and fail to include household or childcare activities, which comprised a substantial proportion of physical activity during pregnancy[8]. This may result in misclassification that limits their ability to estimate and differentiate physical activity levels among pregnant women[9].

The Pregnancy Physical Activity Questionnaire (PPAQ)[9] is a specifically designed and successfully validated tool for the assessment of physical activity levels among pregnant women. PPAQ has been translated into different languages as Japanese[10], Vietnamese[11], French[12], Turkish[13], Portuguese[14] and Chinese[15]. In addition, these versions have been validated against pedometer[11,13], uniaxial accelerometer[9,10,15], and biaxial accelerometer[12]. Validation studies or specific cutpoints for this devices have not been developed for pregnant women[12,16]. Inherent limitations were found in this devices, such as the limited use for monitoring intensity of activity, impossibility of detect upper body movements due to its placement, low compliance[17] and uncomfortable location for pregnant women[18]. Although a new multi-sensor monitor that overcomes the limitations has been validated on pregnant women[18], none of the standardized physical activity questionnaire has been validated against this monitor in this population.

Despite the large amount of Spanish-speaking people in the world, to our knowledge there is currently no validated Spanish version of this tool, which takes into account the cultural differences of Spanish-speaking pregnant women. Consequently, the aim of this study was to transculturally adapt the PPAQ into Spanish and analyze the psychometric properties of this tool, validating it against multi-sensor body monitor.

Methods

Participants

We recruited healthy pregnant women, aged 18-45 years old at first prenatal care visit from health clinic of the Sanitary Area of Seville (Spain). The exclusion criteria included physical illnesses or

disabilities that affect normal daily routine and high risk pregnancy (i.e. diabetes or hypertension). We obtain written informed consent of participants prior to enrolling in the study and after receiving detailing information about the study aims and protocol. A total sample of 260 and a subsample of 120 eligible women were used to analyze validity and test-retest reliability, respectively, but pregnant women with incomplete protocol were excluded. Finally, 208 and 109 pregnant women were included in the validity and reliability analysis, respectively.

Study protocol

The study protocol obtained ethical approval from the Medical Research Ethics Committee of the University Hospital Virgen del Rocio (Seville, Spain) according to the Declaration of Helsinki. The study protocol was performed in two stages: transcultural translation process of the PPAQ from English to Spanish, and analysis of reliability and validity of the Spanish version of the PPAQ (PPAQ-S).

Transcultural adaptation process

As prescribed the scientific literature[19], the adaptation process for the PPAQ used the direct and reverse translation (forward-backward translation). The Supplementary Figure I showed the steps followed in this process. Subsequently, individual interviews were conducted for the pregnant women to evaluate the understanding comprehensibility and feasibility of the questionnaire (cognitive debriefing), as described by previous studies[20].

Reliability and validity

Two face-to-face sessions, separated by an interval of 8 days was performed to complete the reliability and validity process. At first session, sociodemographic and anthropometrical characteristics, weight and height, were evaluated following the standard procedures with calibrated digital scale (Tanita Corporation BC-420, Tokio, Japan) and a stadiometer (Seca-780, Hamburg, Germany). Body mass index (BMI) (kg/m2) was calculated. In addition, pre-pregnancy BMI was calculated using the weight and height measured by sanitary professional at first prenatal care visit. In this session pregnant women completed the first PPAQ-S and a multi-sensor monitor was placed on the left arm of each pregnant women. At the second session, the second PPAQ-S was completed and the monitor was removed. Participants were asked not to change their habitual lifestyle.

Instruments

The PPAQ[9] is a semiquantitative questionnaire which reports the time spending in 32 activities categorized in five types of activity. Respondents are asked to select the category which best approximates the amount of time spent in each activity per day or week during the current trimester. The number of hours spent in each activity was multiplied by the activity intensity to arrive at average daily energy expenditure (MET-hours/day) attributable to each activity. This tool used specific METs values for pregnant women when is possible as previously established[9]. Activities were categorized by intensity, type or as total activity.

A multi-sensor monitor, Sensewear Mini Armband (BodyMedia Inc., Pittsburgh, USA) was used to assess physical activity and energy expenditure. This monitor provides more accurate estimation of energy expenditure than accelerometry-based devices[21] and have shown a well correlation with indirect calorimetry measured on pregnant women[18]. It includes sensors to measure energy expenditure by monitoring the heat flow from the body, skin temperature, galvanic skin response and 3-axis accelerometer for motion detector. Data were downloaded using Sensewear professional software version 8.1, and were exported as METs data minute to minute into excel, where we calculated the METs·h/week. The monitor was worn 8 completed days, except during water-based activities, including five week days and two weekend days completed. It must have been carried over more than 95% of the whole day (1368 min) for considering a completed day. Data of swimming were substituted for a constant MET value according to the Compendium of Ainsworth as explained previous research[22]. To avoid any kind of immediate reactivity, we removed from the analysis the first completed day monitored.

Statistical analysis

Test-retest reliability was studied calculating 2-way mixed average Intraclass correlation coefficient with 95% confident interval. Estimated means and differences between the measurements, standard deviations of the differences, intraindividual standard deviation[23], and standard error of measurement[24] was studied. Agreement between test and retest was assessed using Bland-Altman plots, including the 95% levels of agreement[23].

To assess the validity of the PPAQ-S we followed the Edinburgh Framework[25] and the COSMIN checklist[26]. Estimated means of subjective (PPAQ) and objective (SWA) measures were calculated for intensity categories time. Systematic differences between both measures were calculated by means of paired t-test. Concordance between the objective and subjective measures was studied with concordance correlation coefficient[27]. Pearson correlation coefficient was used as additional information for the concordance correlation coefficient, and to compare against previous validity studies for PPAQ.

Bland-Altman plots were calculated as previously explained. The association between the difference and the magnitude of the measurement (i.e. heterodasticity) was examined by regression analysis. Receiver operating characteristic curve was constructed to determine the areas under the curve and 95% confidence intervals, specificity and sensitivity of PPAQ as predictor of the fulfillment of minimum physical activity recommendations of ≥150 min/week in bouts of ≥10min[28] or 600 METs·min/week[29]. To assess relative activity levels, we used Jonckheere-Terpstra test evaluating whether grouping participants into tertiles according PPAQ-S total activity yielded groups with different "true" activity levels.

We used parametric statistics because of the large sample size; however, some of the study variables were non-normally distributed. We repeated the analysis using a nonparametric statistics,

and the result did not substantially change. Date were analyzed using SPSS package version 20.0 for windows (IBM Corporation) with statistical significance set at $p<0.05$.

Results

Study population

A previous sample of 16 pregnant women, aged from 21 to 37 years, gestational age between 9 and 35 weeks, and educational levels from no schooling to university were used for the transcultural adaptation process. Sociodemographic characteristic of sample and subsample are shown in Table 1. The main intensity and type of physical activity reported using PPAQ-S were light intensity and household and caregiving activities, 57% and 52% of total activity respectively.

Transcultural adaptation process

During the process of the forward and backward translation, the range of difficulty for the translators varied between 1 and 6, whereas the conceptual equivalence varied between 7 and 10. Items that presented the greatest difficulty and/or the least conceptual equivalence are shown in Table I of online Appendix, and were discussed during the first and second consensus meeting. Individual interviews were conducted for 16 pregnant women, to analyze the cognitive debriefing of questionnaire. Table II of online Appendix showed the complete process of transcultural adaptation for four items. Regarding the acceptance and formality of PPAQ-S, all pregnant women found the format comfortable and considered their comprehension sufficient to suggest changes in specific items of the questionnaire.

Operational qualities

The mean time required to complete the PPAQ-S was 8 min ± 4 min per patient (ranged 3 to 20). None of patients needed external help to complete the questionnaire.

Test-retest reliability

Results of test-retest reliability for PPAQ-S scores are presented in Table 2. Intraclass correlation coefficient were good for both total activity scores (0.90 and 0.96), all intensity categories (0.87-0.92) and all type of activities (0.87-0.98); except transportation which was moderate (0.65). Mean differences between test and retest did not differ substantially from zero and were lower than the standard error of the mean. Standard error of measurement for all PPAQ-S summaries varied from 0.0 to 19.2 METs·h/week. Bland-Altman plots and the limits of agreement for total activity (-75.8, 60.2), moderate to vigorous activity and moderate activity (-37.0, 30.8 for both) were shown in Figure I. There was significant association between the difference and the magnitude of the test-retest PPAQ-S measurement for all summaries (β from 0.190 to 0.487), except for total activity.

Validity

PPAQ-S overestimated physical activity by 32% of total activity (32.3 METs·h/week) and 14% of moderate to vigorous activity (5.1 METs·h/week) compared with SWA. The difference between both methods was significant for all intensity categories, except for moderate and moderate to vigorous activity (Table 3). However, assessing relative activity levels, we found a significant linear

trend for increasing total activity based on SWA data across tertiles of whole sample for activity based on PPAQ-S score (p=0.005). A low but significant correlation was found for sedentary activity and total activity, whereas no significant correlation was found for other intensity categories. The concordance correlation coefficient value between PPAQ-S and SWA ranged from -0.011 to 0.133 for all summary categories. Attending to specific subgroups, the PPAQ-s showed significantly higher total activity compared with SWA across all stratified variables and significant differences between moderate to vigorous physical activity values were found on workers, non-workers, BMI≥25 kg/m^2, second trimester and multiparous groups. The group of young, BMI ≥25, second trimester, nulliparous and workers showed slightly stronger correlations in total activity between PPAQ-S and SWA measurements compared with their respective counterparts (Table III of online Appendix).

Figure II showed Bland-Altman plots and the limits of agreement for total (-92.3, 32.4), moderate to vigorous (-88.6, 5.2) and moderate (-88.2, 5.4) activity. There was a significant association between the difference and the magnitude of the PPAQ-S and SWA measurements for all intensity categories (β from -0.211 to 0.981).

Receiver operating characteristic analysis identifed PPAQ-S as poor predictor of the proportion of patients meeting minimum physical activity recommendation of ≥150 min of moderate to vigorous physical activity in bouts of 10 minutes and ≥600 METs·min/week, showing a high sensitivity (81% and 78% true positive, respectively) but low specificity (29% and 20% true negative, respectively).

Discussion

This study provides adequate transcultural adaptation, good reliability, good ability to rank physical activity levels of pregnant and poor validity analysis of the PPAQ-S, being the first standardized physical activity questionnaire validated against a multi-sensor monitor in pregnant women.

In the transcultural adaptation process, no significant problems appeared throughout the translation into Spanish or the evaluation of the conceptual equivalence of the items. The ability of pregnant women to comprehend the questionnaire was good and the mean administration time of the questionnaire was similar to the original version, approximately 8 versus 10 min[9].

The median total activity reported was similar to Japanese version[10], lower than Turkish[13], and higher than original[9], Vietnamese[11] and Chinese[15] versions. The predominance of light intensity and household and caregiving activities found in our sample is in line with other PPAQ versions[9–11,13], and can be explained because the pregnant women select less demanding activities[30] during pregnancy for compensate the increase of basal energy expenditure[31] and because approximately half of our sample were un-employed or sick from work and multiparous, prevailing household and caregiving activities in their daily life.

Our reliability results for total activity were higher than original version[9], and similar with other versions[10,11], explained by the similar period of time between both applications. The difference with original version may be due to the mailed administration used in the original version for the second

administration. Bland-Altman plots and heterocedasticity analysis revealed that for total activity when the amount of activity reported was higher, the differences no increased, suggesting that this summary activity score may be repeatable irrespective of the amount of activity reported. Focus on intensity categories, the reliability results were slightly greater for moderate activity than other intensity categories, consistent with other versions[9,11–13]. Focus on type categories, in line with others PPAQ versions, reliability results were good for all types of activity[10–13], except transportation[10,12]. This may reflect a true variability on this activity and could be explained because pregnancy implies structured medical visits that may change this behavior in the daily life of pregnant women. Nevertheless household and caregiving and occupational types of activity could be more routine activities.

In line with previous study[16], PPAQ-S overestimated physical activity levels for all intensity categories compared against SWA, except for sedentary and vigorous activities. Validity results showed only significant relationship for total and sedentary activities, and Bland Altman plots and heterocedasticity analysis for total and moderate to vigorous activity indicated that just as amount of physical activity reported was higher the differences between methods increase. This overestimation of physical activity shows the difficulty of pregnant women to discriminate the intensity or the duration of their activities, and could be explain by the increase of weight and basal energy expenditure[31] and the difficulties on movement[32] inherent to pregnancy that could make pregnant women to perceive these difficulties with a higher duration or effort level. Receiver operational characteristic analysis revealed a poor prediction of fulfillment of minimum physical activity recommendations, showing a high sensitivity and low specificity, leading to consider this instrument a bad discriminator of people who reach the minimum physical activity recommendation, but a good instrument to detect moderate to vigorous physical activity. However, the significant linear trend showed on relative activity levels assessment suggests the ability of PPAQ-S to discriminate activity levels reflecting the true ranking of physical activity, and allowing to examine associations between physical activity levels and health variables during pregnancy[9,10,15]. The use of both objective and subjective measures of physical activity should be used simultaneously in future studies in order to adequate capture physical activity during pregnancy.

This study present several limitations, such as the exclusion of high risk pregnant women and the recruitment only of pregnant women who meet eligibility criteria and voluntarily participated. The percentages of young women, overweight/obese and third trimester women were considerably lower than their counterparts so it may result in self-selection bias. In contrast parity, educational level and occupational status groups had a similar percentage. The cross-sectional design of our study precludes the identification of any casual relations. Longitudinal studies are needed to examine the sensitivity to change of this questionnaire after interventions. The know limitation of nonprobability samples, including their less representativeness and unknown levels of sampling error, are further limitations.

The strengths of this study were the systematic and rigorous process of the transcultural adaptation process, the strict standardization of methodology and the use, for first time, of 24 hours

multi-sensor monitor to validate the PPAQ, which may solve the main limitations of accelerometers and pedometers, used in previous validation studies. Moreover, the use of the same units (METs·h/week) for both methods, allow the direct comparison without needing of establish cutpoints to estimate the intensities or being non-equivalent methods[33]. In addition, the use of specific METs values for pregnant women by PPAQ and the quantification of energy expenditure by Sensewear may appropriately account for the physiological and cardiovascular changes that occur during pregnancy. Other strength of this study is the strict quantification period, although between 3 to 5 days of monitoring are sufficient to estimate habitual physical activity[22], we used a period of at least eight completed days (upper than 95% of the day), eliminating the first and the last day, allowing to minimized the reactivity of wore the Sensewear Armband and to capture an habitual week of lifestyle of pregnant women.

Since self-reported instruments facilitate the study of physical activity patterns on clinical practices, epidemiologic and large population studies, future research should considerer the comparison of the psychometric properties of different questionnaires against multi-sensor devices on pregnant women to know the most adequate self-report measure of physical activity on pregnant women population.

Conclusions

The results obtained in the present study indicated that the PPAQ-S is a brief and easy to interpret questionnaire with a good reliability and ability to rank pregnant women respect to their physical activity, and a poor validity compared against multi-sensor monitor. The availability of validated versions of the original questionnaire into different languages allows the use of this questionnaire in cross-national clinical trials.

We recommend the usefulness of this instrument to discriminate physical activity levels among pregnant women, providing pregnancy-specific activities information in order to predict maternal and fetal health outcomes and to propose health promotion strategies during pregnancy.

What is known about the topic?

PPAQ is a specifically designed questionnaire for pregnant women that overcomes the limitation of questionnaires designed for adults, taking into account household and childcare activities and not only moderate and vigorous sports. PPAQ have not been transculturally adapt into Spanish.

What does this study add to the literature?

This study provides the Spanish version of PPAQ and establishes the first validation of standardized physical activity questionnaire in pregnant women using a multi-sensor monitor, which overcomes the limitations of accelerometers. The Spanish version of PPAQ, which includes specific cultural adaptation, is required to develop research studies among Spanish-speaker pregnant women.

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Table 1. Socioemographic characteristics.

		Total Sample (n=208)	Subsample (n=109)
Variables		Mean (SD)	Mean (SD)
Age, years		32.7 (4.3)	32.0 (4.4)
Prepegnancy BMI, kg/m^2		24.6 (4.1)	23.7 (4.0)
		n (%)	n (%)
Ethnicity			
Caucasian		208 (100%)	109 (100%)
Age			
18-30 years old		48 (23.1%)	36 (33.0%)
31-44 years old		160 (76.9%)	73 (67.0%)
Trimester of gestation			
Second trimester		126 (60.6%)	74 (67.9%)
Third trimester		82 (39.4%)	35 (32.1%)
Prepregnancy BMI*			
<25 kg/m^2		130 (62.5%)	76 (69.7%)
>25 kg/m^2		78 (37.5%)	33 (30.3%)
Marital status			
Single without couple		3 (1.4%)	1 (0.9%)
Single with couple		66 (31.7%)	36 (33.0%)
Married		136 (65.4%)	68 (62.4%)
Divorced or separated		3 (1.4%)	4 (3.7%)
Parity			
0		114 (54.8%)	68 (62.4%)
1		84 (40.4%)	35 (32.1%)
>1		10 (4.8%)	6 (5.5%)
Highest level of education			
Non-Tertiary		109 (52.4%)	64 (58.7%)
Tertiary		99 (47.6%)	45 (41.3%)
Occupational status*			
Workers		101 (48.6%)	51 (46.8%)
Non-workers	Unemployed	53 (25.5%)	32 (29.4%)
	Sick leave from work	50 (24.0%)	26 (23.9%)

*Four student excluded of occupational status on total sample.
Abbreviations. BMI: Body Mass Index,

Table 2. Test-retest reliability of the PPAQ-S scores in pregnant women (n=109).

PPAQ summary scores	Mean (SD) Test 1 (mets·h/week)	Mean (SD) Test 2 (mets·h/week)	Difference mean (SD) (mets·h/week)	Intrapatient SD (mets·h/week)	Intraclass correlation coefficient	95% confidence interval	Standard error of the mean (mets-h/week)	LoA	HT
Summary activity scores									
Total activity (>1.5 METs)	133.2 (61.9)	125.4 (55.3)	-7.8 (34.7)	57.4	0.90	0.86-0.93	19.2	-75.8,60.2	0.252
Moderate to vigorous activity (>3 METs)	40.6 (43.2)	37.5 (43.1)	-3.1 (17.3)	22.9	0.96	0.94-0.97	8.8	-37.0,30.8	0.039
By intensity									
Sedentary activity (<1.5 METs)	23.5 (16.1)	21.4 (15.0)	-2.0 (10.4)	15.0	0.87	0.82-0.91	5.7	-22.4,18.4	0.000
Light activity (1.5-2.9 METs)	84.1 (39.8)	79.9 (34.3)	-4.2 (24.0)	31.3	0.88	0.83-0.92	13.5	-51.2,42.7	0.048
Moderate activity (3-6 METs)	40.5 (43.2)	37.4 (43.1)	-3.1 (17.3)	22.8	0.96	0.94-0.97	8.8	-37.0,30.8	0.039
Vigorous activity (>6 METs)	0.0 (0.2)	0.0 (0.1)	0.0 (0.1)	0.1	0.92	0.88-0.95	0.0	-0.2,0.1	0.005
By type									
Household/Caregiving	79.3 (52.6)	72.6 (44.6)	-6.8 (28.9)	50.0	0.90	0.86-0.93	16.3	-63.5,49.9	0.003
Occupational	28.1 (41.2)	27.7 (42.5)	-0.4 (11.1)	2.8	0.98	0.97-0.99	5.5	-22.2,21.4	0.000
Sports/exercise	8.9 (8.6)	8.8 (9.1)	-0.1 (4.2)	1.0	0.94	0.91-0.96	2.1	-8.3,8.0	0.000
Transportation	11.6 (10.1)	11.5 (9.5)	-0.1 (9.9)	0.7	0.65	0.49-0.76	5.9	-19.5,19.4	0.000
Inactivity	20.2 (15.7)	18.2 (14.6)	-2.0 (10.3)	14.6	0.87	0.81-0.91	5.6	-22.1,18.1	0.000

Abbreviations. SD: Standard Deviation, LoA: Limits of Agreement, HT: Heterocedasticity analysis

Table 3. Comparison of intensity category values between SenseWear Armband and PPAQ-S in pregnant women (n=208).

	Estimated (SWA) (Mets-h/week)	Self-reported (PPAQ-S) (Mets-h/week)	P value between methods	DM (SD) (mets-h/w)	CCC	Pearson	$P_{Pearson}$	LoA	HT
Summary activity scores									
Total activity (>1.5 METs)	101.8 (31.2)	134.1 (62.0)	0.000	32.3 (63.6)	0.133	0.201	0.004	-92.3,156.9	0.000
Moderate to vigorous activity (>3 METs)	36.5 (19.4)	41.6 (43.4)	0.121	5.2 (47.8)	-0.011	-0.015	0.826	-88.6,98.9	0.000
By Intensity									
Sedentary activity (<1.5 METs)	66.1 (12.4)	23.4 (15.6)	0.000	-42.7 (17.6)	0.039	0.224	0.001	-77.3,-8.2	0.002
Light activity (1.5-2.9 METs)	65.3 (18.3)	83.6 (37.1)	0.000	18.3 (39.3)	0.081	0.122	0.079	-58.7,95.3	0.000
Moderate activity (3-6 METs)	36.2 (19.1)	41.6 (43.4)	0.104	5.4 (47.7)	-0.014	-0.019	0.787	-88.2,99.0	0.000
Vigorous activity (>6 METs)	0.2 (0.8)	0.0 (0.1)	0.000	-0.2 (0.8)	0.021	0.082	0.242	-1.9,1.4	0.000

Abbreviations. DM: Difference mean between methods, SD: standard deviation, CCC: Concordance correlation coefficient, Pearson: Pearson correlation coefficient, PPearson: P value for Pearson correlation coefficient.. HT: Heterocedasticity analysis

Table I: Questions Arising in the Process of Direct and Reverse Translation and Raised on the Cognitive Test

Items	Detected Problem	Consensus Term
Item 2 of PPAQ Period	The conceptual equivalence between period and "*periodo*" or "*menstruacion*" was raised	*Periodo*, because of the women preference following the results of the cognitive test and its used among gynaecologist.
Item 26 of PPAQ Jogging	The conceptual equivalence between jogging and "*trotar suavemente*" or "*correr suavemente*" was raised	*Correr*, because of its lower comprehension difficulty following the results of the cognitive test
Item 33 and 34 of PPAQ Carrying	The conceptual equivalence and comprehension difficulty between carrying and "*portar*" or "*sostener*" was raised	*Sostener*, because of the women preference following the results of the cognitive test.

Table II: Examples of the Complete Process of Transcultural Adaptation

Process of Transcultural Adaptation	Item 2 of PPAQ	Item 26 of PPAQ	Item 33 of PPAQ
Original version	What was the first day of your last period?	How much time do you usually spend: Jogging	How much time do you usually spend: Standing or slowly walking at work while carrying things
Direct translation A	¿Cuál fue el primer día de su última menstruación?	Durante este trimestre cuanto tiempo emplea habitualmente: Trotando	Cuanto tiempo suele emplear: De pie o caminando lentamente en el trabajo mientras portas cosas
Equivalence	10	9	8
Difficulty	1	2	2
Direct translation B	¿Cuál fue el primer día de su último periodo?	Durante este trimestre cuanto tiempo emplea habitualmente: Corriendo	Cuanto tiempo suele emplear: De pie o caminando lentamente mente en el trabajo mientras sostienes cosas
Equivalence	9	8	8
Difficulty	1	2	3
First consensus version	¿Cuál fue el primer día de su último periodo?	Durante este trimestre cuanto tiempo emplea habitualmente: Trotando suavemente	Cuanto tiempo suele emplear: De pie o caminando lentamente mente en el trabajo mientras sostienes cosas
Reverse translation	When was the first day of your last period?	During this trimester how much time do you usually spend: Gentle Jogging	How much time do you usually spend: Standing or walking slowly at work while carrying things
Second consensus version	Two options suggested to pregnant women in the cognitive test: *¿Cuál fue el primer día de su último periodo?* *¿Cuál fue el primer día de su última menstruación?*	Two options suggested to pregnant women in the cognitive test: *Durante este trimestre cuanto tiempo emplea habitualmente: Corriendo suavemente* *Durante este trimestre cuanto tiempo emplea habitualmente: Trotando suavemente*	Two options suggested to pregnant women in the cognitive test: *Cuanto tiempo suele emplear: De pie o caminando lentamente mente en el trabajo mientras sostienes cosas* *Cuanto tiempo suele emplear: De pie o caminando lentamente mente en el trabajo mientras portas cosas*
Cognitive Test	Most of pregnant women (8/16) preferred the option "*periodo*" to "*menstruación*", Two pregnant women didn't found differences between both terms. *Periodo:* They recognised the use of this term more usual in their daily life and in their conversation with the gynaecologist. *Menstruación:* They attributed lower use of this term.	Most of pregnant women (14/16) preferred the option "*corriendo suavemente*" to "*trotando suavemente*". *Correr:* They attributed lower comprehension difficulty *Trotar:* They attributed higher comprehension difficulty and some of them did not understand its meaning.	All of the pregnant women preferred the option "*sostienes*" to "*portas*". They believed "*sostienes*" has a higher conceptual equivalence and lower comprehension difficulty than "*portas*". *Sostener:* This term has a lower comprehension difficulty and its use is more common in Spanish. *Portar*: This term has a higher comprehension difficulty.
Final Version	¿Cuál fue el primer día de su último periodo?	Durante este trimestre cuanto tiempo emplea habitualmente: Corriendo suavemente	Cuanto tiempo suele emplear: De pie o caminando lentamente mente en el trabajo mientras sostienes cosas

Table III. Comparison of total activity between SenseWear Armband and Pregnancy Physical Activity Questionnaire in pregnant women by age, BMI, and trimester of gestation, parity, occupational and educational level in pregnant women. (n=208).

	Total activity (Light and above)							Moderate to vigorous activity						
	Estimated (SWA) (min/d)	Self-reported (PPAQ) (min/d)	*P* value between methods	DM (SD) (min/d)	CCC	Pearson	$P_{Pearson}$	Estimated (SWA) (min/d)	Self-reported (PPAQ) (min/d)	*P* value between methods	DM (SD) (min/d)	CCC	Pearson	$P_{Pearson}$
All (N=208)	101.8 (31.2)	134.1 (62.0)	0.000	32.3 (63.6)	0.13	0.20	0.004	36.5 (19.4)	41.6 (43.4)	0.121	5.2 (47.8)	-0.01	-0.02	0.826
Age (y)														
20-30 (n=48)	106.3 (32.5)	126.2 (63.4)	0.034	19.9 (63.1)	0.20	0.26	0.070	40.0 (19.0)	41.8 (49.8)	0.819	1.8 (54.0)	-0.03	-0.04	0.788
31-44 (n=160)	100.4 (30.8)	136.5 (61.6)	0.000	36.1 (63.4)	0.12	0.19	0.016	35.4 (19.4)	41.6 (41.5)	0.091	6.2 (46.0)	-0.01	-0.01	0.927
P value between groups	0.257	0.313						0.147	0.974					
BMI (kg/m^2)														
<25 (n=126)	109.7 (29.9)	130.4 (60.5)	0.000	20.7 (61.9)	0.15	0.20	0.023	40.9 (19.6)	38.2 (39.7)	0.483	-2.7 (44.0)	0.01	0.01	0.875
≥25 (n=82)	88.6 (29.0)	140.3 (64.4)	0.000	51.8 (61.9)	0.15	0.31	0.006	29.2 (16.8)	47.5 (48.7)	0.002	18.3 (51.2)	0.01	0.02	0.864
P value between groups	0.000	0.262						0.000	0.134					
Trimester														
Second (n=130)	106.0 (32.2)	149.9 (62.2)	0.000	41.0 (62.6)	0.15	0.25	0.006	38.7 (19.4)	48.6 (47.5)	0.033	9.8 (51.1)	0.01	0.02	0.863
Third (n=78)	95.3 (28.6)	114.4 (56.7)	0.007	19.1 (63.2)	0.01	0.01	0.896	33.0 (18.9)	31.0 (33.8)	0.668	-2.0 (41.7)	-0.16	-0.18	0.100
P value between groups	0.016	0.000						0.036	0.004					
Parity														
0 (n=114)	97.3 (30.1)	117.8 (52.0)	0.000	20.5 (51.9)	0.23	0.29	0.002	36.6 (19.3)	34.7 (42.9)	0.680	-1.8 (46.7)	0.01	0.02	0.845
>1 (n=94)	107.1 (31.8)	153.9 (67.5)	0.000	46.7 (73.1)	0.03	0.05	0.609	36.4 (19.6)	50.0 (42.7)	0.007	13.6 (48.0)	-0.04	-0.05	0.600
P value between groups	0.024	0.000						0.952	0.011					
Occupational status														
Workers (n=101)	104.4 (29.8)	148.5 (58.6)	0.000	44.1 (55.8)	0.19	0.35	0.000	35.6 (17.6)	56.4 (50.1)	0.000	20.7 (52.1)	0.03	0.05	0.587
Non-workers (n=103)	99.7 (32.8)	118.6 (61.0)	0.005	18.9 (66.4)	0.08	0.10	0.328	37.5 (21.0)	26.3 (28.7)	0.002	-11.2 (36.1)	-0.03	-0.03	0.738
P value between groups	0.423	0.001						0.708	0.000					
Educational level														
Non-tertiary (n=109)	105.8 (32.5)	133.0 (64.8)	0.000	27.2 (66.4)	0.14	0.20	0.037	38.2 (19.5)	42.4 (32.3)	0.339	4.3 (46.4)	0.01	0.01	0.901
Tertiary (n=99)	97.4 (29.3)	135.4 (59.1)	0.000	38.0 (60.1)	0.13	0.21	0.035	34.6 (19.2)	40.8 (44.8)	0.219	6.2 (49.6)	-0.03	-0.05	0.637
P value between groups	0.053	0.782						0.192	0.788					

Abreviations: BMI: Body mass index; DM: Difference mean between methods, SD: standard deviation, CCC: Concordance correlation coefficient, Pearson: Pearson correlation coefficient, PPearson P value for Pearson correlation coefficient.

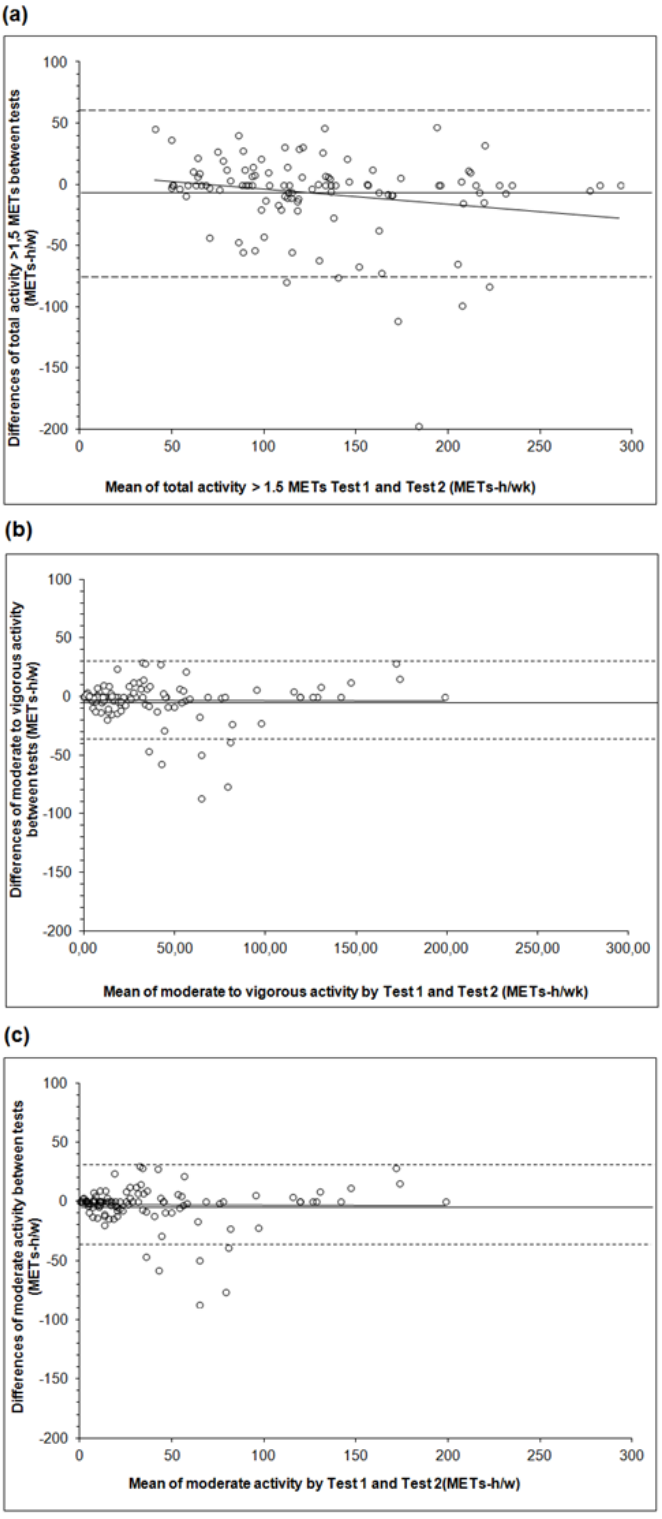


Figure 1. Bland and Altman plots of the differences between test 1 and test 2 for the PPAQ scores: (a) total activity, (b) moderate to vigorous activity, and (c) moderate activity. The means of the differences (solid lines) and limits of agreement (dashed lines) within ± 2 SDs are shown.

Abbreviations:

PPAQ (Pregnancy Physical Activity Questionnaire)

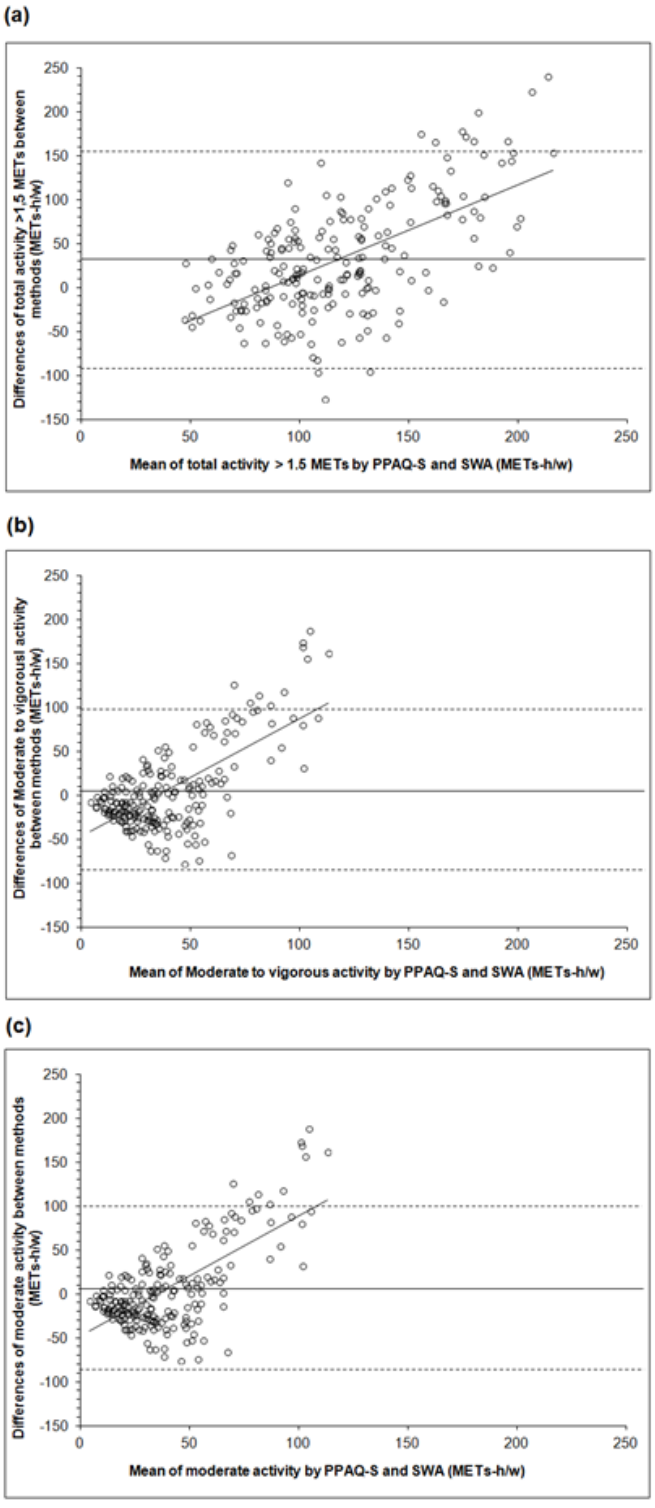
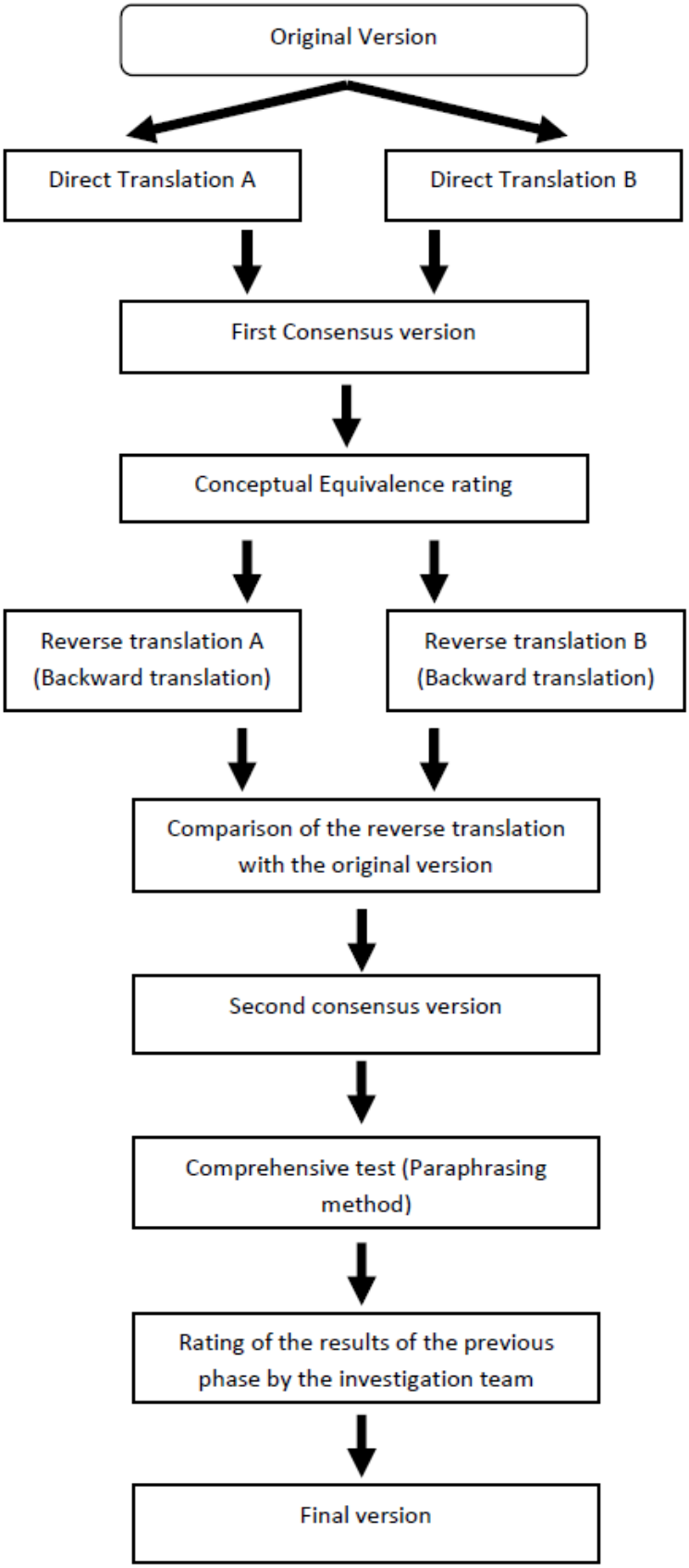


Figure 2. Bland and Altman plots of the differences between PPAQ and SWA for (a) total activity, (b) moderate to vigorous activity, and (c) moderate activity. The means of the differences (solid lines) and limits of agreement (dashed lines) within ± 2 SDs are shown.

Abbreviations:

SWA (Sensewear) and PPAQ (Pregnancy Physical Activity Questionnaire)



Supplementary Figure 1. Stages in the adaptation process of the Pregnancy Physical Activity Questionnaire to Spanish.

III

Apoyos y barreras para la actividad física durante el embarazo y madres con bebes.

Oviedo-Caro MA en La promoción de la actividad física en la sociedad contemporánea. Madrid, España: Díaz de Santos.

In press.

Resumen

El embarazo es un periodo temporal en la vida de la mujer, que lleva asociado cambios anatómicos, fisiológicos, físicos, psicológicos y de rol social, persistiendo algunos hasta las 4 o 6 semanas postparto, afectando a la salud de la mujer.

La actividad física presenta multitud de beneficios para la salud durante el embarazo y el postparto, pese a ello los niveles de actividad física decrecen en estas etapas comparadas con la etapa previa al embarazo.

La identificación de factores psicosociales que afectan a la práctica de actividad física es fundamental para el desarrollo de intervenciones de promoción de la práctica en estas etapas. Siguiendo al modelo ecológico se categorizan en factores intrapersonales, interpersonales y ambientales.

Las principales barreras para la práctica de actividad física durante el embarazo se relacionan con restricciones temporales, afecciones de los cambios fisiológicos, anatómicos y psicológicos del embarazo, falta de información, consejos y apoyos, no poseer hábitos previos de actividad física, condiciones atmosféricas adversas, y dificultad de acceso a entornos facilitadores para la práctica.

En la etapa de postparto las principales barreras para la práctica de actividad física se relacionan con falta de tiempo y aislamiento social debido a la priorización del cuidado del bebé sobre las actividades físicas y sociales, falta de energía, falta de información y apoyos, y falta de programas de actividad física específicos para esta etapa.

Los principales apoyos para la práctica de actividad física durante la etapa de embarazo y postparto son similares: poseer hábitos de actividad física previos al embarazo, poseer información y apoyos, disponer de un horario flexible, y fácil acceso a entornos facilitadores para la práctica de actividad física.

Programas de promoción de la actividad física que superen las barreras y potencien los apoyos para la práctica durante el embarazo y el postparto, predisponen a obtener una buena adherencia y ser eficientes.

Palabras clave: Actividad física, embarazo, postparto, barreras, apoyos.

Introducción

El embarazo es un periodo temporal en la vida de la mujer, que lleva asociado cambios anatómicos, fisiológicos, físicos, psicológicos y de rol social (1). Estos cambios convierten el embarazo en un periodo vulnerable para la aparición de síntomas físicos y psicológicos que afectan a la salud de la embarazada (2) y a la calidad de vida relacionada con la salud percibida (3,4). Algunos de los cambios anatómicos y fisiológicos relacionados con el embarazo persisten hasta las 4 o 6 semanas postparto, siendo esta etapa de riesgo para el desarrollo de obesidad, debido a la retención de peso derivado del embarazo (5). A nivel social y psicológico, el periodo postparto es una etapa de riesgo para el desarrollo de depresión que pueden afectar al funcionamiento familiar (6), debido al cambio en el rol social de la mujer, que supone la priorización en el desarrollo de tareas relacionadas con el cuidado y la alimentación del bebe (7).

La actividad física tiene multitud de beneficios para la salud de la mujer durante el embarazo, como es la prevención de una excesiva ganancia de peso (8), la reducción del riesgo de padecer diabetes mellitus gestacional(9) o preeclampsia (10), la reducción del riesgo de padecer ansiedad o depresión (11), y la percepción de una mejor imagen corporal (12). Beneficios de la actividad física que también son extensibles al feto, incluyendo una disminución de la masa grasa y una mejor tolerancia al estrés (13).

Aunque la actividad física tiene multitud de beneficios para la salud de la mujer, durante el embarazo se produce una disminución de la práctica de actividad física respecto a los niveles pre embarazo (14). Del mismo modo, durante el curso del embarazo los niveles de actividad física descienden conforme avanza la gestación, incrementando el tiempo empleado en conductas sedentarias (15).
El posparto es una etapa donde la mujer no sólo puede retener el peso derivado de la ganancia de peso gestacional, sino que además puede ganar peso adicional. La actividad física ha demostrado ser una estrategia eficiente sobre la retención de peso (16). Además la actividad física en la etapa postparto se relaciona con un bienestar psicosocial, menor incidencia de ansiedad y depresión, menor impacto de la pérdida ósea inducida por la lactancia y menor impacto de la incontinencia urinaria (17).

El establecido descenso de los niveles de actividad física en la vida de la mujer durante la etapa de gestación, puede mantenerse también durante la etapa de postparto (18,19), debido sobre todo a la priorización de las tareas de cuidado del bebé respecto al desarrollo de actividades físicas (7).
Diversos factores influyen en el descenso de la práctica de actividad física durante el embarazo y el postparto. Estudios científicos han establecido la correlación de bajos niveles de actividad física con factores sociodemográficos como edad (20), número de hijos (21,22), tener sobrepeso u obesidad pre-embarazo (23), nivel de ingresos (21,24,25) o nivel educativo (22,24,25). La determinación de dichos factores permite establecer grupos de riesgo para bajos niveles de actividad física durante el embarazo, pero son factores no modificables. Otros factores psicosociales representan características

modificables, las cuales posibilitan el desarrollo de intervenciones en el ámbito de la salud que predispongan a la práctica de actividades físicas (21).

En el abordaje de la influencia de las variables psicosociales en la práctica de actividad física, varios estudios proponen la utilización del modelo ecológico (26,27). Este modelo postula que la actividad física puede estar influenciada por variables psicosociales, las cuales se pueden categorizar en tres constructos: factores intrapersonales, factores interpersonales o sociales, y factores ambientales (28).

El presente capítulo tiene como objetivo identificar las principales barreras para la práctica de actividad física percibidas por las mujeres durante el embarazo y el postparto. Así como, identificar los principales apoyos que las mujeres perciben como facilitadores hacia la práctica de actividad física durante el embarazo y el postparto.

Barreras para la práctica de actividad física en mujeres durante el embarazo.

Siguiendo el modelo ecológico, las barreras para la práctica de actividad física durante el embarazo serán categorizadas en intrapersonales, interpersonales y ambientales.

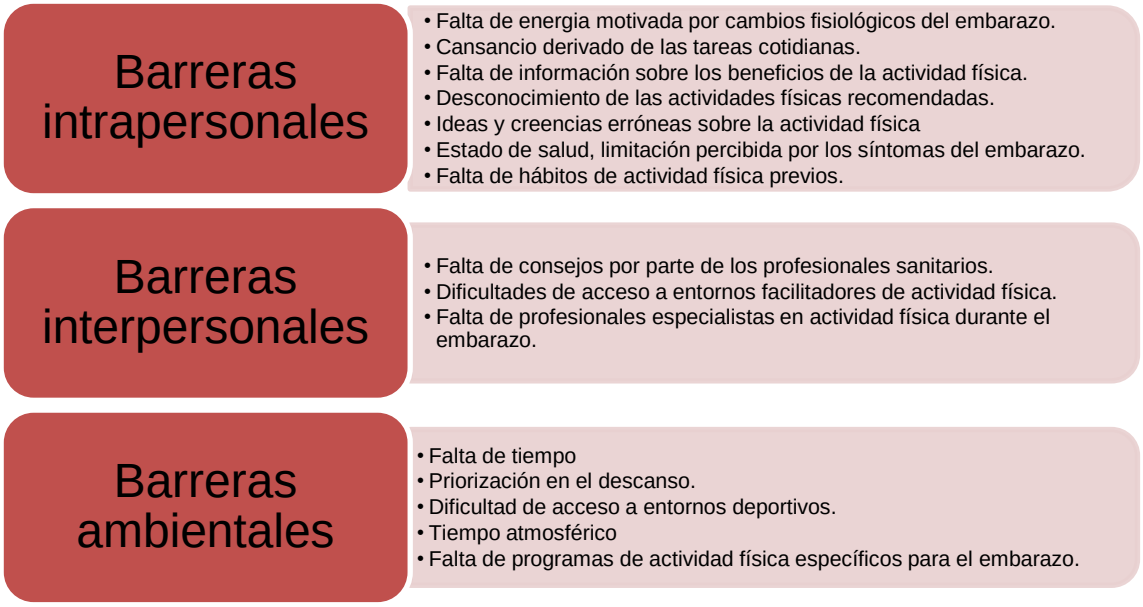


Figura 1. Barreras para la práctica de actividad física durante el embarazo.

Barreras intrapersonales para la práctica de actividad física durante el embarazo.

Entre las barreras intrapersonales para la práctica de actividad física durante el embarazo destaca como factor más reportado en diversos estudios la falta de energía (25,27,29–31). Aspecto que puede ser explicado por los cambios fisiológicos que se producen durante la gestación para garantizar la llegada de nutrientes al feto, los cuales implican un incremento del gasto energético tanto basal como durante las actividades diarias (32).

Relacionado con esta falta de energía, factores como el cansancio derivado del desarrollo de tareas domésticas (33–36), de tareas de cuidados de hijos (27,36) y del trabajo (26,34,35) también han sido identificado como barreras determinantes de bajos niveles de actividad física. Los cambios fisiológicos derivados de la gestación y el consecuente incremento del gasto energético también pueden explicar este mayor esfuerzo percibido en el desarrollo de las tareas de la vida cotidiana.

Estudios previos han identificado como barrera para la práctica de actividad física la percepción de que las actividades diarias y laborales son suficientes para llevar un estilo de vida activo (26,37). Este pensamiento puede estar motivado por el mayor esfuerzo percibido al desarrollar las actividades laborales debido a los cambios fisiológicos previamente comentados.

Varios estudios destacan la falta de conocimiento sobre la influencia de la actividad física en la salud de la embarazada y el feto como una barrera para la práctica de actividad física, centrándose en aspectos como el desconocimiento de la seguridad y los beneficios de la actividad física como factores determinantes (26,27,31). Esta falta de información también se orienta hacia el desconocimiento sobre qué tipo de actividades físicas son recomendables para la realización durante la etapa del embarazo, siendo identificada como barrera para la práctica de actividad “no saber qué actividad física realizar” (27).

Relacionada con la falta de información, las ideas y creencias que la mujer embarazada posee sobre la actividad física tiene gran influencia en la práctica de actividad física desarrollada durante el embarazo. Entre ellas, ideas y creencias erróneas como el temor a un efecto adverso para el feto o el riesgo de parto prematuro han sido identificadas como barreras para la práctica en diversos estudios (26,27,30,37). En las ideas y creencias que la embarazada posee sobre la actividad física tiene gran influencia la cultura, así en zonas rurales y países con culturas con una visión tradicional del embarazo el temor a lesionarse ha sido identificada como una barrera hacia la práctica, motivada por el pensamiento erróneo de que la mujer embarazada es una persona frágil (37,38).

El estado de salud ha sido identificado como factor determinante para la práctica de actividad física durante el embarazo (30,39). La prevalencia de síntomas relacionados con el embarazo, pueden ser percibidos por la embarazada como una limitación en su estado de salud y por consiguiente como una barrera para la práctica de actividad física (24). Síntomas como nauseas (26,37,40), dolor pélvico y de espalda (26,27), dolor muscular (41), síntomas psicológicos (42,43), y dificultad respiratoria o falta de aliento (27) se identifican como barreras percibidas por las mujeres embarazadas. La percepción como barrera para la práctica del síntoma de dificultad respiratoria o falta de aliento es mucho más acusado en mujeres con sobrepeso, obesidad o una excesiva ganancia de peso (31), derivado del aumento de la masa corporal.

Los hábitos de actividad física y el estilo de vida previo al embarazo es un factor determinante en la práctica de actividad física durante el embarazo. No poseer hábitos de actividad física previos al embarazo es interpretado como una barrera para la práctica de actividad física (30,37). Esta falta de hábitos de actividad física previos al embarazo se traduce en una falta de información sobre los beneficios de la actividad física en la salud, una menor condición cardiorrespiratoria y una menor tolerancia al esfuerzo físico, factores influyentes en la predisposición de la embarazada para modificar sus hábitos de vida y en la percepción de bienestar en la realización de actividad física.

La falta de divertimento o disfrute en la práctica de actividad física ha sido identificado como una barrera hacia la práctica de actividad física (27). Del mismo modo otro factor identificado como barrera es la falta de motivación hacia la práctica de actividades físicas (26,27,30,31,37,38,44). En este sentido, Marshall et al. (2013) establecieron que esta falta de motivación hacia la práctica de actividad física puede ser un indicador de debilidad personal, baja autoestima o baja autoeficacia, más que una falta de motivación intrínseca, aspecto aún más acusado en embarazadas con sobrepeso u obesidad (45).

Barreras interpersonales para la práctica de actividad física durante el embarazo.

La falta de consejos por parte de los profesionales sanitarios ha sido identificada como barrera hacia la práctica de actividad física (27,30). En este sentido, además de la falta de información recibida por los profesionales sanitarios, Connelly et al. (2015) identificaron como barrera el consejo de restringir la actividad física por parte de doctores sin haber complicaciones en el embarazo. Estudios previos muestran como los profesionales sanitarios son una vía ideal para aportar información sobre estilo de vida saludable, siendo la cave para incrementar el conocimiento de las mujeres embarazadas sobre los beneficios de un estilo de vida saludable y los hábitos de vida activo durante el embarazo (46).

Otro aspecto interpersonal percibido como barrera para la práctica de actividad física durante el embarazo es la falta de apoyo emocional, que ha sido ampliamente identificada como un factor determinante de bajos niveles de actividad física (27,30,31). Dicha falta de apoyo emocional puede producirse por diferentes vías, como la falta de apoyo por parte de familiares (27) o por parte de amigos de amigos (30). En este sentido el apoyo recibido por amigos o familiares no sólo se dirige al consejo y aliento para la realización de actividades físicas, sino también a la falta de recomendaciones derivadas de una falta de información por parte de familiares o amigos y la posesión de creencias e ideas erróneas sobre la actividad física (31).

Barreras ambientales para la práctica de actividad física durante el embarazo.

Entre las barreras ambientales destaca como factor más reportado en diversos estudios la falta de tiempo. Esta falta de tiempo puede ser determinada principalmente por diversos factores como las labores domésticas (27,35,47), el cuidado de hijos(27,30,35,37,40,48), o el trabajo

(27,30,35,37,40,48,49). Otro factor determinante de la falta de tiempo, reportado en el estudio de Evenson et al. (2009), es la falta de tiempo por el elevado tiempo de sueño. Este factor expresa la idea de algunas mujeres embarazadas de que el tiempo empleado en dormir tiene más importancia que el tiempo empleado en la actividad física, aspecto que puede derivarse de una creencia errónea sobre los hábitos de sueño durante el embarazo y el desconocimiento sobre los beneficios que sobre la calidad del sueño posee el desarrollo de las actividades físicas, como indican multitud de estudios en población adulta y en mujeres embarazadas (50).

Otra barrera ambiental hacia la práctica de actividad física es la dificultad de acceso a entornos deportivos, tales como escasez o lejanía de instalaciones donde practicar actividad física (27,30,31). Estas dificultades se ven aumentadas en áreas con menores recursos, como áreas rurales o países en vías de desarrollo (51,52).

El tiempo atmosférico también ha sido reportado como una barrera para la práctica de actividad física por varios estudios (27,30,31). La influencia del tiempo atmosférico viene determinada por la limitación sobre la actividad física realizada al aire libre, tanto referente a las horas del día como el número de días al año con temperaturas agradables para el desarrollo de actividades al aire libre.

Apoyos para la práctica de actividad física en mujeres durante el embarazo.

Siguiendo el modelo ecológico, los apoyos para la práctica de actividad física durante el embarazo serán categorizadas en intrapersonales, interpersonales y ambientales.

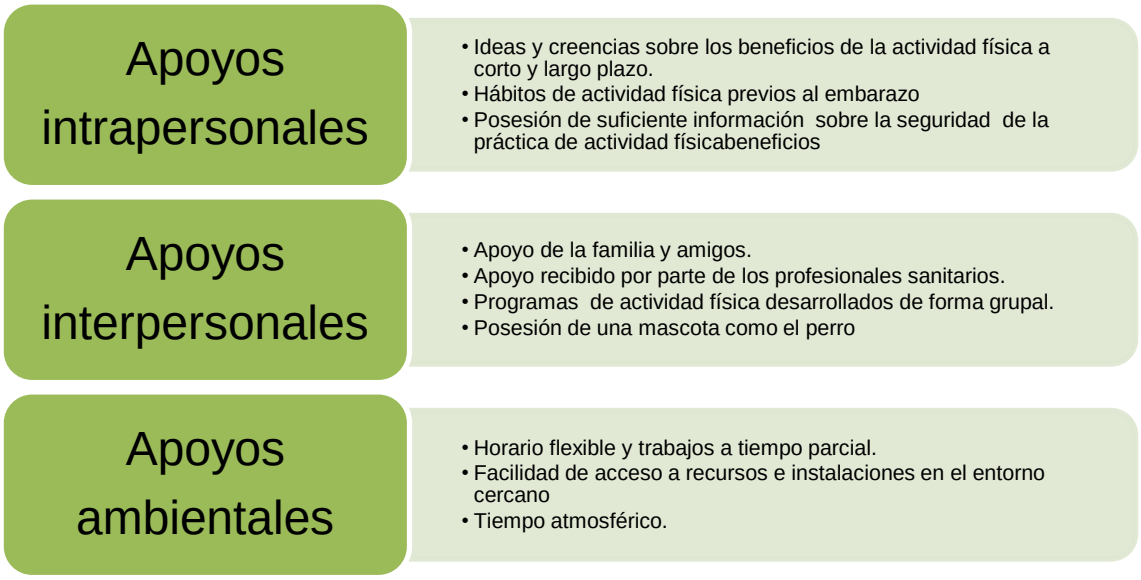


Figura 2. Apoyos para la práctica de actividad física durante el embarazo

Apoyos intrapersonales para la práctica de actividad física durante el embarazo.

Entre los factores intrapersonales, las ideas y creencias que la mujer embarazada tiene sobre la actividad física es un determinante fundamental para la práctica de actividad física durante el

embarazo. Entre estas creencias, los beneficios para el bienestar emocional (30,53), la reducción de la prevalencia de síntomas depresivos (31) y los beneficios sobre el control del peso (30,54) han sido establecidos como apoyos para la práctica de actividad física reportados por las mujeres embarazadas. En este sentido, Márquez et al. (2009) diferencian entre beneficios a corto plazo, como bienestar emocional tras la realización de la actividad física, y beneficios a largo plazo, como mejoras en el estado de salud materno y fetal.

Relacionado con las ideas y creencias, otro factor reportado como apoyo para la práctica de actividad física son los hábitos de actividad física y el estilo de vida previos al embarazo. Ser una mujer físicamente activa previamente al embarazo es identificado como un determinante favorable para la práctica de actividad física (40,45,55), ya que por un lado incrementa la información que la embarazada posee sobre los beneficios de la actividad física y el bienestar emocional y físico producido por ésta, y al mismo tiempo existe la motivación intrínseca de seguir manteniendo los hábitos de vida activos desarrollados previamente al embarazo. Relacionado con la posesión de hábitos previos de actividad física, la percepción de autoeficacia en la realización de actividad física ha sido identificado como una poyo para la práctica (56).

Un apoyo hacia la práctica de actividad física reportado por las mujeres embarazadas es la posesión de suficiente información sobre la seguridad de la práctica de actividad física durante el embarazo. También la información que posee la mujer embarazada sobre los beneficios que la actividad física aporta a la salud de la embaraza, el adecuado crecimiento del feto y la adecuada evolución del embarazo ha sido identificada como un importante apoyo para la práctica de actividad física (31). Dicha información va a construir el conocimiento que la embarazada posee sobre la actividad física, contribuyendo a que el desarrollo de las ideas y creencias se alejen de mitos y se centren en información derivada de estudios científicos.

Apoyos interpersonales para la práctica de actividad física durante el embarazo.

Entre los factores interpersonales identificados como apoyos para la práctica deportiva, el factor más reportado es el apoyo de la familia (31,55,57) y amigos (18,55). Dentro del apoyo de la familia presenta gran relevancia el apoyo recibido por parte de la pareja (40). El entorno cercano de la mujer embarazada tiene una gran influencia en la vida diaria de la embarazada, explicado por el hecho de que el embarazo supone un periodo vulnerable para el estado psicológico del embarazo debido a los cambios en el estatus social relacionado con el rol de género.

El apoyo recibido por parte de los profesionales sanitarios responsables del seguimiento al embarazo es un factor determinante, ya que además de promocionar la práctica de actividad física alentando a la mujer embarazada a crear rutinas de actividad física, posee un papel clave para que la embarazada posea la suficiente información, aspecto anteriormente comentado como uno de los apoyos

intrapersonales con más incidencia. Los profesionales sanitarios son el referente para la embarazada en cuanto al control de la evolución del embarazo, aportando información basada en estudios científicos lo que supone un pilar básico para que la embarazada posea la suficiente información y se destierren falsos mitos derivados de experiencias personales y/o tradiciones.

Otro factor identificado como un apoyo para la actividad física por parte de las mujeres embarazadas es la disponibilidad de programas de ejercicio desarrollados de forma grupal (35,40). El enfoque grupal para la práctica de actividad física, permite establecer vínculos afectivos entre las mujeres participantes, facilitando el incremento de la adherencia a dichos programas y aumentando el interés por la práctica.

Un aspecto interesante aportado en el estudio de Leppanen et al. (2014), es la posesión de una mascota como el perro, como un apoyo para la práctica de actividad física. No debe sorprender este aspecto, ya que influye positivamente en la creación de rutinas y un elemento extrínseco que crea una necesidad de realizar una actividad física como caminar o marchar mientras se pasea al perro.

Apoyos ambientales para la práctica de actividad física durante el embarazo.

Respecto al ámbito ambiental, un horario flexible (31) y trabajos a tiempo parcial (40), han sido identificados como factores facilitadores para la práctica de actividades físicas durante el embarazo. Dichos factores están en relación con la superación de una de las principales barreras percibidas por las mujeres embarazadas como es la falta de tiempo disponible para el desarrollo de actividades físicas.

Otro aspecto importante es la disposición de recursos e instalaciones para la práctica de actividad física, tales como centros deportivos, parques o instalaciones deportivas en el entorno cercano de la mujer embarazada. La facilidad de acceso a recursos e instalaciones ha sido establecido como un factor facilitador de la práctica de actividad física durante el embarazo (31,55).

Relacionado con la disposición de instalaciones, un factor ambiental importante reportado por las mujeres embarazadas es el tiempo atmosférico (31,40), el cual permite que con temperaturas agradables aumente la predisposición de la mujer embarazada por realizar actividades físicas al aire libre. En este sentido la disposición de un entorno que posibilite a la mujer embarazada la realización de actividades físicas al aire libre, o en caso contrario, instalaciones climatizadas que permitan superar esa barrera ambiental, son factores fundamentales que predispondrán a la mujer embarazada para la práctica de actividad física.

Barreras para la práctica de actividad física durante en mujeres con bebes durante el postparto.

Siguiendo el modelo ecológico, las barreras para la práctica de actividad física durante el postparto serán categorizadas en intrapersonales, interpersonales y ambientales.

Figura 3. Barreras para la práctica de actividad física durante el postparto.

Barreras intrapersonales para la práctica de actividad física durante el postparto.

En el ámbito intrapersonal, la barrera más reporta es la falta de energía o cansancio (58–60). Esta falta de energía puede explicarse por los cambios fisiológicos y hormonales que se producen en el organismo de la mujer de cara a garantizar la correcta alimentación del bebe a través de la lactancia (32). Otro aspecto importante en la percepción de falta de energía o cansancio por las mujeres durante el postparto es la alteración del sueño, la cual viene alterada por la lactancia y el cuidado del bebe en las horas nocturnas (61).

La falta de motivación hacía la práctica de actividad física ha sido reportada como barrera, siendo determinada principalmente por la priorización en el cuidado del bebe que establecen las embarazadas y un descenso en la atención en ellas mismas (58). Esta alta prioridad establecida para el cuidado del bebé conlleva que la actividad física tenga una baja prioridad en las actividades diarias durante el postparto. Unida a esta falta de motivación hacia el ejercicio puede encontrarse un pensamiento de baja eficacia hacia la realización de actividad física (62), debido al mantenimiento de los cambios anatómicos, fisiológicos y hormonales del embarazo en los primeros meses postparto y la retención de peso derivado del embarazo.

Barreras interpersonales para la práctica de actividad física durante el postparto.

Entre las barreras interpersonales, la falta de información recibida por los profesionales sanitarios es una de las barreras para la práctica de actividad física reportada por las mujeres durante el postparto (19,45,58,63).

Relacionado con la priorización en las actividades de cuidado y alimentación del bebe, muchas mujeres perciben un aislamiento social en la etapa postparto (58), debido a la imposibilidad de mantener ciertas actividades sociales por los requerimientos de la lactancia y el cuidado del bebe.

En este sentido la falta de apoyo emocional por parte de pareja, familiares y amigos es identificada como una barrera para la práctica de actividad física durante el postparto (58,60).

Barreras ambientales para la práctica de actividad física durante el postparto.

La barrera ambiental más reportada es la falta de tiempo (33,58,60,64,65).Esta falta de tiempo en los primeros meses del postparto está derivada principalmente por las actividades relacionadas con el cuidado del bebé, percibiendo las embarazadas que siempre tienen al bebe junto a ellas (58). Entre estas actividades de cuidado de bebe, la actividad que supone una mayor barrera es la lactancia, ya que conlleva una gran dependencia materna y una prioridad en el establecimiento del cronograma diario de la embarazada.

Las dificultades de acceso a instalaciones para la práctica de actividad física es la principal barrera ambiental reportada por las mujeres durante el postparto (58,60). Entre estas dificultades encontramos la cercanía de instalaciones urbanas (parques, etc.) o deportivas donde poder realizar actividad física, facilidades de transporte para el desplazamiento hacia las instalaciones, así como precios asequibles para el uso de estas instalaciones. Esta falta de instalaciones es más acusada en entornos donde el tiempo atmosférico es percibido como una barrera para la práctica de actividad física (58,60).

Otra barrera ambiental reportada es la falta de programas de actividad física adaptados a las características de las mujeres en la etapa postparto (58) así como la falta de instructores con conocimientos específicos (52), la cual requiere de programas de actividad física con unas connotaciones específicas que se adapten a las necesidades de las mujeres durante esta etapa de postparto.

Apoyos para la práctica de actividad física durante en mujeres con bebes durante el postparto.

Siguiendo el modelo ecológico, los apoyos para la práctica de actividad física durante el postparto serán categorizadas en intrapersonales, interpersonales y ambientales.

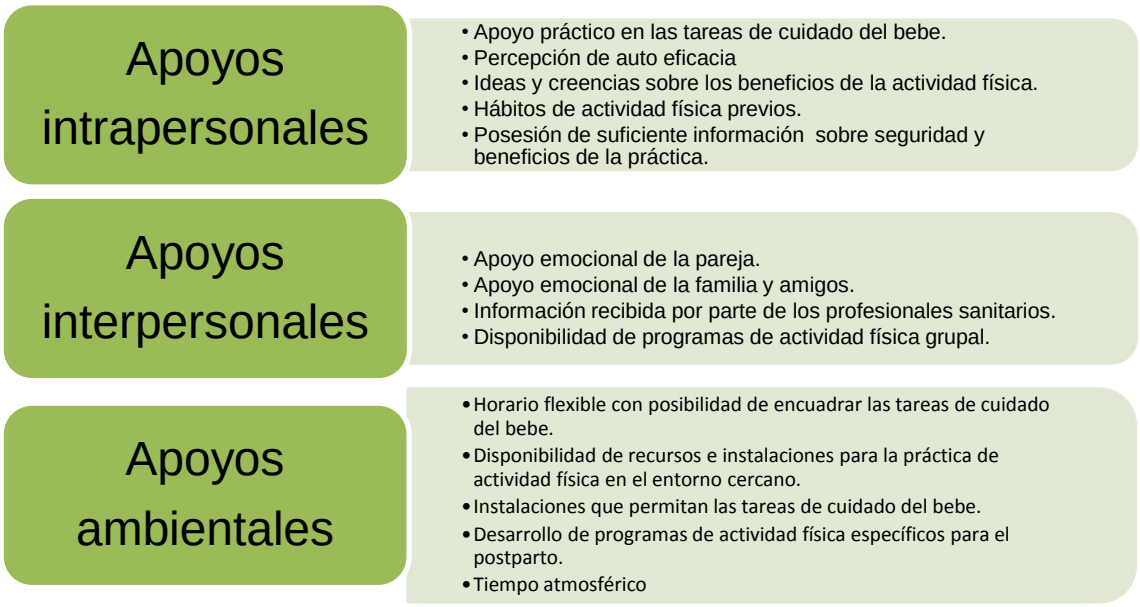


Figura 4. Apoyos para la práctica de actividad física durante el postparto.

Apoyos intrapersonales para la práctica de actividad física durante el postparto.

El apoyo práctico recibido, determinado por la ayuda en el desarrollo de las tareas de cuidado del bebe, es un determinante fundamental para la práctica de actividad física en la etapa postparto (58,66). En este sentido este apoyo práctico es indispensable para poder superar una de las principales barreras reportadas por las mujeres en la etapa postparto como era la falta de tiempo.

Relacionado con este apoyo práctico, la posibilidad de encuadrar la actividad física dentro de la rutina diaria de le mujer, en concreto con las actividades de cuidados y alimentación del bebe, es reportada como un factor determinante para la práctica de actividad física (58).

Las ideas, creencias sobre la actividad física y los hábitos de actividad física previos son identificados como apoyos para la práctica de actividad física por las mujeres en la etapa postparto (58,60)

La percepción de auto eficacia es un apoyo intrapersonal para la práctica de actividad física que comienza a aparecer una vez transcurridos los primeros meses tras el parto (60), cuando los cambios anatómicos, fisiológicos y hormonales relativos al embarazo han remitido.

Otro aspecto reportado como un apoyo hacia la práctica de actividad física es un bebe más activo (60). En este sentido el inicio del movimiento del bebé y comienzo del gateo o caminar por parte del bebe es reportado por la mujeres como un apoyo hacia la práctica de actividad física en la etapa postparto, relacionado también con los cambios en los horarios de la lactancia.

Apoyos interpersonales para la práctica de actividad física durante el postparto.

El factor más reportado como apoyo interpersonal para la práctica de actividad física es el apoyo de la pareja (7,33,58–60,62,67). La pareja presenta un rol fundamental en el desarrollo de las tareas

domésticas y del cuidado del bebe, y al mismo tiempo para alentar hacia la práctica de actividad física a la mujer en la etapa postparto. En este sentido parejas físicamente activas y el desarrollo de actividades físicas con la pareja han sido reportados como apoyos para la práctica (58).

El apoyo social también es reportado como determinante para la práctica de actividad física (59,62,66,67). Dicho apoyo puede ser determinado por las recomendaciones para la práctica y también por el desarrollo de actividades grupales de actividad física. En este sentido amigas con hijos de la misma edad facilita el desarrollo de actividades físicas grupales en la etapa postparto, incrementando la adherencia a la misma (58).

La información recibida por parte de los profesionales sanitarios sobre los beneficios de la práctica de actividad física durante la etapa postparto también es un factor determinante reportado por las mujeres (60). Las clases de educación postnatal es un medio fundamental donde transmitir la información relativa a los beneficios de un estilo de vida activo durante postparto.

Apoyos ambientales para la práctica de actividad física durante el postparto.
Entornos con disponibilidad de recursos e instalaciones para la práctica de actividad física, y que permitan un fácil y económico acceso es un elemento fundamental para favorecer la práctica de actividad física en la etapa postparto, aspecto más importante en entornos con tiempo atmosférico adverso (19,63). Además un aspecto importante que destacan las mujeres durante el posparto son instalaciones que permitan desarrollar las actividades de cuidado del bebe (60).

El desarrollo de programas de actividad física dirigidos específicamente a mujeres en la etapa postparto ha sido reportado como un apoyo para la práctica de actividad (58), que puede ser determinante de cara a aumentar la promoción de la actividad física en esta etapa. Actividades físicas desarrolladas de forma grupal es un apoyo ampliamente valorado por las mujeres en la etapa postparto (59,62,67), aspecto que se relaciona con la percepción de autoeficiencia y el apoyo social recibido mediante estas clases grupales.

Consideraciones prácticas
Los beneficios de la actividad física y el estilo de vida activo sobre la salud materna, fetal, el factor protector que posee sobre la evolución del embarazo y el factor protector frente a la retención de peso postparto, establecen la necesidad de la promoción de hábitos de actividad física y de hábitos de vida activo en las mujeres durante el embarazo y el postparto.

A la hora de desarrollar la promoción de la actividad física, se debe tener en cuenta un enfoque multidimensional y multidisciplinar, en el cual se establezcan los medios necesarios para facilitar la superación de aquellos factores identificados por las mujeres como barreras hacia la práctica de actividad física, y al mismo tiempo se potencien aquellos factores identificados como apoyos para la

práctica de actividad física de cara a crear la máxima predisposición para la práctica de actividad física durante el embarazo y el postparto.

Programas para la promoción de un estilo de vida activo en el cual la práctica de actividad física sea habitual durante el embarazo y el postparto deben partir de una adecuada transmisión de información sobre los beneficios y la seguridad de la actividad física, que permita a las mujeres poseer información con base científica y destierren falsos mitos basados en experiencias personales o tradiciones. Aunque en la transmisión de la esta información se debe proceder mediante un enfoque multidisciplinar, el papel de los profesionales sanitarios en la transmisión de información y la resolución de dudas o cuestiones personales concretas de cada embarazada es clave para garantizar una información accesible y de calidad, como sugieren estudios científicos al respecto (46).

La inclusión de la pareja y familiares cercanos en las clases sobre el embarazo el postparto desarrolladas en los centros de salud, garantiza que dichos familiares cercanos, identificados como un apoyo fundamental para la práctica de actividades físicas, dispongan de la información necesaria para aconsejar y alentar a las mujeres a la realización de actividades físicas (40). La utilización de nuevas tecnologías en la transmisión de información es un aspecto a tener en cuenta dado que el embarazo es una etapa en la vida de la mujer en la que posee un deseo de aprendizaje (68). El uso de herramientas de mhealth es un apoyo a la transmisión de información realizada por los profesionales sanitarios en consulta (68), superando el conocido tiempo limitado que se posee en las consultas (38).

Un entorno social y físico que predisponga a la práctica de actividades físicas, es clave para garantizar que las mujeres en el embarazo y la etapa postparto puedan tener facilidades de acceso a la práctica de actividad física. Del mismo modo la disponibilidad de instalaciones tanto climatizadas (centros deportivos), como al aire libre (parques o pistas deportivas) en el entorno urbano o incluidas en los propios centros sanitarios favorecen el desarrollo de actividades en estas etapas de la vida de la mujer.

Programas de actividad física planificados y dirigidos por profesionales especialistas en actividad física desarrollados de forma específica para mujeres embarazadas o en la etapa postparto son fundamentales para promover la práctica de actividades físicas en estas etapas superando las barreras de falta de información o percepción de inseguridad que puedan poseer algunas embarazadas (41). Así mismo la incorporación en estos programas de actividades grupales es un elemento identificado como facilitador para la práctica de actividad física en estas etapas.

Acciones para superar la falta de tiempo, que es reportada como una de las principales barreras para la práctica de actividad física, son necesarias. En este sentido, para facilitar la superación de la falta de tiempo por motivos laborales, estrategias como la inclusión de programas de ejercicio o el desarrollo de actividades físicas dentro del propio horario laboral y en la instalación de la propia empresa han mostrado muy buenos resultados de cara a potenciar la realización de actividades físicas por los

empleados (69,70). La falta de tiempo debido al cuidado de hijos, puede ser facilitada con el desarrollo de programas de actividad física en casa (71) y el establecimiento de actividades complementarias en los centros deportivos, sanitarios o sociales, tales como escuelas infantiles donde se lleven a cabo actividades dirigidas por profesionales de educación infantil coincidiendo con el horario en que las madres practican sus actividades físicas en el mismo centro. En este sentido instalaciones deportivas que dispongan de espacios habilitados para que las madres puedan desarrollar las actividades de cuidado infantil, como la lactancia, es un aspecto facilitador para la práctica de actividad física.

La identificación de las barreras y apoyos para la práctica de actividad física durante el embarazo y el postparto deben guiar la promoción y el establecimiento de programas de actividad física en estas etapas de cara a asegurar las facilidades de acceso y se garanticen los beneficios para salud que la actividad física posee.

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IV

Measuring sedentary behavior during pregnancy: comparison between self-reported and objective measures.

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Matern Child Health J.

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Abstract:

Objectives: To quantify and compare the sedentary time estimated by the Sedentary Behavior Questionnaire (SBQ) and the sedentary time objectively measured by a multi-sensor monitor (SWA) in pregnant women.

Methods: One hundred eighty-six participants answered the SBQ and wore the SWA at least 7 valid days. The concordance, correlation, agreement and relative activity levels between both measures of sedentary time were examined. Differences of sedentary time between weekday and weekend and between groups stratified by sociodemographic and clinical characteristic were evaluated by one-way analysis of variance. *Results*: Pregnant women were sedentary the 64% of their waking hours. Television viewing is the most prevalent sedentary behavior. The concordance, correlation, and agreement between SBQ and SWA were weak, yet a significant correlation in weekday and average day sedentary time (r = 0.23 and 0.20, *P* = 0.001 and 0.008, respectively) was observed. A significant linear trend was found for increasing sedentary time between both methods using a relative activity levels analysis. *Conclusions*: Pregnant women experience high amount of sedentary time, for approximately half of the day. The SBQ shows a low validity and agreement, but strong ability to rank individuals compared with SWA in pregnant women.

Keywords: sedentary behavior, pregnancy, activity monitor, self-report.

Significance: This study is the first to quantify and compare the sedentary time estimated by a specific multiple-domain questionnaire and objectively measured by a multi-sensor monitor in pregnant women. The SBQ shows a strong ability to rank individuals in respect to their sedentary activities. The combined use of SBQ and multi- sensor monitor may be appropriate to capture all aspect of sedentary behavior. The quantification of sedentary behaviors allows the exploration of associations between sedentary activities and maternal and fetal health outcomes and the assessment of the effectiveness of intervention strategies promoting health benefits for pregnant women.

Introduction:

Sedentary behavior can be defined as any waking behavior characterized by an energy expenditure of ≤ 1.5 metabolic equivalents (METs) while in a sitting or reclining posture[1]. A sedentary lifestyle has been described as a major public health problem of the 21st century[2]. Several longitudinal studies have shown the negative health consequences of a sedentary lifestyle[3–5] independent of a lack of physical activity[6].

An increase in sedentary behavior during pregnancy has been associated with adverse perinatal health outcomes including lower birth weight[7], abnormal glucose tolerance[8], increased risk for gestational diabetes mellitus[8, 9], decreased insulin sensitivity and increased insulin secretion[10], and excessive gestational weight gain[11]. Important strategies to manage healthy weight gain during pregnancy and reduce the prevalence of chronic disease include engaging in regular physical activity and reducing excessive sedentary time[12].

It is in the interest of public health to have an objective and self-reported diagnosis of sedentary time because such a diagnosis helps to characterize the patterns of sedentary behavior for developing intervention studies aimed at improving maternal and fetal outcomes. Only one study with a modest sample size (n = 48) has objectively measured sedentary behavior during waking hours in pregnant women using multi-sensor monitors, which allow for a direct estimation of sedentary behavior according to METs for multiple and consecutive 24-hour periods[13]. Other studies have used accelerometers as an objective indirect estimation of sedentary behavior based on the absence of whole-body movement periods during waking hours[14, 15]. However, considering sedentary behavior as the absence of whole-body movement instead of METs may limit the ability to discern between sedentary behavior and inactivity[16]. Some studies have used single-item sitting time questions or physical activity questionnaires[7, 8] as self-report measures to quantify sedentary behavior during pregnancy. However, measuring sedentary behavior as the absence of physical activity is inappropriate[17], because sedentary behavior is a unique set of behaviors, with a range of potentially unique health consequences, as they influence obesity and other metabolic precursors of chronic diseases[18]. Currently, no standardized questionnaires that have been validated in pregnant women exist for the analysis of sedentary behavior. Validated self-report measurements of specific

multiple-domains sedentary behaviors, such as the Sedentary Behavior Questionnaire (SBQ)[19], can provide useful information to identify high-risk sedentary behavior in large-scale studies of pregnant women**.**

Therefore, we aimed to quantify and compare the sedentary time estimated by the SBQ and the sedentary time objectively measured by a multi-sensor monitor in a relatively large sample of pregnant women, stratified by age, body mass index (BMI), trimester of gestation, parity, occupational status, and educational level. We also compared the sedentary time among the aforementioned groups.

Methods:

At their first prenatal care visit from eleven health clinics in the Sanitary Area of Seville (Spain), eligible participants (n = 273) received detailed information about the study aims and protocol and voluntarily gave their written informed consent prior to enrolling in the study. The exclusion criteria included physical illnesses or disabilities that affect normal daily routine and high risk pregnancy (i.e. diabetes or hypertension). Healthy singleton pregnant women aged 18-45 years old were included in the study sample (n = 203). Seventeen participants were excluded due to incomplete protocol. The study protocol obtained ethical approval from the Medical Research Ethics Committee of the University Hospital Virgen del Rocio (Seville, Spain) and were performed during two face-to-face sessions, separately by an interval of 8 days.

At the first session, sociodemographic characteristics (age, marital status, educational level and occupational status), clinical characteristics (pre-pregnancy BMI, trimester of gestation and parity), and anthropometric measurements were recorded (Seca 780, Hamburg, Germany), and BMI was calculated using standard procedures[20]. In this session, a multi-sensor monitor was placed on the left arm of each participant who was asked not to change their habitual lifestyle.

A multi-sensor monitor, Sensewear Mini Armband (BodyMedia Inc., Pittsburgh, PA, USA) (SWA), validated in pregnant women[21], was used to objectively assess sedentary behaviors that involved levels of energy expenditure of ≤ 1.5 METs during waking hours. Monitor includes sensors to measure energy expenditure by monitoring the heat flow from the body, skin temperature, galvanic skin responses and 3-axis accelerometer for motion detection. The multi-sensor monitor was worn 8 completed days, including five weekdays and two weekend days, except during water-based activities

like swimming or bathing. To be considered a completed day, the multi-sensor monitor was required to be carried for at least 95% of the entire day (1.368 minutes or longer). To avoid any kind of immediate reactivity that may altered their habitual lifestyle, we removed from the analysis the first day of monitoring.

At the second session, the multi-sensor monitor was removed and the Spanish version of the SBQ[22] was administered. The SBQ was designed to assess the amount of time spent engaging in 11 behaviors (specified in Table 1). Time reported in each behavior were converted into hours and were summed separately for weekdays and weekend days, and weekly estimates were calculated summing weekday hours multiplied by 5 and weekend hours multiplied by 2. The SBQ shown acceptable measurement properties in overweight adults[19] and Spanish patients with fibromyalgia[22].

We calculated estimated means for the objective and subjective measures in weekday, weekend, and average day sedentary time across sociodemographic and clinical variables: age, BMI, trimester of gestation, parity, occupational status and educational level. Differences among the above mentioned groups were analyzed by a one-way analysis of variance. Differences in sedentary time levels on weekdays versus the weekend were estimated with a one-way analysis of variance for repeated measures. Systematic differences between both measures of sedentary time were calculated using paired t-tests. Concordance between both measures was examined using concordance correlation coefficients[23]. Pearson correlation coefficients were used as additional information to form comparisons with previous validity studies of sedentary behavior questionnaires. The agreement between both measures of sedentary time was assessed using Bland-Altmant plots,[24] including the 95% levels of agreement. The association between the difference and the magnitude of the measurement was examined using regression analysis. We tested the significance of the differences between methods against zero using a one-sample t-test. To assess relative activity levels, we used the Jonckheere-Terpstra test to evaluate whether the tertile groups of SBQ total sedentary time ranked activity from the objective measurement in an anticipated graded order. A receiver operating characteristic curve was constructed to analyze the validity of the SBQ in predicting $\geq$ 8 hours/day and $\geq$ 11 hours/day of sedentary behaviors, which are associated with high health risks[4, 5]. We

determined the areas under the curve (AUC) and 95% confident intervals, and the specificity and sensitivity of the SBQ.

Floor or ceiling effects were calculated from the percentage of participants showing the highest (24 hours/day) or lowest (0 hour/day) value in average day sedentary time on the SBQ[25]. We used parametric statistics because of the large sample size; however, some of the study variables were non-normally distributed. We repeated the analyses using nonparametric statistics, and the results did not substantially change. Data were analyzed using SPSS package version 20.0 for windows (IBM Corporation) with statistical significance set at $p < 0.050$.

Results:

The one hundred eighty-six participants who were included in the analysis provided written consent, wore the SWA for seven valid days, and completed the SBQ (response rate: 74%). The characteristics of the sample are shown in Table 1. No floor/ceiling effects were presented for the average sedentary time of SBQ (2% ceiling effect and 0% floor effect).

Participants reported an average of 8.7 ± 3.5 hours of sedentary behaviors while awake. The highest mean time reported for individual items was for watching television, followed by eating, and lying and resting. The lowest reported time was for playing musical instruments, followed by sitting listening to music, and arts and crafts (Table 1). A total of 35% of the participants reported watching television for more than 20 hours/week (~3 hours/day). Approximately 45% and 36% of pregnant women reported watching television during the weekend and weekdays, respectively, for more than 3 hours/day.

Pregnant women spent a mean of 10.0 ± 2.1 hours/day in objectively measured sedentary behavior, comprising 63.5% of their waking time. This proportion of time was slightly higher on weekdays than on weekends ($P = 0.326$). The subgroups with more time spent in objectively measured sedentary behavior were pregnant women with BMI > 25 kg/m^2 (10.7 hours/day, 68.2% of waking time), tertiary education (10.6 hours/day, 66.1% of waking time) and women in their third trimester (10.5 hours/day, 65.9% of waking time). The subgroups with less time spent in sedentary behavior were younger pregnant women (9.3 hours/day, 60.3% of waking time) and women with BMI < 25 kg/m^2 (9.7 hours/day, 61.0% of waking time) (Table 2).

Table 2 summarizes sedentary behavior levels, according to the SBQ and SWA, stratified by age, BMI, trimester of gestation, parity, occupational, and educational level. The SBQ presented significantly lower sedentary time compared with the SWA across all stratified groups, except the younger age subgroup (< 30y). No differences between weekday and weekend sedentary time were found across all stratified subgroups, except for women with tertiary education who presented higher sedentary time during weekdays than weekends using the SWA (P = 0.030). The subgroups of age > 30y, BMI > 25 kg/m^2, third trimester of pregnancy, and tertiary education presented significantly higher sedentary time using the objective measure (SWA) to measure sedentary time in an average day (P = 0.001 to 0.014) compared with their respective counterparts. Only nulliparous pregnant women reported significantly higher average day sedentary time than parous pregnant women using the SBQ (P = 0.010).

Compared to the SWA, the SBQ underestimated by 12% to 13% (1.2 to 1.3 hour/day) the weekday, weekend, and average day sedentary time. The difference in weekday, weekend, and average day sedentary time between the two methods was significant (P < 0.001 for all). A low but significant correlation was observed between self-reported (SBQ) and objective (SWA) weekday sedentary time and average day sedentary time (r = 0.23 and 0.20, P = 0.001 and 0.008, respectively), whereas no correlation was found for weekend sedentary time (r = 0.12, P = 0.103) (Table 3).

Focusing on groups stratified by sociodemographic and clinical characteristics, the differences between the two methods in weekday, weekend, and average day sedentary time was significant among all subgroups (P < 0.050), except the younger age subgroup and during the weekday for the nulliparous subgroup. The subgroups of parous pregnant women, BMI < 25 kg/m^2, second trimester of pregnancy, non-workers, and tertiary education presented slightly stronger correlations between SBQ and SWA measurements compared with their respective counterparts (Table 3).

The Bland-Altman plots and the wide limits of agreement between the SBQ and SWA measurements for the weekday (6.0, -8.6), weekend (6.5, -9.1), and average day sedentary time (6.8, -9.2) are shown in Supplemental Figure 1. No significant association was found between the difference and the magnitude of both methods for the weekday, weekend, and average day sedentary time (P > 0.050). Analysis of the receiver operating characteristic curve identified the SBQ as a poor predictor of the

proportion of patients achieving more than 8 and 11 hours/day of sedentary activities, showing high sensitivity (88% true positive) but low specificity (21% true negative) for 8 hours/day, and low sensitivity (40% true positive) but high specificity (68% true negative) for 11 hours/day. The assessment of relative activity levels presented a significant linear trend for increasing total sedentary time based on SWA data across tertiles of sedentary time based on SBQ scores (P = 0.009).

Discussion:

This study is the first to quantify and compare the sedentary time estimated by a multiple-domain questionnaire and objectively measured by a multi-sensor monitor in pregnant women. The findings suggest adequate operational qualities for the SBQ but a low validity and agreement when the self-reported sedentary time measured by the SBQ was compared with the objectively measured sedentary time by the SWA in a convenient sample of low-risk pregnant women.

Our pregnant women spent the 64% of their waking hours in objectively measured sedentary behavior. Our results are slightly lower than the 76% of time spent in sedentary behavior found by the one study among pregnant women that used the same objective measurement monitor to assess sedentary time according to METs[13]. Similar findings were found in a study that used the same measurement instrument in patients with fibromyalgia[22]. Contrary, the non-pregnant adult population has been reported to spend approximately 55-60% of their waking hours in sedentary behavior[26]. Consequently, pregnant women appear to represent a population that engages in high levels of sedentary behavior. The SBQ provides information about the pattern of specific sedentary behaviors suitable for analyzing high-risk sedentary behavior during the week in specific contexts. The primary purpose of sedentary time reported by pregnant women was watching television, consistent with findings from other studies in pregnant women[27], clinical[22] and general populations[28]. More than one-third of our participants watched television for more than 20 hours/week, which has been shown to be associated with detrimental health outcomes[1] and could increase their risk of developing gestational diabetes mellitus[9]. In line with other populations[29], this excessive television watching was most prevalent on the weekends, with almost half of the pregnant women watching television for more than 3 hours/day.

The SBQ presented lower values of sedentary time compared with the SWA across all stratified groups. Similar to our results, the SBQ[22, 30] and other self-reported questionnaires[31] underestimated the average day sedentary time. Contrary, other studies conducted in populations of non-pregnant adults[32, 33] overestimated the sedentary time using domain-specific questionnaires. This overestimation may be explained by the use of different questionnaires and/or different objective monitors as criterion measures. Studies using accelerometers with inclinometers, which identify sedentary behavior based on posture allocation, usually show an overestimation of self-reported sedentary time[32, 33]. While studies using multi-sensor monitors (SWA), which identify sedentary behavior according to METs, usually show an underestimate of self-reported sedentary time[22, 30]. The use of accelerometers with inclinometer or multi-sensor monitors as criterion measure may produce measurement discrepancies due to possible misclassification of sedentary time because they are unable to differentiate between time sleeping and awake, and between postures (i.e., sitting), respectively. Further studies using both tools simultaneously are likely to provide interesting data to validate sedentary behavior questionnaires.

The validity of the SBQ was better for weekdays than for weekend days, suggesting that weekend sedentary time may not be suitable as the sole measure of sedentary behaviors. These findings concur with those of other studies in the adult population[32] and may be explained by less structured daily activities during weekend days compared to weekdays, making it more difficult to recall weekend sedentary time. Both the subjective and objective measures did not show differences between weekend and weekday sedentary time, except for women with tertiary education who presented higher sedentary time during weekdays than weekends using the SWA. This reduction of sedentary time during weekends is consistent with findings from previous study in non-pregnant women[34] and can be partially explained by reduced work-related sitting time, since almost half of women with tertiary education perform sedentary office work.

Very few studies have used SWA monitors as the criterion measure for self-reported measures of sedentary time. One other study that used this criterion measure and this questionnaire in a clinical population of women with fibromyalgia found greater accuracy at the group level, as evidenced by a small mean difference but lower correlation[22]. The weak relations and agreement between objective

and subjective methods in the present study could suggest that the SBQ fails to adequately capture sedentary behaviors in low-risk pregnant women. In addition, the results of the specificity and sensitivity analysis suggest that the SBQ poorly discriminated people who surpassed 8 and 11 hours of sedentary activities, characteristics that are associated with high health risks[4, 5]. Nevertheless, the significant linear trend presented on the assessment of relative activity levels suggests the ability of the SBQ to discriminate relative activity levels, reflecting the true ranking of sedentary time and allowing for the examination of its association with health-related variables during pregnancy. Our results suggest that the use of both tools may be appropriate for capturing all aspects of sedentary behavior, but whether the low correlations in the current study were caused by the nature of the survey questions or the types of referent measure is uncertain. The reasons for the low correlations between both methods in pregnant women are unclear and require more studies with additional indicators of validity.

Regarding the stratified groups, the younger subgroup was the only subgroup that presented no significant differences between both methods, indicating, in line with other studies[35] that younger participants could present fewer difficulties when reporting their sedentary behavior levels. The subgroups of pregnant women who were parous and had the lowest age, BMI and trimester of gestation presented slightly stronger correlations and/or smaller mean differences than their counterparts, demonstrating better levels of validity when sedentary time measurements were compared between both methods. This finding might be partially explained by the fact that above mentioned subgroups are more sedentary than their counterparts, thus allowing for a lower margin of error in estimating sedentary time and a lower tendency to reflect social desirability. However, estimates were poor at an individual level, as suggested by wide limits of agreement displaying discrepancies up to approximately 7 hours/day in sedentary time. The SBQ may be most suited for use in large-scale studies than for studies requiring estimates at an individual level, and in subgroups of women with the following characteristics: parous, BMI < 25 kg/m2, second trimester of pregnancy, non-workers, and tertiary education.

Overall, only the objective measure (SWA) found significant differences in time spent in sedentary behaviors between age, BMI, trimester of gestation, and educational level subgroups. However, both

the subjective and objective measures showed that the subgroups of pregnant women who were in their third trimester, had higher BMI, were tertiary educated, were nulliparous, and were over 30 years old were the most sedentary subgroups. This finding highlights that these subgroups may be aware of their high levels of sedentary behaviors. Although pregnant women under 30 years old and with lower BMI presented the lowest sedentary time, both subgroups engaged in sedentary behavior with a duration that exceeded the 60% of their waking hours. Our findings on the increase in sedentary time with age, BMI, trimester of gestation, and education are consistent with findings from other studies among pregnant women[13, 27], establishing these subgroups at high risk of a sedentary lifestyle.

A first limitation of the study is the inclusion of pregnant women who met eligibility criteria and volunteered to participate, which may result in a self-selection bias. High-risk pregnant women were excluded from the current study. There were no women in their first trimester due to the location of recruitment. The number of participants in the subgroup of overweight and obese women was much lower than the number of participants in the < 25 kg/m^2 subgroup. Since overweight and obese and/or mobility-impaired pregnant women may be at an increased risk for high levels of sedentary time, future research should investigate the measurement properties of sedentary behavior questionnaires in this subgroup. The cross-sectional design of our study precludes the identification of any causal relations. Longitudinal studies are also needed to further understand the predictive value of sedentary behaviors over the course of the pregnancy and to examine the utility of this questionnaire to evaluate change after interventions. The known limitations of nonprobability samples, including their lower representativeness and unknown levels of sampling error, are further limitations.

One strength of the present study was the strict standardization of the methodology used to measure sedentary time. All women had measurements for seven consecutive valid days and reactivity was minimized. The use of SWA may solve the main limitations of accelerometers and inclinometers through heat production measurements, differentiation between sleep and waking time, and placement on the upper arm. The examination of a sedentary behavior questionnaire that included an extensive list of specific sedentary behaviors is another strength. However, a suggestion to further refine the SBQ is to remove or combine certain questions with very low levels of responses (e.g., playing musical instrument) thus minimizing the participant burden and shortening the completion time.

Conclusion:

Pregnant women experience high amount of sedentary time, for approximately half of the day. Pregnant women aged ≥ 30 years, with a pre-pregnancy BMI > 25 kg/m^2, with tertiary education, and in their third trimester of pregnancy are objectively more sedentary than their respective counterparts. Television viewing is the most prevalent sedentary behavior, with more than one-third of pregnant women watching television for more than 20 hours/week. We find a low validity of self-reported estimates of average day sedentary behavior in pregnant women, but a stronger validity for weekdays than for weekend days. The SBQ shows a strong ability to rank individuals with respect to their sedentary activities. This continuous improvement of self-report measure of sedentary time will be important to obtain a better understanding of the relationship between sedentary behavior and health in pregnant women.

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Table 1. Demographic characteristics of study sample (n=186).

Variables		Mean ± SD (% cases)
Age, years		32.5 ± 4.4
Prepregnancy Body Mass Index (BMI), kg/m^2		24.2 ± 3.7
Total objective sedentary time (hours/day, % waking time)		10.0 ± 2.1 (64%)
Total objective sleep time (hours/day)		6.5 ± 1.1
Total self-reported sedentary time (hours/day)		8.7 ± 3.5
Specific self-reported sedentary behaviors (hours/day)		
Watching television		2.3 ± 1.2 (99%)
Eating		1.8 ± 1.2 (100%)
Lying/resting		1.7 ± 1.2 (99%)
Playing computer/video games		0.4 ± 0.7 (43%)
Listening to music		0.1 ± 0.2 (22%)
Talking with others		0.8 ± 1.0 (94%)
Doing paper/office work		1.0 ± 1.6 (48%)
Reading		0.6 ± 0.9 (73%)
Playing a musical instrument		0.0 ± 0.2 (3%)
Doing arts and crafts		0.1 ± 0.4 (14%)
Driving/travelling in a motor vehicle		0.6 ± 0.4 (97%)
		n (%)
Ethnicity		
Caucasian		186 (100)
Trimester of gestation		
Second trimester		109 (58.6)
Third trimester		77 (41.4)
Prepregnancy BMI*		
<25 kg/m^2		120 (64.9)
>25 kg/m^2		65 (35.1)*
Marital status		
Single without couple		3 (1.6)
Single with couple		64 (34.4)
Married		116 (62.4)
Divorced or separated		3 (1.6)
Parity		
0		103 (55.4)
1		76 (40.9)
>1		7 (3.8)
Educational level		
Non-Tertiary	Unfinisehd studies	36 (19.3)
	Polytechnic school	38 (20.4)
	High school	23 (12.4)
Tertiary	Medium academic degree	31 (16.7)
	Highly academic degree	58 (31.2)
Occupational status**		
Workers		91 (48.9)
Non-workers	Unemployed	49 (26.3)
	Sick leave from work	43 (23.1)

*One missing data on prepegnancy BMI.
**Three student excluded of occupational status on total sample.

Table 2. Descriptive sedentary time data from the SBQ and SWA by age, BMI, and trimester of gestation, parity, occupational, and educational level in pregnant women.

Participants	Weekdays sedentary time (hours/day)			Weekend sedentary time (hours/day)			Average day sedentary time (hours/day)		
	Estimated (SWA)	Self-reported (SBQ)	P value between methods	Estimated (SWA)	Self-reported (SBQ)	P value between methods	Estimated (SWA)	Self-reported (SBQ)	P value between methods
All (n=186)	10.1 (2.3)	8.8 (3.9)	<0.001	9.9 (2.4)	8.7 (3.6)	<0.001	10.0 (2.1)	8.7 (3.5)	<0.001
Age (y)									
20-30 (n=47)	9.3 (2.3)	8.7 (4.3)	0.442	9.4 (2.6)	8.6 (3.6)	0.208	9.3 (2.3)	8.7 (3.9)	0.328
31-44 (n=139)	10.4 (2.2)	8.8 (3.7)	<0.001	10.1 (2.3)	8.8 (3.6)	<0.001	10.3 (2.0)	8.8 (3.4)	<0.001
P value between groups	0.003	0.983		0.068	0.686		0.005	0.893	
BMI (kg/m^2)									
<25 (n=120)	9.7 (2.2)	8.5 (3.6)	<0.001	9.7 (2.4)	8.4 (3.4)	0.002	9.7 (2.1)	8.5 (3.3)	<0.001
≥25 (n=65)	10.8 (2.2)	9.3 (4.2)	0.012	10.5 (2.2)	9.3 (3.8)	0.021	10.7 (2.1)	9.3 (3.8)	0.009
P value between groups	0.002	0.149		0.021	0.108		0.002	0.110	
Trimester									
Second (n=109)	9.8 (2.4)	8.7 (4.0)	0.006	9.6 (2.4)	8.3 (3.4)	0.001	9.7 (2.2)	8.6 (3.5)	0.002
Third (n=77)	10.5 (1.9)	8.9 (3.7)	<0.001	10.4 (2.4)	9.4 (3.7)	0.036	10.5 (1.9)	9.0 (3.5)	0.001
P value between groups	0.022	0.708		0.022	0.040		0.014	0.373	
Parity									
0 (n=103)	10.3 (2.3)	9.5 (4.0)	0.061	10.1 (2.4)	9.0 (3.3)	0.009	10.2 (2.1)	9.3 (3.5)	0.026
>1 (n=83)	9.9 (2.2)	7.8 (3.5)	<0.001	9.8 (2.4)	8.4 (3.9)	0.003	9.8 (2.1)	8.0 (3.4)	<0.001
P value between groups	0.212	0.004		0.411	0.290		0.229	0.010	
Occupational status									
Workers (n=91)	10.2 (2.3)	9.1 (4.1)	0.015	9.9 (2.5)	8.5 (3.3)	0.001	10.1 (2.2)	8.9 (3.6)	0.005
Non-workers (n=92)	10.0 (2.2)	8.4 (3.6)	<0.001	10.0 (2.3)	9.0 (3.8)	0.020	10.0 (2.1)	8.5 (3.5)	<0.001
P value between groups	0.570	0.236		0.656	0.349		0.775	0.513	
Educational level									
Non-tertiary (n=97)	9.5 (2.2)	8.2 (3.8)	0.003	9.7 (2.4)	8.5 (3.7)	0.014	9.6 (2.1)	8.3 (3.6)	0.003
Tertiary (n=89)	10.7 (2.2)	9.3 (3.8)	0.001	10.2 (2.3)	9.0 (3.4)	0.001	10.6 (2.0)	9.2 (3.4)	0.001
P value between groups	0.000	0.057		0.124	0.445		0.001	0.086	

Values are mean (SD). The difference of SBQ versus SWA is shown using a paired t-test.

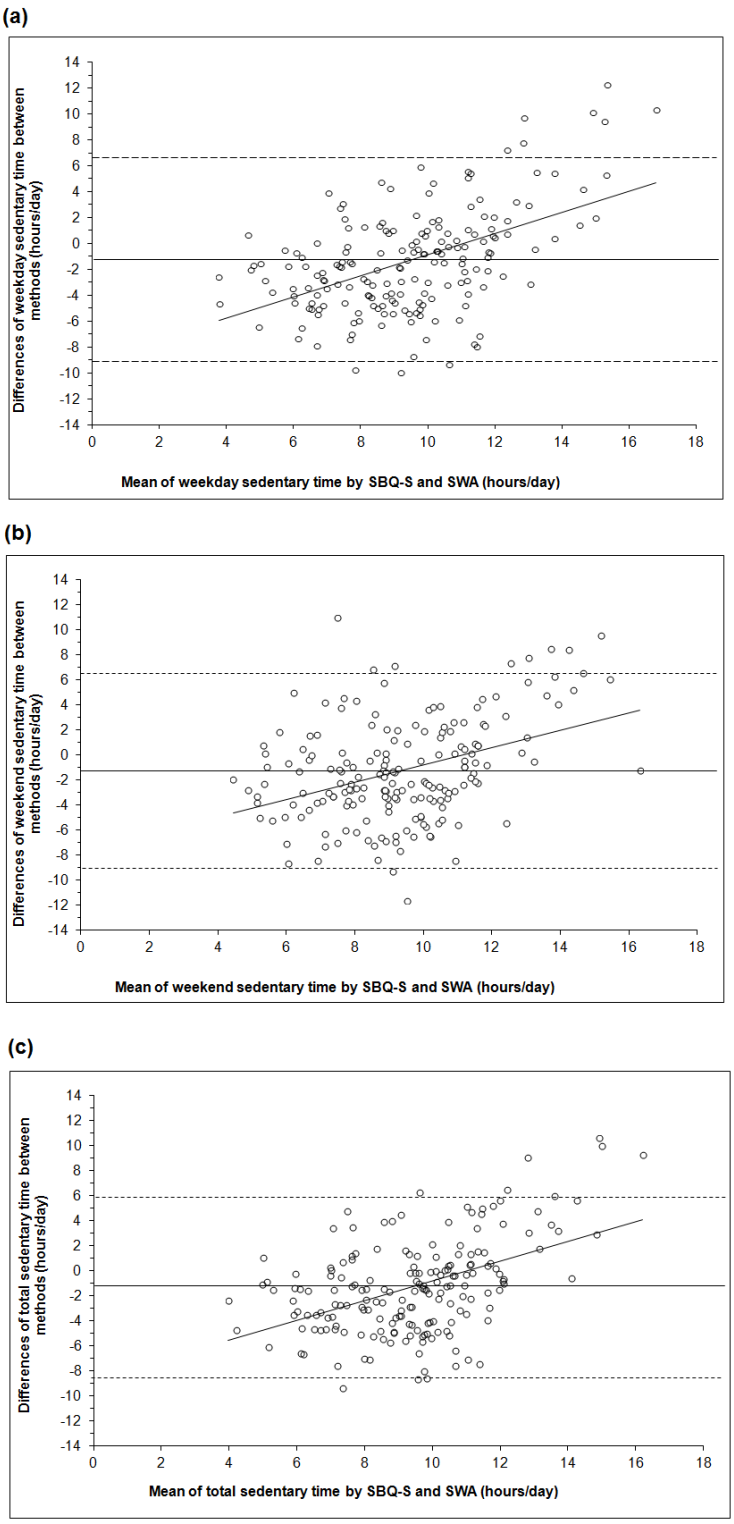
Abbreviations: BMI (Body mass index)

Table 3. Comparison of total weekday, weekend, and average day sedentary time between SenseWear Armband and SBQ by age, BMI, and trimester of gestation, parity, occupational and educational level in pregnant women.

Participants	Weekday sedentary time				Weekend sedentary time				Average day sedentary time			
	DM (SD) (hours/d)	CCC	Pearson	$P_{Pearson}$	DM (SD) (hours/d)	CCC	Pearson	$P_{Pearson}$	DM (SD) (hours/d)	CCC	Pearson	$P_{Pearson}$
All (n=186)	-1.33 (3.99)	0.19	0.23	0.001	-1.20 (4.07)	0.10	0.12	0.103	-1.29 (3.74)	0.16	0.20	0.008
Age (y)												
20-30 (n=47)	-0.52 (4.57)*	0.17	0.17	0.260	-0.83 (4.46)*	0.01	0.01	0.952	-0.61 (4.21)*	0.13	0.15	0.310
31-44 (n=139)	-1.60 (3.74)	0.21	0.27	0.001	-1.32 (3.93)	0.13	0.16	0.061	-1.52 (3.55)	0.17	0.22	0.010
BMI (kg/m^2)												
<25 (n=120)	-1.26 (3.71)	0.22	0.27	0.003	-1.22 (4.13)	0.04	0.04	0.644	-1.25 (3.54)	0.17	0.20	0.028
≥25 (n=65)	-1.45 (4.51)	0.09	0.12	0.357	-1.18 (4.0)	0.17	0.21	0.095	-1.37 (4.13)	0.10	0.12	0.320
Trimester												
Second (n=109)	-1.10 (4.10)	0.21	0.25	0.009	-1.31 (3.95)	0.10	0.11	0.243	-1.16 (3.77)	0.17	0.20	0.036
Third (n=77)	-1.65 (3.82)	0.14	0.20	0.085	-1.03 (4.24)	0.07	0.08	0.507	-1.47 (3.71)	0.12	0.16	0.154
Parity												
0 (n=103)	-0.79 (4.23)	0.14	0.17	0.090	-1.01 (4.12)*	0.00	0.00	0.973	-0.87 (3.92)	0.09	0.10	0.307
>1 (n=83)	-2.00 (3.57)	0.21	0.29	0.007	-1.35 (4.02)	0.20	0.24	0.026	-1.81 (3.45)	0.21	0.29	0.008
Occupational status												
Workers (n=91)	-1.13 (4.36)	0.14	0.17	0.105	-1.38 (3.95)	0.08	0.10	0.365	-1.20 (3.97)	0.09	0.11	0.313
Non-workers (n=92)	-1.62 (3.59)	0.24	0.31	0.003	-1.04 (4.22)	0.12	0.14	0.190	-1.46 (3.52)	0.23	0.29	0.005
Educational level												
Non-tertiary (n=97)	-1.28 (4.16)	0.11	0.14	0.183	-1.13 (4.44)	0.02	0.02	0.853	-1.24 (3.95)	0.09	0.11	0.290
Tertiary (n=89)	-1.38 (3.81)	0.22	0.28	0.007	-1.27 (3.64)	0.20	0.24	0.026	-1.35 (3.52)	0.19	0.25	0.019

*Mean difference not significantly different from zero using a one-sample t-test (p>0.05).

Abreviations: BMI: Body mass index; DM: Difference mean between methods, SD: standard deviation, CCC: Concordance correlation coefficient, Pearson: Pearson correlation coefficient, $P_{Pearson}$ *P* value for Pearson correlation coefficient.



Supplemental Figure 1. Bland and Altman plots of the differences between SWA and SBQ for (a) week days, (b) weekend days, and (c) average day sedentary time. The means of the differences (solid lines) and limits of agreement (dashed lines) within ± 2 SDs are shown.

Abbreviations:

SWA (Sensewear) and SBQ (Sedentary Behaviors Questionnaire)

III. Health-related quality of life during pregnancy and its influential factors.

(Studies V, VI, and VII).

V

Estilo de vida activo en la etapa final de embarazo y su influencia en la salud mental percibida: The PregnActive project.

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Submitted.

Resumen

El objetivo del estudio es analizar el efecto de un estilo de vida activo sobre la calidad de vida relacionada con la salud y los síntomas psicológicos percibidos en la etapa final del embarazo. Noventa y cinco mujeres embarazadas fueron categorizadas en función del cumplimiento de las recomendaciones de actividad física, medida objetivamente mediante un monitor metabólico multisensor, y la percepción de síntomas psicológicos del embarazo, medidos con el Cuestionario de Síntomas del Embarazo. Se analizaron las relaciones entre la actividad física y la percepción de síntomas psicológicos con la calidad de vida relacionada con la salud, medida a través del SF-36. El grupo de embarazadas activas presentó una puntuación media superior estadísticamente significativa en el sumario y tres dominios del componente mental del SF-36 y una menor limitación percibida estadísticamente significativa en los síntomas de sentimientos depresivos y ansiedad. Una mayor frecuencia percibida de síntomas psicológicos conlleva una menor percepción del componente mental de la calidad de vida. Un estilo de vida activo en la etapa final del embarazo tiene un efecto positivo sobre la percepción de la limitación producida por los síntomas psicológicos del embarazo y el componente mental de la calidad de vida relacionada con la salud.

Palabras clave: embarazo, actividad física, síntomas psicológicos, calidad de vida.

Abstract

The aim of this study is to analyze the effect of active lifestyle on health-related quality of life and psychological symptoms perceived at later pregnancy. Ninety five pregnant women were categorized by the fulfillment of physical activity recommendations, objectively measured by multi-sensor metabolic monitor, and psychological pregnancy symptoms perception, measured by Pregnancy Symptoms Inventory. Relationship between physical activity and psychological pregnancy symptoms perception and health-related quality of life, measured by SF-36, were measured. Active group of pregnant women showed statistically significant higher mean scores of summary and three domains of mental component of SF-36, and statistically lower perceived limitation of feeling depressed and anxiety. A higher perception of frequency of psychological symptoms implies a lower perception of mental component of health-related quality of life. An active lifestyle at later pregnancy has a positive

effect on perceived limitation of psychological pregnancy symptoms and mental component of health-related quality of life.

Keywords: pregnancy, physical activity, psychological symptoms, quality of life.

Introducción

El estudio de la calidad de vida relacionada con la salud posee un creciente interés en la salud pública, dado su consideración como una amplia medida de la salud percibida (Hart, 2016). Durante el embarazo, la calidad de vida relacionada con la salud percibida por la embarazada muestra niveles inferiores en comparación con mujeres no embarazadas del mismo intervalo de edad (Gartland et al., 2010), siendo la vitalidad y la función física los principales dominios afectados (Abbaszadeh et al., 2010). El embarazo conlleva la aparición de cambios anatómicos, fisiológicos y psicológicos que afectan la calidad de vida relacionada con la salud percibida por la embarazada (Bize et al., 2007; (Chou et al., 2006; (Kamysheva et al., 2009) y hacen que decrezca conforme avanza el embarazo (Haas et al., 2005; (Kolu et al., 2014; (Tendais et al., 2011).

La actividad física tiene un efecto positivo en la percepción de calidad de vida tanto en la población general (Bize et al., 2007), como en mujeres embarazadas (Claesson et al., 2014; (Kolu et al., 2014). De la misma manera la actividad física tiene un efecto positivo en modificación de la frecuencia y severidad de los síntomas relacionados con el embarazo (Foxcroft et al., 2011), como es el caso de los síntomas relacionados con el aspecto psicológico como la depresión (Loprinzi et al., 2012; (Perales et al., 2015; (Robledo-Colonia et al., 2012) o la ansiedad (Da Costa et al., 2003; (Takahasi et al., 2013).

El objetivo de este estudio es analizar el efecto de un estilo de vida activo sobre la calidad de vida relacionada con la salud y los síntomas relacionados con el aspecto psicológico percibidos a final del embarazo. Así como la influencia de los síntomas relacionados con el aspecto psicológico sobre la calidad de vida relacionada con la salud a final del embarazo.

Nuestra hipótesis de trabajo es que las embarazadas con un estilo de vida activo percibirán menor frecuencia y limitación de los síntomas del embarazo y mejor calidad de vida relacionada con la salud.

Métodología

Participantes

En las visitas rutinarias del seguimiento al embarazado llevado a cabo por las matronas en los centros de salud del Distrito Sanitario de Sevilla, las embarazadas fueron informadas sobre los objetivos y el protocolo del estudio y fueron invitadas a participar en el mismo. Aquellas embarazadas interesadas en la participación fueron informadas pormenorizadamente sobre el protocolo del estudio y

cumplimentaron el consentimiento informado. Los criterios de exclusión incluyeron a las enfermedades crónicas, impedimentos físicos que afectaran la realización de su vida diaria con normalidad, embarazos de alto riesgo (por ejemplo diabetes, hipertensión, etc.). El protocolo del estudio obtuvo la aprobación del Comité de Ética de la Investigación del Hospital Universitario Virgen del Rocío (Sevilla, España), de acuerdo con la Declaración de Helsinki sobre los principios éticos que deben guiar los estudios de investigación en seres humanos.

Protocolo del estudio

Coincidiendo con la primera visita correspondiente al tercer trimestre del seguimiento al embarazo en los centros de salud, las embarazadas interesadas y que cumplimentaron el consentimiento informado fueron citadas para la realización de las sesiones de evaluación del protocolo del estudio. En la primera sesión de evaluación las características sociodemográficas fueron evaluadas mediante un cuestionario específico y las características antropométricas fueron evaluadas siguiendo los protocolos estándar con una báscula digital calibrada (Tanita Corporation, Tokio, Japón) y un estadiómetro (Seca 780, Hamburgo, Alemania). El índice de masa corporal se calculó utilizando el peso y la altura (kg/m2). Los síntomas del embarazo percibidos y la calidad de vida relacionada con la salud fueron evaluados mediante la versión española de los cuestionarios SF-36 (Alonso et al., 1998) y el Cuestionario de Síntomas del Embarazo (PSI) (Oviedo-Caro et al., 2016). En esta primera sesión, el monitor metabólico fue colocado en el brazo izquierdo de la embarazada, quién fue informada para que no cambiara su estilo de vida habitual. El monitor metabólico evaluó la actividad física de la embarazada durante los 8 días siguientes. Al final de este periodo, la embarazada fue citada para la segunda sesión de evaluación, en la cual el monitor metabólico fue retirado.

Instrumentos

El estilo de vida activo fue evaluado objetivamente a través de la actividad física desarrollada por la embarazada, mediante un monitor metabólico multisensor (Sensewear Mini Armband, Bodymedia Inc., Pittsburgh, PA, Estados Unidos), validado positivamente en mujeres embarazadas (Smith et al., 2012). Este monitor metabólico incluye sensores de medición del gasto energético a través del flujo de calor corporal, temperatura de la piel, respuesta galvánica de la piel y acelerómetro de tres ejes para detectar el movimiento. Los datos fueron procesados usando los algoritmos específicos del software

(Sensewear profesional versión 8.1) para obtener una precisa estimación del gasto energético y de la actividad categorizada en función de la intensidad de la misma. El monitor metabólico evaluó la actividad física durante ocho días completos, incluyendo obligatoriamente cinco días entre semana y dos días de fin de semana, exceptuando las actividades acuáticas y el aseo personal. Para considerar un día como completo, el monitor metabólico tuvo que registrar al menos el 95% del día (1368 minutos). El primer día de registro fue eliminado del análisis para evitar cualquier tipo de reactividad producida por el monitor. Las embarazadas fueron agrupadas en activas e inactivas en función del cumplimiento de las recomendaciones de actividad física, 5 días con al menos 30 minutos de actividad física de intensidad moderada o vigorosa (ACOG, 2015).

La versión española del cuestionario SF-36 fue utilizada para evaluar la calidad de vida relacionada con la salud percibida por las embarazadas, la cual ha sido evaluada mostrando buenas propiedades psicométricas (Alonso et al., 1998; (Vilagut et al., 2008).El cuestionario SF-36 está compuesto por ocho dominios, de los cuales cuatro se orientan hacia los aspectos físicos y los otros cuatro hacia los aspectos mentales de la calidad de vida relacionada con la salud. Además dos sumarios resumen dicho componente físico y componente mental, los cuales explican entre el 80 y el 85% de la varianza de los ocho dominios (Vilagut et al., 2008). Las puntuaciones del cuestionario son transformadas a una escala desde 0 a 100 puntos, siendo la puntuación mayor la que representa una mejor percepción de la calidad de vida relacionada con la salud. Una diferencia de cinco puntos en la puntuación de los dominios, o entre dos y tres puntos en la puntuación de los sumarios es considerada clínicamente relevante (Ware et al., 1994).

El cuestionario de síntomas del embarazo se utilizó para evaluar la frecuencia con la que las embarazadas perciben los síntomas del embarazo y la limitación que dichos síntomas tienen sobre la vida diaria de la embaraza. De los 41 ítems que posee el cuestionario se seleccionaron aquellos que evaluaban aspectos psicológicos, como el cansancio o fatiga física, los sentimientos depresivos, la ansiedad y la imagen corporal alterada. Cada ítem evalúa la frecuencia con la que la embaraza percibe un síntoma del embarazado a través de cuatro opciones de respuesta (nunca, raramente, algunas veces y con frecuencia). Además evalúa la percepción de la embarazada sobre la limitación que cada síntoma produce en su vida diaria, a través de tres opciones de respuesta (no limita, limita un poco y

limita mucho). Las embarazas fueron agrupadas en función de la frecuencia percibida de los síntomas (nunca y raramente frente a algunas veces y con frecuencia) y para la limitación percibida (síntoma no percibido y no limita frente a limita un poco y limita mucho).

Análisis estadístico

Se evaluaron las diferencias entre la calidad de vida relacionada con la salud percibida por las mujeres embarazadas agrupadas en función de la actividad física y de la percepción de frecuencia y limitación de los síntomas del embarazo mediante tests T-Student con el nivel de significancia fijado en .050. Para analizar la relación entre la actividad física y la percepción de frecuencia y limitación de los síntomas del embarazo se llevaron a cabo análisis bivariados utilizando tablas de contingencia, utilizando el test Chi cuadrado en cada tabla de contingencia para explorar la relación entre la actividad física y los síntomas del embarazo.

El software estadístico IBM para las ciencias sociales (IBM SPSS Statistics, v. 20.0 for WINDOWS) fue utilizado para realizar el análisis estadístico.

Resultados

Noventa y cinco mujeres embarazadas que cumplían con los criterios de inclusión, aportaron el consentimiento informado y completaron el protocolo del estudio fueron incluidas en el análisis como muestra de estudio. Las características sociodemográficas de la muestra de estudio se presentan en la Tabla 1.

El 69.5% de las mujeres embarazadas que participaron en el estudio cumplían con las recomendaciones de actividad física, desarrollar 5 días al menos 30 minutos de actividad física de intensidad moderada a vigorosa, y fueron consideradas como embarazadas activas. Como muestra la Tabla 2, el grupo de embarazadas activas presentó una puntuación media superior en todos los dominios del SF-36, así como en los dos sumarios. El sumario del componente mental del SF-36, los dominios de vitalidad, función social y rol emocional presentaron diferencias estadísticamente significativas entre los grupos de embarazadas activas e inactivas (p valor entre .003 y .018). Los dominios de función física, rol físico, dolor, salud general y salud mental, aunque no presentaron diferencias estadísticamente significativas, presentaron diferencias superiores a cinco puntos. Por su

parte, el sumario del componente físico del SF-36 no presentó diferencia estadísticamente significativa (p valor .335) ni superior a dos puntos.

En cuanto a la relación entre la actividad física y la percepción de los síntomas del embarazo que evalúan aspectos psicológicos, no se observaron diferencias estadísticamente significativas entre los grupos de actividad física en la frecuencia de síntomas percibida, aunque en todos los síntomas el número de embarazadas inactivas que percibían una mayor frecuencia fue superior. Diferencias estadísticamente significativas fueron encontradas en la percepción de limitación en la vida diaria provocada por los sentimientos depresivos y la ansiedad, siendo superior el número de embarazadas inactivas que percibían limitaciones en su vida diaria (p valor .007 y .014, respectivamente). En los síntomas de cansancio o fatiga física e imagen corporal alterada no se encontraron diferencias estadísticamente significativas entre ambos grupos (Tabla 3).

En la Tabla 4 se muestra la relación entre la frecuencia y la limitación en la vida diaria provocada por los síntomas psicológicos del embarazo y la calidad de vida relacionada con la salud. Diferencias estadísticamente significativas en el sumario del componente mental del SF-36 se encontraron en los síntomas de sentimientos depresivos, ansiedad e imagen corporal alterada, en los cuales una mayor frecuencia percibida supone una menor puntuación en el sumario del componente mental (p valor entre .040 y < .001). El sumario del componente físico no presentó diferencias estadísticamente significativas en ningún síntoma (p valor > .050 en todos). El grupo de embarazadas con mayor frecuencia percibida presentó puntuaciones inferiores en todos los dominios del SF-36 en todos los síntomas psicológicos, excepto el dominio rol emocional en el síntoma de cansancio y fatiga física y el rol físico en el síntoma de imagen corporal alterada. Siendo estas diferencias estadísticamente significativas en los cuatros dominios del componente mental para los síntomas sentimientos depresivos y ansiedad (p valor entre .008 y < .001). El síntoma imagen corporal alterada presenta diferencias estadísticamente significativas en los dominios salud general y salud mental (p valor .003 y .035 respectivamente).

En cuanto a la limitación en la vida diaria provocada por cada síntoma, diferencias estadísticamente significativas se encontraron en el sumario del componente mental, donde el grupo de mayor limitación percibida presentó menores puntuaciones en los síntomas sentimientos depresivos y

ansiedad (p valor < .000) y diferencia de más de 3 puntos en el síntoma de imagen corporal alterada. En el sumario del componente físico sólo se encontró diferencias significativas en el síntoma de cansancio o fatiga física, en el cual el grupo de mayor limitación percibida presentó menor puntuación (p valor .045). El grupo de embarazadas con mayor frecuencia percibida presentó puntuaciones inferiores en todos los dominios del SF-36 en todos los síntomas psicológicos, exceptuando los dominios función física, rol físico y el resumen del componente físico en el síntoma imagen corporal alterada. Siendo estas diferencias estadísticamente significativas en los cuatros dominios del componente mental y el dominio de salud general y rol físico del componente físico para los síntomas sentimientos depresivos y ansiedad (p valor entre .008 y < .001). Así como en el síntoma cansancio o fatiga en los dominios rol físico, vitalidad y función social (p valor entre .019 y < .001). El síntoma imagen corporal alterada no presentó diferencias estadísticamente significativas, aunque en la mayoría de dominios y el resumen del componente mental, las diferencias fueron superiores a 5 y 3 puntos respectivamente.

Discusión

El presente estudio ofrece el análisis de la relación entre la actividad física, los síntomas del embarazo relacionados con el aspecto psicológico y su influencia en la calidad de vida relacionada con la salud de embarazadas en la etapa final del embarazo, siendo el primer estudio que realiza este análisis de forma conjunta. Los principales hallazgos obtenidos muestran como las embarazadas que cumplen con las recomendaciones de actividad física perciben un mejor componente mental de la calidad de vida y una menor limitación provocada por los síntomas psicológicos del embarazo.

El porcentaje de mujeres embarazadas categorizadas como activas por cumplir con las recomendaciones de realizar un mínimo de 5 días con al menos 30 minutos de actividad física de intensidad moderada a vigorosa es algo superior al porcentaje encontrado en un estudio anterior en embarazadas portuguesas (Santos et al., 2016), pudiendo deberse a que en nuestro estudio la embarazada participaba voluntariamente, lo cual puede implicar que las embarazadas con mayor interés en mantener un estilo de vida activo y saludable sean también las más interesadas en participar en el estudio.

El grupo de embarazadas activas presentó una mayor puntuación en todos los dominios y sumarios del SF-36, similar a previos estudios en población general (Hart, 2016) y embarazadas (Claesson et al., 2014). Diferencias estadísticamente significativas fueron encontradas en el sumario del componente mental y los dominios de vitalidad, función social y rol emocional, resultados concurrentes, excepto en el dominio de vitalidad, a estudios previos en embarazadas (Claesson et al., 2014) y en población general (Hart, 2016). El sumario del componente físico fue el único aspecto de la calidad de vida relacionada con la salud que no presentó diferencia estadísticamente significativa o diferencia considerada clínicamente relevante (Ware et al., 1994). Dichos datos avalan la promoción de un estilo de vida activo durante la etapa final de embarazo (Currie et al., 2013) con el objetivo de mejorar la calidad de vida relacionada con la salud percibida por las embarazadas, sobre todo en el aspecto mental de la calidad de vida Estudios previos apoyan este argumento, los cuales han mostrado los beneficios de la actividad física sobre la salud mental de la embarazada (Da Costa et al., 2003; (Demissie et al., 2011; (Haas et al., 2005), otorgando un papel importante a la promoción de un estilo de vida activo por parte de los profesionales sanitarios encargados del seguimiento del embarazo. Respecto a la relación entre la actividad física y la percepción de síntomas del embarazo relacionados con el aspecto psicológico, los resultados obtenidos muestran que aunque en la frecuencia de síntomas percibidos no hubo diferencias estadísticamente significativas entre los grupos de embarazadas activas e inactivas, la percepción de limitación en la vida diaria si presenta diferencias estadísticamente significativas entre ambos grupos para los síntomas de sentimientos depresivos y ansiedad. Centrándonos en la frecuencia de síntomas percibidos en la etapa final de embarazo, observamos como en todos los síntomas relacionados con el aspecto psicológico los porcentajes de embarazadas que perciben dichos síntomas son algo superiores en el grupo de embarazadas inactivas que en el grupo de embarazadas activas, aunque hay que recalcar la ausencia de diferencias significativas. Resultados similares encontramos en la literatura científica, donde se muestra una correlación positiva entre el cumplimiento de las recomendaciones de actividad física (Demissie et al., 2011; (Loprinzi et al., 2012) o la participación en programas de ejercicio físico (Perales et al., 2015; (Robledo-Colonia et al., 2012) y la prevalencia de síntomas depresivos, o entre el cumplimiento de las recomendaciones de actividad física y la percepción de ansiedad (Da Costa et al., 2003; (Takahasi et al., 2013). En cuanto

a la limitación provocada en la vida diaria por los síntomas psicológicos en la etapa final del embarazo, encontramos diferencias significativas en los síntomas de sentimientos depresivos y ansiedad. La ausencia de significatividad en dichas diferencias en la frecuencia de síntomas percibidos y las plausibles diferencias en la limitación que dichos síntomas producen en la vida diaria de las embarazadas, muestran como el transcurso del embarazado y los cambios físicos, fisiológicos y psicológicos que lleva asociados (Zib et al., 1999), conllevan necesariamente la aparición de síntomas físicos y psicológicos. El estilo de vida activo puede modificar la frecuencia de dichos síntomas (Foxcroft et al., 2011; (Sternfeld et al., 1995), aunque no evita su aparición. Sin embargo, tal y como muestran los resultados obtenidos, el estilo de vida sí tiene un importante efecto en la percepción de limitación que esos síntomas conllevan en la vida diaria de la embarazada, reduciendo el impacto limitante percibido por la embarazada. En línea con los beneficios del estilo de vida activo sobre el componente mental de la calidad de vida, la promoción del estilo de vida activo por parte de los profesionales sanitarios es indispensable para conseguir una baja prevalencia de síntomas relacionados con el aspecto psicológico en la etapa final del embarazo.

Atendiendo a la relación entre la percepción de los síntomas relacionados con el aspecto psicológico y la calidad de vida relacionada con la salud percibida por la embarazada, encontramos como los síntomas relacionados con el aspecto psicológico tienen una gran influencia en el componente mental de la calidad de vida. En todos los síntomas analizados en nuestro estudio, el grupo donde la frecuencia de síntomas percibida era superior presenta una menor puntuación en el sumario y todos los dominios del componente mental, exceptuando el dominio rol emocional en el síntoma cansancio o fatiga física. Dichos resultados son concurrentes con estudios previos, los cuales muestran como los síntomas del embarazo afectan la calidad de vida relacionada con la salud percibida por la embarazada, aunque en dichos estudios se centraron en síntomas físicos y no psicológicos (Chou et al., 2006; (Kamysheva et al., 2009). En nuestro estudio, el sumario del componente físico de la calidad de vida no presenta diferencias significativas entre los grupos de frecuencia percibida de los síntomas psicológicos, lo cual indica que los síntomas psicológicos del embarazo tienen escasa influencia en el componente físico de la calidad de vida, estando dicho componente determinado por los síntomas físicos del embarazo. En cuanto a la limitación provocada en la vida diaria percibida por los síntomas

psicológicos analizados observamos que, exceptuando al síntoma imagen corporal alterada, en todos los síntomas el grupo de mayor limitación percibida presenta menores puntuaciones en los dominios y sumario del componente mental del SF-36. En la línea con la frecuencia de síntomas percibidos, dichos resultados muestran como los síntomas del embarazo relacionados con el componente psicológico tienen una gran influencia sobre el componente mental percibido de la calidad de vida relacionada con la salud.

Este estudio presenta algunas limitaciones. El diseño transversal del mismo impide establecer la evolución de la actividad física desarrollada y la evolución de los síntomas del embarazo relacionados con el aspecto psicológico en las diferentes etapas del embarazo, así como el análisis de su influencia en cada etapa del embarazo. Futuros estudios científicos deben analizar longitudinalmente dichas relaciones a lo largo del periodo completo de embarazo. La voluntariedad en la participación en el estudio y los criterios de exclusión establecidos, hacen que las embarazadas con enfermedades crónicas y embarazos de alto riesgo queden fuera del análisis, lo cual limita la extrapolación de los datos como datos normativos.

Entre las fortalezas de este estudio encontramos el análisis de la influencia de la actividad física y los síntomas del embarazo relacionados con el aspecto psicológico, de forma conjunta sobre la percepción de la calidad de vida relacionada con la salud en la etapa final de embarazo. Además la utilización de un monitor metabólico multisensor y el estricto protocolo utilizado en el análisis de los datos permite una evaluación objetiva del gasto energético y la actividad física desarrollada por la embarazada, lo cual mejora la precisión de la medida de la actividad física y el gasto energético comparada con estudios previos que utilizaron medidas subjetivas (Claesson, 2013).

Conclusión

Un estilo de vida activo durante la etapa final del embarazo, determinado mediante el cumplimiento de las recomendaciones de actividad física, tiene un efecto positivo en el componente mental de la calidad de vida relacionada con la salud percibido por las embarazas. Así mismo, un estilo de vida activo durante la etapa final del embarazo aunque no evita la aparición de los síntomas del embarazo relacionados con el aspecto psicológico, puede reducir su frecuencia y la limitación que causan en la vida diaria percibida por las embarazadas, lo que se relaciona con una mejor percepción del

componente mental de la calidad de vida. La promoción de un estilo de vida activo durante la etapa final de embarazo debe ser propuesta para conseguir un mejor estado de salud y de la calidad de vida percibida en las embarazadas.

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Tabla 1. Características sociodemográficas de la población de estudio (n=95)

Variables		Media (DE)
Edad (años)		33.0 (4.3)
IMC pre embarazo (kg/m^2)		25.0 (4.6)
IMC actual (kg/m^2)		28.7 (4.6)
		n (%)
Estado civil		
Soltera sin pareja		1 (1.1)
Soltera con pareja		29 (30.5)
Casada		63 (66.3)
Divorciada or separada		2 (2.1)
Numero de hijos		
0		49 (51.6)
1		41 (43.2)
>1		5 (5.3)
Nivel educativo		
Estudios no universitarios		49 (51.6)
Estudios universitarios		46 (48.4)
Estado laboral*		
Activas		25 (26.3)
Inactivas	Desempleadas	27 (28.4)
	Baja laboral	42 (44.2)

*Una estudiante excluida del estado laboral.
Abreviaciones. IMC: Índice de masa corporal.

Tabla 2. Niveles de calidad de vida relacionada con la salud al final del embarazo de embarazadas clasificadas en función de las recomendaciones de actividad física.

	Inactivas (n=29)	**Activas** (n=66)	**p valor**
Función Física (0-100)	55.5 (21.0)	62.0 (18.8)	.141
Rol físico (0-100)	46.1 (28.4)	54.8 (23.5)	.122
Dolor (0-100)	60.1 (22.0)	61.4 (22.3)	.795
Salud general (0-100)	68.2 (18.5)	75.1 (17.1)	.080
Vitalidad (0-100)	44.4 (16.6)	52.4 (14.0)	.018
Función social (0-10)	69.4 (26.0)	84.3 (19.9)	.003
Rol emocional (0-100)	84.8 (21.9)	94.2 (14.8)	.016
Salud mental (0-100)	73.3 (18.4)	78.7 (14.9)	.131
Sumario del Componente físico (0-100)	38.5 (8.9)	40.4 (8.7)	.335
Sumario del Componente mental (0-100)	50.5 (10.1)	55.5 (8.2)	.014

Datos expresados en medias y desviación estándar.

Tabla 3. Relación entre síntomas psicológicos percibidos y grupos de embarazadas clasificadas en función de las recomendaciones de actividad física

	Inactivas n (%)	**Activas** n (%)	p valor
Frecuencia de síntomas percibidos			
Cansancio o Fatiga física			
Nunca/Raramente	23 (79.3)	57 (86.4)	.385
Algunas veces/Con frecuencia	6 (20.7)	9 (13.6)	
Sentimientos depresivos			
Nunca/Raramente	22 (75.9)	52 (78.8)	.752
Algunas veces/Con frecuencia	7 (24.1)	14 (21.2)	
Ansiedad			
Nunca/Raramente	24 (82.8)	58 (87.9)	.504
Algunas veces/Con frecuencia	5 (17.2)	8 (12.1)	
Imagen corporal alterada			
Nunca/Raramente	24 (82.8)	56 (86.2)	.669
Algunas veces/Con frecuencia	5 (17.2)	9 (13.8)	
Limitación percibida			
Cansancio o Fatiga física			
No percibido/No limita	4 (14.8)	15 (23.4)	.355
Limita un poco/Limita mucho	23 (85.2)	49 (76.6)	
Sentimientos depresivos			
No percibido/No limita	19 (67.9)	58 (90.6)	.007
Limita un poco/Limita mucho	9 (32.1)	6 (9.4)	
Ansiedad			
No percibido/No limita	19 (70.4)	58 (90.6)	.014
Limita un poco/Limita mucho	8 (29.6)	6 (9.4)	
Imagen corporal alterada			
No percibido/No limita	26 (92.9)	58 (93.5)	.903
Limita un poco/Limita mucho	2 (7.1)	4 (6.5)	

Tabla 4. Niveles de calidad de vida relacionada con la salud al final del embarazo de embarazadas clasificadas en función de la percepción de síntomas psicológicos.

	n	Función Física (0-100)	Rol físico (0-100)	Dolor (0-100)	Salud general (0-100)	Vitalidad (0-100)	Función social (0-100)	Rol emocional (0-100)	Salud mental (0-100)	Sumario del Componente físico (0-100)	Sumario del Componente mental (0-100)
Frecuencia de síntomas percibidos											
Cansancio o Fatiga física											
Nunca/Raramente	80	60.3 (20.2)	52.5 (26.1)	61.3 (22.4)	73.4 (17.1)	50.9 (15.6)	81.4 (22.1)	91.4 (18.5)	78.4 (15.7)	39.8 (8.8)	54.6 (9.1)
Algunas veces/Con frecuencia	15	58.7 (17.2)	50.4 (20.9)	59.5 (20.8)	70.9 (21.4)	44.6 (12.0)	70.8 (25.7)	91.1 (12.8)	70.0 (16.9)	39.8 (8.5)	50.6 (7.8)
		.776	.771	.776	.625	.139	.100	.961	.065	.970	.117
Sentimientos depresivos											
Nunca/Raramente	74	60.5 (19.9)	54.4 (25.3)	61.8 (21.8)	75.5 (16.2)	52.4 (14.5)	85.1 (19.5)	95.3 (11.9)	81.8 (12.9)	39.7 (8.9)	56.8 (6.4)
Algunas veces/Con frecuencia	21	58.1 (19.1)	44.3 (24.0)	58.3 (23.4)	64.0 (20.1)	41.1 (14.7)	60.7 (24.1)	77.4 (26.4)	60.5 (15.6)	40.2 (8.5)	44.1 (10.1
		.617	.108	.529	.008	.002	.000	.000	.000	.813	.000
Ansiedad											
Nunca/Raramente	82	60.2 (20.2)	54.3 (25.3)	62.1 (22.3)	74.3 (16.7)	51.7 (14.8)	83.8 (20.4)	94.3 (14.1)	79.6 (13.7)	39.9 (9.1)	55.8 (7.1)
Algunas veces/Con frecuencia	13	58.8 (16.0)	38.9 (21.2)	54.1 (20.1)	65.0 (22.4)	38.9 (13.8)	53.8 (21.3)	72.4 (25.8)	60.8 (21.0)	39.6 (6.7)	42.5 (11.5)
		.821	.041	.223	.080	.004	.000	.000	.000	.906	.000
Imagen corporal alterada											
Nunca/Raramente	80	60.9 (20.4)	52.0 (26.5)	62.0 (22.1)	75.1 (16.4)	51.0 (15.3)	81.4 (22.3)	92.1 (16.5)	78.4 (15.0)	40.1 (9.2)	54.7 (8.3)
Algunas veces/Con frecuencia	14	56.1 (15.2)	53.6 (18.6)	56.2 (22.6)	60.3 (20.7)	43.8 (14.3)	69.6 (24.9)	86.3 (23.9)	68.6 (20.7)	38.6 (5.9)	49.3 (11.9)
		.402	.827	.371	.003	.101	.077	.264	.035	.559	.040
Limitación percibida											
Cansancio o Fatiga física											
No percibido/No limita	19	63.7 (19.0)	68.1 (27.9)	66.5 (22.4)	77.2 (15.7)	57.2 (14.0)	91.4 (11.8)	95.2 (12.5)	81.3 (15.3)	43.1 (8.9)	56.8 (5.8
Limita un poco/Limita mucho	72	58.4 (19.9)	47.3 (23.2)	59.3 (22.0)	71.3 (18.2)	47.9 (15.4)	76.9 (23.9)	90.5 (18.5)	76.3 (16.3)	38.6 (8.5)	53.5 (9.6
		.303	.001	.210	.207	.019	.012	.304	.226	.045	.158
Sentimientos depresivos											
No percibido/No limita	77	61.2 (19.5)	54.5 (23.7)	62.3 (21.4)	75.6 (16.5)	52.4 (14.6)	85.7 (18.0)	96.4 (9.1)	82.1 (11.9)	39.8 (8.7)	57.1 (5.7)
Limita un poco/Limita mucho	15	52.0 (20.1)	37.5 (29.5)	52.9 (24.3)	58.0 (17.5)	37.1 (13.5)	51.7 (23.1)	66.7 (26.9)	53.7 (14.1)	38.5 (9.2)	39.7 (8.6)
		.098	.017	.131	.000	.000	.000	.000	.000	.610	.000
Ansiedad											
No percibido/No limita	77	60.5 (20.3)	54.3 (25.6)	63.0 (21.8)	75.4 (15.9)	52.1 (15.1)	85.6 (18.6)	95.9 (11.4	81.2 (12.5)	39.8 (9.0)	56.7 (6.0)
Limita un poco/Limita mucho	14	55.7 (17.6)	37.9 (20.9)	51.0 (20.3)	61.2 (20.5)	38.4 (12.9)	51.8 (22.4)	67.3 (24.6)	56.4 (18.6)	39.0 (6.7)	40.4 (10.3)
		.408	.027	.060	.004	.002	.000	.000	.000	.740	.000
Imagen corporal alterada											
No percibido/No limita	84	59.6 (20.2)	51.2 (26.1)	60.5 (22.3)	73.3 (17.8)	50.3 (15.6)	80.7 (22.4)	91.8 (17.7)	78.2 (15.0)	39.4 (9.0)	54.6 (8.6)
Limita un poco/Limita mucho	6	66.7 (13.3)	57.3 (17.9)	60.8 (15.6)	64.2 (20.0)	44.8 (16.0)	72.9 (30.0)	86.1 (16.4)	67.5 (28.9)	42.3 (5.3)	48.1 (13.5)
		.405	.576	.967	.233	.408	.426	.449	.119	.446	.086

Datos expresados en medias y desviación estándar.

VI

Determinants and levels of health-related quality of life among pregnant women at midpregnancy: A cross-sectional study of The PregnActive Project.

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Submitted.

Abstract

Objectives: The purposes of this study were to identify the determinants and establish HRQoL levels of pregnant women at midpregnancy.

Design: Exploratory cross-sectional design was used.

Settings: Antenatal clinic of high resolution Hospital in southern Spain.

Participants: A total of 134 healthy women completed questionnaires, development the cardiorespiratory fitness test and wore the multi-sensor body monitor for 7 days at midpregnancy.

Methods: A cross-sectional design was used. Health-related quality of life was assessed using the SF-36 questionnaire. Pregnancy-related symptoms were assessed using the Pregnancy Symptoms Inventory. Cardiorespiratory fitness was examined using the 6-minute walk test. Physical activity was measured using a multi-sensor body monitor. Simple correlations, differences between groups, and linear regression tests were performed.

Findings: CRF (β=0.35; $p<0.001$), musculoskeletal symptoms (β=-0.26; $p=0.001$), and age (β=-0.26; $p=0.001$) were identified as independent predictors of the physical component summary of HRQoL. Independent predictors of the mental component summary of HRQoL were musculoskeletal (β=-0.24; $p=0.005$) and psychological (β=-0.21; $p=0.014$) symptoms, and light activity (β=0.17; $p=0.048$). Significant differences in HRQoL levels were found by age, parity, educational level, occupational status, body mass index, pregnancy symptoms, and CRF groups ($p<0.050$).

Key conclusions: CRF, musculoskeletal and psychological symptoms, and light activity are determinant of women`s HRQoL at midpregnancy. Older, parous, non-tertiary education, non-workers, overweight and obese, high number of pregnancy symptoms, and low CRF level pregnant women present high risk of low levels of physical HRQoL. Pregnant women who are young and have a high number of pregnancy symptoms presented a high risk of low levels of mental HRQoL.

Implications for practice: The identification of the determinants and high-risk groups of HRQoL at midpregnancy allow the development of prenatal care interventions that ameliorate the decline of HRQoL that pregnancy produces.

Keywords: Health-related quality of life, pregnancy, cardiorespiratory fitness, symptoms, physical activity.

Introduction

Health-related quality of life (HRQoL) is considered a broad measure of perceived health related to both self-reported chronic diseases and their risk factors(Centers for Disease Control and Prevention, 2000). The study of HRQoL is a growing interest in public health, especially during gestation due to the established decline in HRQoL levels during the course of pregnancy(Álvarez Silvares et al., 2008; Förger et al., 2005). The lower HRQoL levels among pregnant women compared to non-pregnant women of similar age highlight the need to identify the aspects that affect HRQoL during pregnancy, specifically in physical functioning, which is the main aspect of HRQoL affected by the progressive impairment that pregnancy produces(Álvarez Silvares et al., 2008; Förger et al., 2005).

The course of pregnancy implies anatomical, physiological, and psychological changes that involve the presence of pregnancy-related symptoms, producing impairments in pregnant women's health, an increase in sedentary behaviors, and associations with low HRQoL(Nicholson et al., 2006; Olsson and Nilsson-Wikmar, 2004; Setse et al., 2009). The majority of the literature has been focused on specific symptoms and are necessary studies that assess the wide range of pregnancy-related symptoms(Nazik and Eryilmaz, 2014).

In terms of physiological changes, pregnancy is characterized by an increase in heart rate at rest, an increase in cardiac output, and diminished peripheral vascular resistance in order to meet the complex demands of fetal development(Dallmann et al., 2017). Cardiorespiratory Fitness (CRF) has been established as a determinant of individual physical work capacity and better physical health(Ehrman et al., 2017); however, CRF declines during pregnancy. Physical inactivity leads to make this decline worse, and consequently aerobic exercise programs have been proposed to prevent the decline of CRF during pregnancy(Ramirez-Velez et al., 2011). Although physical functioning is known as the main aspect of HRQoL that is affected by pregnancy and although CRF has a consistent positive association with HRQoL in the general adult and clinical populations(Engberg et al., 2017; Munguía-Izquierdo et al., 2015), the associations between CRF levels and HRQoL during pregnancy remain unexplored.

Exercise(Gaston and Prapavessis, 2013) and physical activity counseling(Kolu et al., 2014) interventions have been revealed to improve pregnant women's quality of life. Although it has been well-established that exercise interventions improve HRQoL during pregnancy, the associations

between physical activity levels and HRQoL perceived by pregnant women are unclear. Previous studies did not find associations between self-reported measures of physical activity and HRQoL(Bahadoran and Mohamadirizi, 2015; Tendais et al., 2011), but the current use of self-reported measures of physical activity in the scientific literature indicates the need to objectively measure physical activity in future studies to improve our understanding of the association between physical activity and HRQoL in pregnant women.

The objectives of this study were 1) to assess the association of CRF, pregnancy symptoms, and objectively measured physical activity levels with HRQoL in pregnant women at midpregnancy and 2) to establish and compare HRQoL levels at midpregnancy, as measured by the SF-36 and stratified by sociodemographic, physical, and clinical variables.

Our working hypotheses were that high CRF and physical activity levels would be positively associated with high HRQoL levels, and that pregnancy-related symptoms would be negatively associated with HRQoL.

Methods

Study Population

At the 12th gestational week visit to the gynecologist at Utrera Hospital, potential participants, aged 18-45 years old, were individually informed about the study aims and protocol. The exclusion criteria included physical illnesses or disabilities that affected their normal daily routine and high-risk pregnancy (i.e., diabetes or hypertension). Written informed consent was obtained from participants prior to enrolling in the study. The study protocol obtained ethical approval from the Medical Research Ethics Committee of the University Hospital Virgen del Rocio (Seville, Spain) in accordance with the Declaration of Helsinki, approval number 2014PI-066. The STROBE guidelines were followed during the course of the study(von Elm et al., 2008).

Study Protocol

Coinciding with the second visit to gynecologist (approximately 20th week of gestation), sociodemographic and anthropometrical characteristics were evaluated following the standard procedures using a calibrated digital scale (Tanita Corporation, Tokio, Japan) and a stadiometer (Seca 780, Hamburg, Germany), and body mass index (BMI) was calculated (kg/m^2). In this session,

HRQoL and pregnancy-related symptoms were assessed using the standardized questionnaires, CRF was examined through a field-based test, and a body monitoring device was placed on the left arm of pregnant women. The body monitoring device measured the energy expenditure and physical activity behaviors of pregnant women during the following 8 days, during which pregnant women were asked not change their habitual lifestyle. At the end of this period, pregnant women returned to the hospital to remove the body monitoring device.

Instruments

The Medical Outcome Study 36-item short form (SF-36) is a HRQoL questionnaire that offers a basic understanding of the health status, has a high internal consistency, reliability and validity, and their psychometric properties have been analyzed satisfactorily among pregnant women(Jomeen and Martin, 2005). The Spanish version has good psychometric properties(Vilagut et al., 2008). This tool contains eight domains which are summarized in a physical component summary (PCS) and mental component summary (MCS). The scores of SF-36 are transformed to a 0-to-100 scale, where the high score represent the best HRQOL. These two summary scales explain 80 to 85% of the variance in the eight domains(Vilagut et al., 2008). The mean score for the general population is 50, with a standard deviation of 10 points. A difference of half an SD or a five-point difference (domain scores) and two to three point difference (summary scores) are considered clinically relevant(Norman et al., 2003).

Pregnancy Symptoms Inventory is a 41-item Likert inventory that assesses how often symptoms occurred and what effect they had. The Spanish version of this tool(Oviedo-Caro et al., 2017) was used. For each symptom pregnant women must choice between four options of prevalence (never/rarely/sometimes/often). We created summary scores quantifying the number of symptoms perceived sometimes and above among each category of pregnancy-related symptoms(Nazik and Eryilmaz, 2014).

The distance covered in the 6-minute walk test, previously used in pregnant women(Ramirez-Velez et al., 2011), was used to assess CRF. We used a 45.7-meter rectangular course delimited by cones, with 90 degree turn in order to minimize changes of rhythm compared with a straight corridor space with 180 degree turn. Pregnant women were encouraged to walk as far as possible without running or jogging. The same trained instructor explained the protocol giving a demonstration prior to start,

supervised the test and recorded the distance covered to the nearest 0.1 m. Heart rate was controlled during the test and 2-min recovery period.

A body monitoring device, Sensewear Mini Armband (BodyMedia Inc., Pittsburgh, PA, USA) was used to objectively assess energy expenditure, physical activity, and sedentary behavior. This device, which has been validated in pregnant women(Smith et al., 2012), includes sensors to measure energy expenditure by monitoring the heat flow from the body, skin temperature, galvanic skin response, and 3-axis accelerometer for motion detection. The physiologic information gathered by sensor array together with simple body measurements were processed using Sensewear algorithms to obtain accurate estimations of energy expenditure for all types of activities (Sensewear professional software version 8.1). The monitor was worn during 8 completed days, including five weekdays and two weekend days, except for during water-based activities such as swimming or bathing. The monitor was required to be carried for more than 95% of the entire day (1368 min) for the day to be considered completed. To avoid any kind of immediate reactivity, we removed the first completed day of monitoring from the analysis.

Statistical analysis

Statistical tests were performed using the Statistical Package for the Social Sciences version 20 (IBM Corp., Armonk, NY, USA), with significance set at $p<0.050$.

To quantify associations between HRQoL and physical activity, CRF or pregnancy-related symptoms, Pearson or Spearman correlation coefficients were used, depending on whether the data showed normal or skewed distributions. Variables with skewed distributions were transformed when possible using a square root transformation for moderate activity and MVPA, and a reciprocal transformation for prepregnancy and current BMI. Correlations were corrected for confounders previously associated with pregnant women(Baron et al., 2016): age, parity, and BMI. Correlation values were interpreted as follows: <0.25, weak or null; 0.25 to 0.50, fair; 0.50 to 0.75, moderate to good; and >0.75, good to excellent.

Multiple stepwise linear regression analysis was used to determine the relative contributions of study variables to the summary scales of HRQoL (dependent variables). Variance inflation factor values greater than 3 were used to indicate multicollinearity problems in the model. Graphic and statistical

analyses of residuals were used to verify normality, linearity, and homoscedasticity of the regression analysis.

Estimated means for HRQoL scores were calculated using stratified groups of sociodemographic variables with an influence on pregnancy(Baron et al., 2016), classification of MVPA recommendations(World Health Organization, 2010), levels of light activity, CRF, and number of pregnancy-related symptoms grouped using the median split procedure. Differences between groups were analyzed using Student's t-test or the Mann-Whitney U test depending on whether the data showed normal or skewed distributions, respectively.

Results

One hundred thirty-four healthy pregnant women with a mean age of 32.5 years old and a mean BMI of 26.5 kg/m^2 who fulfilled the inclusion criteria, provided written consent, and completed the study protocol were included in the study sample. The characteristics of the sample are presented in Table 1.

Table 2 presents the simple correlations of sample characteristics, physical activity, CRF, and pregnancy symptoms with all domains and summaries of the SF-36. Significant positive associations were found between the PCS and vigorous activity, days meeting MVPA recommendations, and CRF (r = 0.17 to 0.37; all p<0.050). Significant negative associations were found between the PCS and musculoskeletal, cardiovascular, gastrointestinal, and psychological symptoms, as well as the total symptoms summary (r = -0.17 to -0.30; all p<0.050). These associations remained significant after adjusting for age, BMI, and parity, except for psychological symptoms (p=0.150; data not shown). The MCS presented significant positive association with light activity and light-to-vigorous activity (r = 0.16 and 0.17, respectively; all p<0.050). Significant negative associations were found between the MCS and psychological, musculoskeletal, cardiovascular, gastrointestinal, urogenital, and dermatological symptoms, as well as the total symptoms summary (r= -0.19 to -0.38, all p<0.050). After adjusting for age, BMI, and parity, these associations remained significant, except for dermatological symptoms (p=0.07; data not shown).

The multiple regression analysis identified that CRF (β=0.35; p<0.001), age (β=-0.26; p=0.001), and musculoskeletal symptoms (β=-0.26; p=0.001) were independent predictors of the PCS of HRQoL, and the model explained 15% (p<0.001) of the variability. There was no multicollinearity among the

variables within the final model. Musculoskeletal symptoms (β=-0.24; p=0.005), psychological symptoms (β=-0.21; p=0.014), and light activity (β=0.17; p=0.048) were identified as independent predictors of the MCS of HRQoL, and the model explained 16% (p<0.001) of the variability. There was no multicollinearity among the variables within the final model.

Table 3 provides the HRQoL scores for pregnant women at midpregnancy, stratified by sociodemographic, physical, and clinical variables. Average scores for the domains ranged from 52.8 points in the vitality domain to 91.4 points in the emotional role domain. The PCS score was clinically and significantly lower than the MCS score (p<0.001). Pregnant women who were older, parous, actual overweight and obese, non-workers, non-tertiary educational level, had a high number of pregnancy symptoms, and had a low level of CRF presented significantly and clinically relevant lower PCS scores than their counterparts (p<0.050). Pregnant women who were older and had a high number of pregnancy symptoms presented higher MCS scores than their counterparts (p<0.050). Only pregnant women with a high number of pregnancy symptoms scored significantly lower in all summaries and domains of HRQoL (p<0.050) than their counterparts.

Discussion

This study is the first to assess the associations of objectively measured physical activity, CRF, and pregnancy-related symptoms with HRQoL at midpregnancy. The findings of this study corroborate that the physical component of HRQoL is more affected by pregnancy than the mental component; and highlight the importance of CRF, musculoskeletal and psychological symptoms, light activity, and age as independent predictors of HRQoL. In addition, this study establishes reference values of the Medical Outcome Study 36-item short form at midpregnancy, stratified by sociodemographic, physical, and clinical variables.

Consistent with previous studies in clinical populations(Engberg et al., 2017; Munguía-Izquierdo et al., 2015), our study identified CRF as an independent predictor of the physical component of HRQoL, and no association was found between CRF and the mental component of HRQoL. Our results indicate that high CRF during pregnancy is the main determinant of the PCS of HRQoL. Although expected, such a finding has not been previously demonstrated, and further studies are needed to confirm it. This finding can be explained by the fact that CRF is an essential and integral biological indicator of human

health that represents the capacity for daily living activities. The reduction of the work capacity of the aerobic system during pregnancy due to maternal demands(Davenport et al., 2009) and the protective effect of CRF on established pregnancies(Thorell et al., 2015) emphasize the importance of future studies investigating existing methods to improve or maintain CRF in pregnant women to enhance HRQoL.

Pregnancy symptoms presented a negative impact on both the PCS and MCS of HRQoL, musculoskeletal symptoms were identified as an independent predictor of both summary components, and psychological symptoms were identified as an independent predictor only for the MCS of HRQoL. In line with our findings, several studies have revealed the negative impact of numerous musculoskeletal symptoms on both the PCS and MCS(Ghanei-Gheshlagh et al., 2014; Olsson and Nilsson-Wikmar, 2004), which could be explained by the impaired physical abilities and functional limitations produced by musculoskeletal symptoms in pregnant women's activities of daily life. This limitation in daily life activities affects not only physical functioning but also the social and mental activities of pregnant women's lives, thus explaining the negative impact on both summary components of HRQoL. The negative impact of psychological symptoms on the MCS of HRQoL is consistent with findings from previous studies in pregnant women(Nicholson et al., 2006; Setse et al., 2009). This consistency across studies could be explained by the fact that pregnancy is a vulnerable period of mental health in women's lives due to the intense psychological and biological changes occurring during this period, which are translated into impairments in social interactions and changes in social status related to gender role socialization (Marcus, 2009). Future studies and interventions should aim to include the wide range of pregnancy symptoms and not only focus on specific symptoms to reduce the impact of pregnancy-related symptoms on pregnant women's HRQoL.

Age was identified as an independent predictor of the PCS of HRQoL; in addition, clinically and significantly lower PCS scores were found in older groups of pregnant women compared to younger groups. These results are consistent with those of previous studies(Li et al., 2012; Vilagut et al., 2008) and could be explained by the fact that older pregnant women are more likely to have impaired physical health than younger pregnant women(Li et al., 2012) due to the established high frequency of health problems, such as gestational diabetes, chronic hypertension, placenta previa or

miscarriage(Khalil et al., 2013). Although age was not identified as an independent predictor of the MCS of HRQoL, younger pregnant women presented lower MCS scores than older pregnant women, consistent with findings from previous studies(Li et al., 2012). This finding may be due to the high stress levels perceived by younger pregnant women, given the changes produced in their lives by expecting a child, and emotional immaturity and economic dependency may be more often a characteristic of younger pregnant women than older pregnant women(Kelly et al., 2016). In this sense, older pregnant women have had more life experiences and that may have helped them developed better coping methods that they can use address emotional problems(Li et al., 2012).

With regard to physical activity, time spent in light-intensity activities was identified as an independent predictor of the MCS of HRQoL; however, we did not find associations with MVPA, consistent with findings from previous studies in pregnant women(Bahadoran and Mohamadirizi, 2015) and female adults(Shibata et al., 2007). This finding may indicate the necessity of taking into account light-intensity activities in the assessment of the physical activity levels and patterns of pregnant women, supported by the high prevalence of light-intensity physical activities in pregnant women's daily lives, which can be explained by pregnant women's selection of less-demanding activities during pregnancy in order to compensate for the increase in basal energy expenditure(Melzer et al., 2009). Only the time spent in vigorous-intensity activities and days meeting MVPA recommendations presented significant correlations with the PCS of HRQoL, but these associations did not remain significant in the multiple regression model. The lack of association between MVPA levels and HRQoL is consistent with findings from previous studies in pregnant women(Bahadoran and Mohamadirizi, 2015) and female adults(Shibata et al., 2007). This result highlights that meeting the recommended physical activity volume recommendations is not enough for women to perceive significantly better HRQoL. A dose-response of the number of days fulfilling the physical activity recommendation may be related to a better physical component of HRQoL, but further studies that assess this association and confirm these statements are needed.

Our results indicated that mean scores of all SF-36 domains were lower and exceeded the threshold for determining clinically relevant differences(Norman et al., 2003) than values found in healthy pregnant women at the second trimester(Förger et al., 2005), except for emotional role. These discrepancies

could be explained because the previous study(Förger et al., 2005) included a higher percentage of nulliparous than parous pregnant women, while in our study, the percentages of each were similar. It has been established that nulliparous pregnant women report higher scores of HRQoL than parous pregnant women(Li et al., 2012). Consistent with a previous study(Li et al., 2012), our participants reported low scores on the physical role and vitality domains, indicating the highest impairment at the second trimester of pregnancy and suggesting the need to focus health care interventions on these specific domains. Compared with normative data for age-matched healthy adult women(Vilagut et al., 2008), we found clinically relevant lower scores for the PCS in pregnant women than in healthy adult women. However, the MCS did not present clinically relevant differences. In contrast with the scores revealed in healthy age-matched adult women(Vilagut et al., 2008), pregnant women presented higher scores on the mental than the physical component of HRQoL. These statements highlight the substantial impairment of physical health caused by pregnancy(Álvarez Silvares et al., 2008), and the importance of the development of multi-dimensional interventions in routine health care during pregnancy focused on the amelioration of this impairment.

According to the differences between stratified groups, our findings were consistent with different studies that found that pregnant women who were parous(Li et al., 2012), currently overweight and obese(Sahrakorpi et al., 2017), non-workers, and of non-tertiary educational level(Rezaei et al., 2016) presented clinically and significantly lower PCS scores than their counterparts. The low PCS scores found in the multiparous group can be explained by the fact that physical problems, such as low back and pelvic pain, were at higher risk of presentation with increased parity(Mogren and Pohjanen, 2005). The low PCS scores found in overweight and obese pregnant women can be explained by the fact that weight gain, mainly fat mass, decreases relative CRF, and consequently, obese pregnant women require increased physical effort for daily living activities. In this line of findings, a previous study indicated a greater decline of HRQoL during pregnancy in an obese and overweight group than in a normal weight group(Sahrakorpi et al., 2017). The low PCS scores found in groups of pregnant women who were non-workers or who had tertiary education levels could be explained by the fact that a high level of education may enable women to have more knowledge about the anatomical changes and difficulties in movement caused by pregnancy(Dallmann et al., 2017), and these women may

interpret these changes not as impairments in the PCS, but rather as normal aspects of pregnancy. Meanwhile, pregnant women on sick leave from work were included in our group of non-workers; these women had impaired physical health that may have worsened their PCS scores.

Strengths and limitations

A strength of this study is the objective measurement of physical activity using a validated device in pregnant women(Smith et al., 2012). The preferential use of objective measures is important to improving our understanding of the associations between physical activity and HRQoL in pregnant women, thus enhancing the precision of the self-reported physical activity measurements used in previous studies(Kolu et al., 2014). The strict analysis of Sensewear data, which included only pregnant women who wore the monitor more than 95% of the day during seven completed days, strengthens the objective measurement of daily activity. Another strength of this study is the establishment of values of the SF-36 for pregnant women at midpregnancy, stratified by sociodemographic, physical, and clinical variables, which allows the detection of high-risk groups, which can then be targeted by prenatal interventions.

The present study is not without limitations. The cross-sectional design precludes the description of the evolution of the main outcomes along the course of pregnancy, and avoids the identification of any relationships between outcomes at different stages of the pregnancy. Future studies should analyze the determinants of HRQoL among pregnant women at later stage of pregnancy and conduct longitudinal analysis over the course of the pregnancy. Another limitation is the exclusion of high-risk pregnant women and the inclusion only of pregnant women who met eligibility criteria and voluntarily participated, which could result in self-selection bias. In the stratified group analysis, age and occupational status groups did not present similar percentages of pregnant women, which could have limited statistical power. However, the low percentage of younger pregnant women in the present study can be explained by the fact that the median age of pregnant women in Spain was 32.4 years old(Instituto Nacional de Estadística del Gobierno de España, 2015).

Conclusion

To conclude, younger age, a lower level of musculoskeletal symptoms, and a high level of cardiorespiratory fitness contribute to an increased physical component of HRQoL in pregnant women

at midpregnancy. Low levels of psychological and musculoskeletal symptoms and high levels of light-intensity physical activities contribute to an increased MCS of HRQoL in pregnant women at midpregnancy. Pregnant women who are older, parous, of non-tertiary educational backgrounds, non-workers, overweight and obese, experiencing high numbers of pregnancy symptoms, and have low CRF levels are at high risk of low levels on the physical component of HRQoL. Younger pregnant women and those with high numbers of pregnancy symptoms are at high risk of low levels on the mental component of HRQoL.

Prenatal care must focus on these HRQoL determinants and high-risk groups of pregnant women. Modifiable determinants of HRQoL, such as poor cardiorespiratory fitness and inactive lifestyles, may be important areas to target in interventions aimed at promoting HRQoL in women at midpregnancy. Greater knowledge will likely help to improve multidisciplinary treatment and, consequently, the HRQoL of women at midpregnancy.

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Table 1. Demographic characteristics of the sample (n=134).

Variables		Mean (SD)
Age (years old)		32.5 (4.2)
Pre-pregnancy BMI (kg·m^{-2})		24.9 (4.4)
Current BMI (kg·m^{-2})		26.5 (4.5)
Parity (number of daughter)		0.5 (0.6)
Light activity (h·d^{-1})		5.2 (1.4)
Moderate activity (min·wk^{-1})		609.5 (284.1)
Vigorous activity (min·wk^{-1})		2.9 (8.9)
Light to vigorous activity (min·d^{-1})		398.1 (106.7)
MVPA in ≥10-min bouts (min·wk^{-1})		255.5 (199.8)
Days meeting ≥30 min if MVPA in ≥10-min bout (d/wk^{-1})		3.0 (2.1)
		N (%)
Ethnicity		
Caucasian		134 (100)
Age		
18-30 years old		33 (24.6)
31-44 years old		101 (75.4)
Pre-pregnancy BMI		
<25 kg/m^2		77 (57.5)
>25 kg/m^2		57 (42.5)
Current BMI		
<25 kg/m^2		65 (48.5)
>25 kg/m^2		69 (51.5)
Marital status		
Single without couple		2 (1.5)
Single with couple		39 (29.1)
Married		91 (67.9)
Divorced or separated		2 (1.5)
Parity		
0		72 (53.7)
≥1		62 (46.3)
Highest level of education		
Non-Tertiary		72 (53.7)
Tertiary		62 (46.3)
Occupational status*		
Workers		85 (63.4)
Non-workers	Unemployed	28 (20.9)
	Sick leave from work	19 (14.2)
MVPA recommendations		
Inactive		99 (73.9)
Active		35 (26.1)

*Two student excluded of occupational status.
Abbreviations. BMI: Body Mass Index,

Table 2. Associations between HRQL scores and the rest of variables in pregnant women at midpregnancy (n=134).

	Physical Function (0-100)	Physical Role (0-100)	Pain (0-100)	General Health (0-100)	Vitality (0-100)	Social Function (0-100)	Emotional Role (0-100)	Mental Health (0-100)	Physical Component Summary (0-100)	Mental Component Summary (0-100)
Sociodemographic										
Age (yr)	-0.19 *	-0.17	-0.09	-0.10	-0.12	-0.04	-0.04	0.05	-0.21 *	0.06
Parity	-0.05	-0.17 *	-0.23 **	-0.16	-0.22 *	-0.06	0.01	0.01	-0.22 *	0.01
Pre-pregnancy BMI (kg·m^{-2})	-0.22 *	-0.03	0.05	-0.22 *	-0.05	-0.20 *	-0.00	-0.07	-0.11	-0.08
Current BMI (kg·m^{-2})	-0.28 ***	-0.09	0.01	-0.20 *	-0.06	-0.18 *	-0.08	-0.05	-0.16	-0.07
Physical activity categories										
Light activity (h·d^{-1})	0.14	0.22 *	0.09	0.13	0.07	0.23 **	0.18 *	0.14	0.14	0.16 *
Moderate activity (min·d^{-1})	0.13	0.08	0.04	0.16	0.09	0.16	0.07	0.07	0.09	0.11
Vigorous activity (h·d^{-1})	0.24 **	0.20 *	-0.02	0.22 *	-0.01	0.10	-0.08	0.05	0.26 **	-0.02
Physical activity summaries										
Light to vigorous activity (min·d^{-1})	0.19 *	0.20 *	0.08	0.17 *	0.09	0.27 **	0.17 *	0.13	0.15	0.17 *
Moderate to vigorous activity in ≥10-min bouts (min·d^{-1})	0.16	0.05	0.06	0.16	0.07	0.11	0.02	0.05	0.14	0.03
Meeting ≥ 30 minutes of MVPA in ≥10-min bouts (d·wk^{-1})	0.20 *	0.07	0.06	0.16	0.12	0.07	0.03	0.06	0.17 *	0.03
Pregnancy-related symptoms										
Total Symptoms	-0.32 ***	-0.31 ***	-0.33 ***	-0.16	-0.42 ***	-0.31 ***	-0.31 ***	-0.35 ***	-0.30 ***	-0.38 ***
Musculoskeletal symptoms	-0.27 ***	-0.24 **	-0.41 ***	-0.18 *	-0.35 ***	-0.14	-0.28 ***	-0.23 **	-0.30 ***	-0.23 **
Dermatological symptoms	-0.20 *	-0.12	-0.15	-0.09	-0.18 *	-0.15	-0.21 *	-0.17 *	-0.14	-0.19 *
Urogenital symptoms	-0.17	-0.22 ***	-0.11	-0.07	-0.30 ***	-0.15	-0.15	-0.14	-0.16	-0.20 *
Gastrointestinal symptoms	-0.27 ***	-0.15	-0.11	-0.10	-0.20 *	-0.26 **	-0.10	-0.28 ***	-0.17 *	-0.24 **
Cardiovascular and Respiratory symptoms	-0.19 *	-0.25 **	-0.17 *	-0.08	-0.26 **	-0.21 *	-0.13	-0.23 **	-0.20 *	-0.24 **
Neurological symptoms	-0.03	-0.11	-0.22 **	0.03	-0.12	-0.01	-0.03	0.05	-0.17	0.00
Psychological symptoms	-0.19 *	-0.22 **	-0.22 **	-0.08	-0.32 ***	-0.24 **	-0.25 **	-0.31 ***	-0.18 *	-0.33 ***
Cardiorespiratory fitness										
6MWT distance covered (m)[a]	0.34 ***	0.24 **	0.23 **	0.24 **	0.16	0.23 **	-0.02	0.10	0.37 ***	0.03

Correlation values are either Pearson or Spearman correlation.
*p<0.050.
**p<0.010.
***p<0.001.
[a] One pregnant women excluded due to incomplete data.

Table 3. HRQOL scores in pregnant women at midpregnancy and classified by stratified variables.

	n	Physical function (0-100)	Physical Role (0-100)	Pain (0-100)	General Health (0-100)	Vitality (0-100)	Social Function (0-100)	Emotional Role (0-100)	Mental Health (0-100)	PCS (0-100)	MCS (0-100)
All	134	73.7 ± 16.7	65.2 ± 26.2	67.5 ± 21.7	74.7 ± 15,8	52,8 ± 14,7	80,1 ± 20,5	91,4 ± 16,6	75,3 ± 16,1	45,4 ± 7,7	51,7 ± 8,2
Age											
≤30 years old	33	76.5 ± 17.5	74.8 ± 27.6	70.9 ± 21.4	77.4 ± 17,7	53,8 ± 17,7	79,5 ± 21,2	88,6 ± 21,0	71,1 ± 20,3	48,8 ± 8,0	49,1 ± 9,8
>30 years old	101	72.8 ± 16.4	62.1 ± 25.1	66.4 ± 21.8	73.9 ± 15,1	52,5 ± 13,7	80,3 ± 20,3	92,3 ± 14,9	76,7 ± 14,3	44,3 ± 7,4	52,5 ± 7,5
p value		0.264	0.015	0.301	0.266	0.674	0.851	0.269	0.079	0.003	0.037
Parity											
Nulliparous	72	75.1 ± 14.9	68.8 ± 26.5	71.1 ± 21.3	77.0 ± 15,5	55,3 ± 15,6	80,6 ± 21,7	91,4 ± 16,4	74,7 ± 16,8	47,0 ± 7,2	51,4 ± 8,8
Parous	62	72.1 ± 18.5	61.1 ± 25.4	63.2 ± 21.6	72.0 ± 15,8	50,0 ± 13,1	79,6 ± 19,1	91,4 ± 16,9	76,1 ± 15,4	43,5 ± 8,0	52,0 ± 7,6
p value		0.305	0.091	0.035	0.067	0.037	0.797	0.990	0.599	0.009	0.633
Pre-pregnancy BMI											
<25 kg/m^2	77	74.9 ± 18.1	65.0 ± 27.7	65.6 ± 20.6	77.5 ± 13,3	52,8 ± 15,6	83,6 ± 18,7	90,5 ± 17,9	75,5 ± 16,8	45,7 ± 8,2	51,9 ± 8,7
≥25 kg/m^2	57	72.1 ± 14.5	65.5 ± 24.3	70.0 ± 23.1	71.0 ± 18,1	52,9 ± 13,5	75,4 ± 21,9	92,7 ± 14,7	75,1 ± 15,3	45,0 ± 7,1	51,4 ± 7,7
p value		0.344	0.923	0.241	0.019	0.997	0.022	0.447	0.879	0.598	0.723
Current BMI											
<25 kg/m^2	65	78.3 ± 15.7	68.6 ± 28.1	68.0 ± 20.1	78.2 ± 12,8	53,9 ± 16,1	86,2 ± 18,0	91,7 ± 17,0	75,5 ± 17,2	47,1 ± 7,9	51,9 ± 8,8
≥25 kg/m^2	69	69.3 ± 16.4	62.0 ± 24.0	66.9 ± 23.3	71.5 ± 17,6	51,8 ± 13,3	74,5 ± 21,2	91,2 ± 16,4	75,2 ± 15,1	43,8 ± 7,2	51,4 ± 7,8
p value		0.002	0.151	0.767	0.014	0.404	0.001	0.867	0.931	0.012	0.723
Occupational status*											
Workers	83	75.1 ± 15.8	72.5 ± 23.1	69.8 ± 19.7	76.4 ± 14,8	53,3 ± 15,0	83,3 ± 18,0	93,8 ± 13,6	77,5 ± 14,5	46,7 ± 6,7	52,6 ± 6,8
Non-workers	49	70.8 ± 18.0	52.0 ± 26.3	62.8 ± 24.3	73.0 ± 16,6	52,6 ± 14,1	76,3 ± 22,7	88,9 ± 18,9	73,2 ± 16,7	42,7 ± 8,6	51,2 ± 8,7
p value		0.154	<0.001	0.077	0.227	0.773	0.053	0.091	0.122	0.004	0.321
Educational level											
Non-tertiary	72	71.5 ± 18.2	61.6 ± 27.0	63.7 ± 22.5	73.0 ± 16,7	51,3 ± 15,3	79,2 ± 20,7	90,6 ± 17,5	73,2 ± 15,8	44,1 ± 8,3	51,2 ± 8,0
Tertiary	62	76.3 ± 14.4	69.4 ± 24.8	71.9 ± 20.1	76.7 ± 14,5	54,6 ± 13,9	81,3 ± 20,3	92,3 ± 15,6	77,8 ± 16,3	46,9 ± 6,8	52,2 ± 8,6
p value		0.094	0.089	0.030	0.172	0.192	0.559	0.553	0.098	0.038	0.467
Light activities											
<5 h/d	64	72.8 ± 14.7	61.4 ± 26.1	64.5 ± 22.1	71.7 ± 17,3	51,8 ± 13,6	75,8 ± 21,8	90,2 ± 17,4	72,4 ± 17,9	44,4 ± 7,5	50,4 ± 9,3
≥5 h/d	70	74.5 ± 18.4	68.7 ± 25.9	70.2 ± 21.1	77.5 ± 13,7	53,8 ± 15,7	84,1 ± 18,4	92,5 ± 15,9	78,0 ± 13,9	46,3 ± 7,9	52,8 ± 7,1
p value		0.560	0.110	0.129	0.032	0.415	0.018	0.432	0.045	0.165	0.091
MVPA recommendations											
<5 d/wk with at least 30 min/d	99	72.8 ± 16.5	66.3 ± 24.7	68.4 ± 22.0	73.5 ± 16,3	52,5 ± 14,2	80,6 ± 20,0	92,0 ± 16,1	76,2 ± 14,9	45,2 ± 7,0	52,0 ± 7,3
≥5 d/wk with at least 30 min/d	35	76.1 ± 17.1	62.1 ± 30.0	64.8 ± 21.0	78.2 ± 13,9	53,8 ± 16,2	78,9 ± 22,0	89,8 ± 18,2	72,9 ± 19,2	45,9 ± 9,6	50,6 ± 10,5
p value		0.313	0.423	0.395	0.127	0.674	0.688	0.494	0.292	0.631	0.382
Cardiorespiratory Fitness**											
<555 m	66	69.1 ± 16.9	59.5 ± 28.1	63.9 ± 23.0	71.5 ± 15,9	50,7 ± 13,1	77,5 ± 20,7	90,5 ± 18,0	75,0 ± 13,9	43,0 ± 7,7	51,7 ± 7,2
≥555 m	67	77.9 ± 15.2	70.6 ± 23.1	70.5 ± 19.8	77.7 ± 15,2	54,7 ± 15,9	82,5 ± 20,1	92,2 ± 15,3	75,4 ± 18,2	47,6 ± 7,1	51,5 ± 9,2
p value		0.002	0.014	0.079	0.022	0.115	0.160	0.573	0.874	0.001	0.889
Number of pregnancy symptoms											
<11 symptoms	68	76.5 ± 16.9	72.1 ± 24.3	71.9 ± 21.6	77.9 ± 14,0	58,5 ± 14,5	86,2 ± 16,6	96,3 ± 11,3	80,4 ± 13,7	46,8 ± 7,7	54,6 ± 6,2
≥11 symptoms	66	70.8 ± 16.0	58.1 ± 26.4	62.9 ± 21.0	71.5 ± 16,9	47,1 ± 12,7	73,9 ± 22,2	86,4 ± 19,5	70,2 ± 16,8	43,9 ± 7,5	48,7 ± 9,0
p value		0.044	0.002	0.015	0.019	<0.001	<0.001	<0.001	<0.001	0.031	<0.001

Correlation values are either Pearson or Spearman correlation.
* Two student excluded of occupational status.
** One pregnant women excluded due to incomplete data.

VII

Pregnancy symptoms and their impact on health-related quality of life at midpregnancy: The PregnActive project.

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Submitted.

Abstract

Aim

To analyze the impact of pregnancy symptoms on health-related quality of life (HRQoL) and to identify the main determinants of physical and mental component of HRQoL at midpregnancy.

Materials and methods

A cross-sectional study was conducted in 155 pregnant women at mid-pregnancy. HRQoL was assessed using the SF-36 questionnaire. Pregnancy-related symptoms were assessed using the Pregnancy Symptoms Inventory. Simple correlations, hierarchical linear regressions and standard multiple regressions were performed.

Results

After adjustment for age, parity, body mass index and sum of skinfold thickness, significant correlations were found between the physical component of HRQoL and pregnancy symptoms as back pain, carpal tunnel syndrome, hip or pelvic pain, shortness of breath, tiredness or fatigue, nausea, vomiting and leg cramps. Mental component of HRQoL was correlated with pregnancy symptoms as feeling depressed, anxiety, incontinence, heart palpitations, stretch marks, poor sleep, nausea, vomiting, hip or pelvic pain, and breast pain.

When all variables were entered simultaneously in a multiple regression model, back pain and shortness of breath on the physical component, and feeling depressed and anxiety on the mental component were identified as significant determinants of HRQoL.

Conclusions

Pregnancy-related symptoms have a negative impact on pregnant women's HRQoL. Back pain and shortness of breath, and feeling depressed and anxiety are the main determinants of the physical and mental aspects of HRQoL at midpregnancy, respectively.

Keywords: health-related quality of life, pregnancy, pregnancy-related symptoms, prenatal care, prenatal diagnosis.

Introduction

Pregnancy implies the appearance of physical and psychological symptoms reflecting the anatomical, physiological and psychological changes occurred during gestation[1]. The most frequent symptoms reported during normal pregnancy were increased urinary frequency, tiredness or fatigue, poor sleep, and back pain[1–3].

Pregnancy-related symptoms produce an impairment on pregnant women's health that limits the activities of their daily life[4,5]. This impairment on health resulting in lower level of health-related quality of life (HRQoL) perceived by pregnant women compared to non-pregnant women of similar age[6], specifically in physical functioning, which is the main aspect of HRQoL affected by normal pregnancy[6,7]. HRQoL levels presented a decline during the course of normal pregnancies[8], that highlight the importance of the identification of the aspects that affected it, in order to establish health care interventions with the aim to ameliorate this decline.

Individual pregnancy symptoms as incontinence[9], regurgitation[10], depression[11,12], anxiety[11], nausea and vomiting[13] or low back pain[14] have shown to be associated with low quality of life levels. The majority of the studies have been focused on individual symptoms[9–14] and did not assess the wide range of pregnancy symptoms[1–3].

The limited use of pharmacological treatments during pregnancy due to their effects on fetus development emphasizes the importance of the identification of the pregnancy symptoms that affect pregnant women`s HRQoL[15], in order to establish an early detection and develop effective non-pharmacologic treatments.

The aims of this study were 1) to analyze the associations between pregnancy-related symptoms and health-related quality of life and 2) to identify the pregnancy-related symptoms with greater impact on health-related quality of life perceived by pregnant women at midpregnancy.

Materials and methods

At the first prenatal care visit from health clinic of the Sanitary Area of Seville (Spain), healthy pregnant women, aged 18-45 years old, were recruited and written informed consent were obtain after receiving detailing information about the study aims and protocol. The exclusion criteria were physical illnesses or disabilities that affected their normal daily routine and high-risk pregnancy (i.e., diabetes

or hypertension). The study protocol obtained ethical approval from the Medical Research Ethics Committee of the University Hospital Virgen del Rocio (Seville, Spain) in accordance with the Declaration of Helsinki. The STROBE guidelines were followed during the course of the study[16].

The study protocol was performed coinciding with the second trimester prenatal care visit at health clinics. Sociodemographic and anthropometrical characteristics were evaluated following the standard procedures using a calibrated digital scale (Tanita Corporation, Tokio, Japan) and a stadiometer (Seca 780, Hamburg, Germany) and body mass index (BMI) was calculated (kg/m2). Skinfold thickness (biceps, triceps, subscapular and supra-iliac), previously used in pregnant women[17], were measured to nearest millimeter using calipers (Holtain, Crymich, UK) on the right-hand side of the body by the same trained evaluator. The sum of the four skinfold thicknesses was used as an indicator of total body fat. In this session health-related quality of life and pregnancy-related symptoms were assessed using standardized questionnaires.

The Medical Outcome Study 36-item short form (SF-36) is a HRQoL questionnaire that offers a basic understanding of the health status, have a high internal consistency and their psychometric properties have been analyzed satisfactorily among pregnant women[18]. The Spanish version also has good psychometric properties[19]. This tool contains eight domains and two summaries, the physical component summary (PCS) and the mental component summary (MCS) which explain 80 to 85% of the variance in the eight domains. The scores of SF-36 are transformed to a 0-to-100 scale, where the higher score represent the best HRQOL. The mean score for the general population is 50, with a standard deviation of 10 points.

Pregnancy Symptoms Inventory is a 41-item Likert inventory, successfully validated in pregnant women[2], that assesses how often symptoms occurred and what effect they had. The Spanish version of this tool was used[3]. For each symptom pregnant women must choice between four options of frequency (never/rarely/sometimes/often). This resulted in a 0-3 scale where low scores presented low prevalence and high scores presented high prevalence.

Statistical analysis

Statistical tests were performed using the Statistical Package for the Social Sciences version 20 (IBM Corp., Armonk, NY) with significance set at $P<0.05$.

To quantify relationships between health-related quality of life and pregnancy symptoms, Spearman correlations coefficients were used. Correlations were corrected for confounders previously used in pregnant women[20] as age, parity, BMI, and sum of skinfold thickness.

A series of hierarchical multiple regression analyses were computed to test the importance of pregnancy-related symptoms, after controlling for sociodemographic variables. A standard multiple regression analysis was then performed with all the variables entered simultaneously into the model to determine the relative contributions of these variables to HRQoL. Variables were selected based on the theoretical relevance, a pattern of correlation with the outcome variable and other potential predictor variables, following the assumptions underlying multiple regression analysis.

Results

One-hundred fifty-five pregnant women, mean age of 32.1±4.4 years old, were included in the study sample and their sociodemographic characteristics are presented in the Table 1. Pregnant women perceived, with frequency of sometimes and often, a mean number of 11.6±5 symptoms. Pregnancy symptoms with high percentage of reports were urinary frequency, tiredness or fatigue, and poor sleep, 85.8, 69.7 and 61.3%, respectively (data not show). The mean scores of the PCS of HRQoL were significantly lower than the MCS scores (P<0.001), 44.8±7.9 and 52.1±8.3 points, respectively.

Table 2 presents simple correlations of sociodemographic and anthropometric characteristics, and individual pregnancy symptoms with HRQoL scores. Significant negative associations were found between the PCS of HRQoL and parity, sum of skinfold thickness, and nine pregnancy symptoms. After adjustment for age, parity, BMI and sum of skinfold thickness, correlations remained significant for back pain, carpal tunnel syndrome, hip or pelvic pain, shortness of breath, tiredness or fatigue, vomiting, and leg cramps (r = -0.16 to -0.34, all P<0.050; data not shown). The MCS of HRQoL presented significant negative associations with nineteen pregnancy symptoms. After adjustment for age, parity, BMI and sum of skinfold thickness, correlations remained significant for feeling depressed, anxiety, incontinence, heart palpitation, stretch marks, poor sleep, nausea, vomiting, hip or pelvic pain, and breast pain (r = -0.16 to -0.48, all P<0.050; data not shown). Six symptoms presented significant associations with both components of HRQoL, after controlling for confounders only hip or pelvic pain and vomiting remaining significant on both components.

The results of the hierarchical multiple regression analyses for the PCS are shown in Table 3. The first model tested the contribution of sociodemographic variables to the PCS of HRQoL and was statistically significant (P=0.031), contributing parity to poor PCS of HRQoL (P=0.024). The addition of anthropometry (model 2), gastrointestinal symptoms (model 6), cardiovascular and respiratory symptoms (model 7), neurological symptoms (model 8) and psychological symptoms (model 9) significantly added to the sociodemographic set (P<0.050). Parity only (model 2 and model 6), and together with shortness of breath (model 7), carpal tunnel syndrome (model 8), and tiredness or fatigue (model 9) were identified as contributors to poor PCS of HRQoL (P<0.050). The addition of musculoskeletal symptoms (model 3) significantly added to the demographic set, contributing only back pain to poor PCS of HRQoL (P=0.002). In the standard multiple regression model for the PCS of HRQoL, where all the variables were entered simultaneously ($F_{13,141}$=4.19, R^2=0.28, P<0.001), only back pain (P=0.007) and shortness of breath (P=0.017) remained as significant determinants of the PCS of HRQoL (Table 3).

Table 4 presents the results of the hierarchical multiple regression analyses for the MCS. The first model tested the contribution of sociodemographic variables to the MCS of HRQoL and was not statistically significant (P=0.583). The addition of dermatological symptoms (model 4), urogenital symptoms (model 5), cardiovascular and respiratory symptoms (model 7) and psychological symptoms (model 9) significantly added to the demographic set (P<0.050). Stretch marks (model 4), incontinence (model 5), heart palpitation (model 7), and feeling depressed and anxiety (model 9) contributed significantly to poor MCS of HRQoL (P<0.050). In the standard multiple regression model for the MCS of HRQoL (Table 4), where all the variables were entered simultaneously ($F_{23,131)}$=3.98, R^2=0.41, P<0.001), only anxiety (P=0.022) and feeling depressed (P<0.001) remained as significant determinant of MCS of HRQoL.

Comment

This study explores the impact of pregnancy symptoms on HRQoL perceived by pregnant women at midpregnancy. Several pregnancy symptoms showed significant negative associations with both physical and mental component of HRQoL. Back pain and shortness of breath for the PCS, and feeling depressed and anxiety for the MCS were identified as determinants of HRQoL.

Our results identified back pain, a musculoskeletal symptom, and shortness of breath, a respiratory symptom, as determinants of the PCS of HRQoL. Consistent with findings from previous study, back pain presented the greatest impairment on the PCS of HRQoL[14]. The influence of back pain on the PCS of HRQoL could be explain by their high incidence at midpregnancy[21], and by their etiology, which is associated with biomechanical, hormonal, and vascular changes occurred during pregnancy that involve the development of altered posture, ligamentous laxity and fluid retention within connective tissues[22]. These changes make back pain the most common reason of sick leave during pregnancy[23], due to the impairment that produces in daily living activities as the limitation on the endurance capacity while bipedal position and walking[24]. An early detection of back pain is essential in order to limit their negative impact in the daily activities of pregnant women; in addition, due to their etiology, strategies that counteract the biomechanical, hormonal and vascular changes of pregnancy may prevent the apparition of back pain at midpregnancy and their amelioration of the physical health.

Also shortness of breath was identified as a significant determinant of PCS of HRQoL. Findings from previous studies established shortness of breath as a prevalent symptoms at midpregnancy[25] produced by mechanical compression of the lungs, displacement of the diaphragm by the gravid uterus, the reduction of diffusion lung capacity, and the effect of gestational hormones on the drive to breath[26,27]. Related with this changes, the ventilation is increased and the work capacity of the aerobic system during pregnancy decrease[28], supposing a limitation in the development of daily activities of pregnant women. Aerobic exercise interventions have shown effectiveness to ameliorate this decline of the cardiorespiratory work capacity, also providing health benefits to pregnant women and fetus[29,30]. Additionally respiratory muscle training have been proposal as a successful method to improve respiratory muscle performance in obese adults[31], which also suffer the mechanical compression of lungs and the greater work of breathing similarly to pregnant women.

Parity, carpal tunnel syndrome, and tiredness or fatigue significantly contributed to poor PCS of HRQoL, but did not remain significant in the standard multiple regression model, suggesting that the importance of these variables on PCS can be explained by the interaction with back pain or shortness of breath. Findings from previous studies confirm this interaction, establishing parity as a risk factor

for developing back pain during pregnancy[32], the influence of hormonal changes on the development of back pain[22] and carpal tunnel syndrome[33], and the aforementioned decline of work capacity that increased the perceived effort developed on daily activities and the consequent fatigue produced. An early detection of a wide range of pregnancy symptoms is essential in order to establish multidimensional interventions aimed to ameliorate their impairment on the PCS of HRQoL of pregnant women.

Psychological symptoms as feeling depressed and anxiety were identified as the most significant determinants of the MCS of HRQoL, coinciding with the findings from previous studies[11,12]. This findings could be explained by the rapid fluctuation in hormone levels during pregnancy that increase the prevalence of mood disorders during this time and make pregnancy as a vulnerable period of mental health[34]. These changes are translated into impairments on emotional functioning that affect women's perception of their mental and social interactions[11]. In addition, expecting a child supposes a modification of the social status of women, related to gender role socialization[34], that could be translated in mood and mental disorders due to emotional immaturity or economic dependency of pregnant women. This negative impact of psychological symptoms on the MCS of HRQoL and the established relationship of poor emotional functioning with pregnancy complications as increased fetal distress, increased risk of preterm birth, and increased prenatal resource use, make necessary interventions that ameliorate this impairment on mental health. Educational interventions are shown to be an effective treatment on the attenuation of the mental disorders during pregnancy[35]. In addition, alternative exercise therapies, as yoga, have shown effectiveness in the reduction of depression and anxiety incidence during pregnancy[36].

Also stretch marks, incontinence, and heart palpitation significantly contributed to poor MCS of HRQoL, but did not remain significant in the standard multiple regression model suggesting that the interaction with psychological symptoms could explain their importance on the MCS. Findings from previous studies confirm these interactions, heart palpitations could be perceived by pregnant women due to an exaggerated increase of heart rate which have an negative impact in the psychological aspects of pregnant women's daily life[37]. Incontinence and stretch marks have been demonstrated to produce emotional and psychological distress among pregnant women[38,39]. An early detection of a

wide range of pregnancy symptoms is necessary in the prenatal care routine in order to develop effective non-pharmacologic treatments that reduce this negative impact on mental health.

Consistent with findings from previous studies urinary frequency, tiredness or fatigue, and poor sleep were the individual symptoms with high percentage of pregnant women that reported them[1–3]. In line with our findings, previous studies presented lower scores on the PCS than the MCS of HRQoL[6,7] perceived by pregnant women. The fact that the PCS scores are higher than the MCS scores in age-matched healthy adult women[19], highlighting the substantial impairment that pregnancy produces in the physical health of women.

Our findings highlight that when there is an evaluation of the wide range of pregnancy symptoms, the association of several symptoms with HRQoL could be explain by the interaction between them. The assessment of the wide range of pregnancy symptoms is an important aspect to target in interventions aimed to promoting HRQoL in women at midpregnancy and support the need to develop a multidisciplinary approach in the treatment of pregnancy symptoms in order to reduce their impact on pregnant women's perceived health. Future researches should assess the effectiveness of a multidisciplinary intervention in order to ameliorate the impact of the wide range of pregnancy symptoms on HRQoL and daily living activities of pregnant women.

This study is not without limitations. The cross-sectional design precludes the description of the evolution of the main outcomes along the course of pregnancy, and avoids the identification of any relationships between outcomes at different stages of the pregnancy. Future studies should analyze the impact of pregnancy symptoms on HRQoL at different stages of pregnancy using a longitudinal design. The inclusion only of healthy low-risk pregnant women with low-risk pregnant women and the voluntary participation could result in self-selection bias. Studies that focused on high-risk pregnant women also would contribute to a better knowledge of the determinants of HRQoL during pregnancy.

A strength of this study is the analysis of the impact of the wide range of pregnancy symptoms on pregnant women's HRQoL. Contrarily with the individual focus that the majority of the literature has used, the analysis of a wide range of pregnancy symptoms allow to identify the determinants of HRQoL, enabling the detection of interactions between them, that could explain their impact on HRQoL by its interaction and only by their association with HRQoL. The development of several

statistical tests allows makes possible the aforementioned exploration of the associations between pregnancy symptoms and HRQoL from different perspectives, detecting interactions between pregnancy symptoms that affect their relationship with HRQoL. The use of SF-36 allows the discrimination between physical and mental aspect of HRQoL and the determination of the specific symptoms that affect each one of them. Although it is an advantage, the absence of a unique summary score makes that symptoms with low influence in both domains may be identified as determinants of total HRQoL by studies which used other tools with a unique score, as WHOQoL-BREF.

Conclusion

Pregnancy-related symptoms have a negative impact on pregnant women's HRQoL. Back pain, a musculoskeletal symptom, and shortness of breath, a respiratory symptom, are the main determinants of the PCS of HRQoL. Psychological symptoms as feeling depressed and anxiety are the main determinants of the MCS. The impact of others symptoms on HRQoL could be explained by the interaction between them. An assessment of the wide range of pregnancy symptoms and multidisciplinary interventions could ameliorate the impact of pregnancy symptoms on HRQoL and daily living activities of pregnant women at midpregnancy.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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Table 1. Demographic characteristics of the sample (n = 155).

Variables		Mean (SD)
Age (years)		32.1 (4.4)
Parity (number of daughter)		0.6 (0.6)
BMI ($kg \cdot m^{-2}$)		26.2 (4.5)
Sum of skinfold thickness (mm)		60.7 (18.7)
Number of pregnancy symptoms perceived		11.6 (5.6)
Physical Component Summary of HRQoL (0-100)		44.8 (7.9)
Mental Component Summary of HRQoL (0-100)		52.1 (8.3)
		n (%)
Age		
18-30 years old		47 (30.3)
31-44 years old		108 (69.7)
BMI		
<25 kg/m^2		78 (50.3)
>25 kg/m^2		77 (49.7)
Marital status		
Single without couple		2 (1.3)
Single with couple		46 (29.7)
Married		104 (67.1)
Divorced or separated		3 (1.9)
Parity		
0		78 (50.3)
≥1		77 (49.7)
Highest level of education		
Non-Tertiary		91 (58.7)
Tertiary		64 (41.3)
Occupational status*		
Workers		92 (59.4)
Non-workers	Unemployed	39 (25.2)
	Sick leave from work	22 (14.2)

*Two student excluded of occupational status.
Abbreviations. BMI: Body Mass Index,

Table 2. Association between frequency of specific pregnancy symptoms and HRQOL scores (n = 155).

	Physical Component Summary (0-100)	Mental Component Summary (0-100)
Sociodemographic characteristics		
Age	-0.07	0.04
Parity	-0.21**	0.04
Anthropometric characteristics		
Current BMI	-0.15	-0.03
Sum of skinfold thickness	-0.17*	-0.04
Musculoeskeletical symptoms		
Restless legs	-0.22**	-0.19*
Leg cramps	-0.16*	-0.19*
Sciatica	-0.14	-0.10
Back pain	-0.34***	-0.15
Hip or pelvic pain	-0.27***	-0.16*
Dermatological symptoms		
Greasy skin/acne	0.13	-0.15
Brownish marks on face	0.03	0.01
Itchy skin	0.06	-0.19*
Stretch marks	-0.12	-0.24**
Breast pain	-0.15	-0.16*
Sore nipples	-0.14	-0.13
Changes in nipples	-0.15	-0.01
Urogenital symptoms		
Urinary frequency	-0.05	-0.06
Incontinence	-0.14	-0.25**
Increased vaginal discharge	-0.09	-0.04
Thrush	-0.09	-0.08
Painful veins in vagina	-0.09	-0.01
Gastrointestinal symptoms		
Nausea	-0.23**	-0.21**
Vomiting	-0.22**	-0.20*
Reflux	-0.06	-0.09
Constipation	0.00	-0.13
Dry mouth	-0.01	-0.17*
Food cravings	-0.08	-0.09
Cardiovascular symptoms		
Heart palpitations	-0.12	-0.24**
Varicose veins	-0.13	-0.16*
Hemorrhoids	-0.12	-0.05
Respiratory symptoms		
Shortness of breath	-0.27***	-0.10
Snoring	-0.06	-0.17*
Neurological symptoms		
Carpal tunnel syndrome	-0.29***	-0.05
Dizziness	-0.15	-0.19*
Fainting	0.03	0.00
Swollen hands or feet	-0.14	-0.14
Psychological symptoms		
Tiredness or fatigue	-0.26**	-0.20*
Poor sleep	-0.15	-0.22**
Changes in libido	-0.01	-0.05
Headache	-0.13	-0.16*
Taste/smell changes	-0.09	-0.09
Forgetfulness	-0.08	-0.11
Feeling depressed	-0.04	-0.48***
Anxiety	-0.11	-0.40***
Vivid dreams	0.02	-0.12
Altered body image	-0.06	-0.12

Correlation values are Spearman correlation.
*P<0.050.
**P<0.010.
***P<0.001.

Table 3. Results of regression models predicting Physical Component of HRQoL (n=155).

	Model 1 Sociodemographic		Model 2 Antropometric		Model 3 Musculoeskeletical symptoms		Model 4 Dermatological symptoms		Model 5 Urogenital symptoms		Model 6 Gastrointestinal symptoms		Model 7 Cardiovascular and respiratory symptoms		Model 8 Neurological symptoms		Model 9 Psychological symptoms		Full Model	
	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*
Age	-0.05	0.525	-0.03	0.717	-0.10	0.222					-0.05	0.569	-0.03	0.756	-0.04	0.612	-0.04	0.663	-0.06	0.467
Parity	-0.19	**0.024**	-0.19	**0.023**	-0.12	0.142					-0.17	**0.042**	-0.18	**0.029**	-0.16	**0.047**	-0.17	**0.036**	-0.10	0.217
BMI			0.00	0.968															0.09	0.434
Skinfold sickness			-0.16	0.175															-0.15	0.180
Restless leg					-0.08	0.345													-0.03	0.720
Leg cramps					-0.00	0.996													0.02	0.844
Back pain					-0.26	**0.002**													-0.22	**0.007**
Hip or pelvic pain					-0.16	0.063													-0.15	0.062
Nausea											-0.06	0.605							0.03	0.771
Vomiting											-0.15	0.160							-0.15	0.114
Shortness of breath													-0.23	**0.004**					-0.19	**0.017**
Carpal tunnel															-0.24	**0.003**			-0.11	0.170
Tiredness or fatigue																	-0.20	**0.014**	-0.08	0.341
R^2	0.04		0.07		0.18						0.08		0.10		0.10		0.08		0.28	
Adjusted R^2	0.03		0.04		0.15						0.06		0.08		0.08		0.06		0.21	
F	$F_{(2,152)} = 3.57$		$F_{(4,150)} = 2.78$		$F_{(6,148)} = 5.60$						$F_{(4,150)} = 3.42$		$F_{(3,151)} = 5.38$		$F_{(3,151)} = 5.61$		$F_{(3,151)} = 4.52$		$F_{(13,141)} = 4.19$	
P	$P =$ **0.031**		$P =$ **0.029**		$P <$ **0.001**						$P =$ **0.010**		$P =$ **0.002**		$P =$ **0.001**		$P =$ **0.005**		$P <$ **0.001**	

Boldface indicates statistical significance ($P<0.050$).

Table 4. Results of regression models predicting Mental Component of HRQoL (n = 155).

	Model 1 Sociodemographic		Model 2 Antropometric		Model 3 Musculoeskeletical symptoms		Model 4 Dermatological symptoms		Model 5 Urogenital symptoms		Model 6 Gastrointestinal symptoms		Model 7 Cardiovascular and respiratory symptoms		Model 8 Neurological symptoms		Model 9 Psychological symptoms		Full Model	
	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*
Age	0.09	0.313	0.09	0.282	0.06	0.483	0.04	0.600	0.06	0.456	0.09	0.271	0.15	0.081	0.06	0.444	0.05	0.468	0.01	0.925
Parity	-0.01	0.930	-0.01	0.931	0.04	0.665	0.01	0.915	0.08	0.375	0.01	0.898	-0.04	0.591	0.01	0.897	0.01	0.945	0.04	0.631
BMI			0.02	0.856															0.15	0.197
Skinfold sickness			-0.09	0.479															-0.12	0.266
Restless leg					-0.12	0.224													0.03	0.767
Leg cramps					-0.04	0.676													-0.00	0.987
Hip or pelvic pain					-0.12	0.160													0.03	0.742
Itchy skin							-0.12	0.153											-0.11	0.164
Stretch marks							-0.18	**0.025**											-0.08	0.324
Breast pain							-0.11	0.172											0.05	0.572
Incontinence									-0.24	**0.004**									-0.11	0.174
Nausea											-0.10	0.359							0.03	0.809
Vomiting											-0.10	0.356							-0.12	0.256
Dry mouth											-0.12	0.137							-0.00	0.984
Heart palpitation													-0.22	**0.007**					-0.09	0.258
Varicose veins													-0.12	0.142					-0.06	0.424
Snoring													-0.13	0.108					0.02	0.808
Dizziness															-0.14	0.097			-0.07	0.356
Tiredness or fatigue																	-0.15	0.028	-0.10	0.189
Poor sleep																	-0.06	0.404	-0.03	0.715
Headhache																	-0.01	0.893	0.09	0.237
Feeling depressed																	-0.40	<**0.001**	-0.43	<**0.001**
Anxiety																	-0.24	**0.002**	-0.19	**0.022**
R^2	0.01		0.01		0.05		0.08		0.06		0.06		0.10		0.02		0.35		0.41	
Adjusted R^2	-0.01		-0.01		0.02		0.05		0.04		0.03		0.07		0.01		0.31		0.31	
F	$F_{(2,152)}$ = 0.54		$F_{(4,150)}$ = 0.45		$F_{(5,149)}$ =1.56		$F_{(5,149)}$ =2.66		$F_{(3,151)}$ =3.23		$F_{(5,149)}$ = 2.07		$F_{(5,149)}$ = 3.293		$F_{(3,151)}$ = 1.29		$F_{(7,147)}$ =11.10		$F_{(23,131)}$ =3.98	
P	*P* = 0.585		*P* = 0.769		*P* = 0.173		*P* = **0.025**		*P* = **0.024**		*P* = 0.072		*P* = **0.008**		*P* = 0.279		*P* < **0.001**		*P* < **0.001**	

Boldface indicates statistical significance (P<0.050).

FUTURE RESEARCH DIRECTIONS

The present Doctoral Thesis provides useful, validated and transcultural adapted Spanish versions of self-reported tools for assessing a wide range of pregnancy-related symptoms, physical activity and sedentary behavior patterns among pregnant women. Since self-reported instruments have inherent characteristics, as non-invasive, relatively inexpensive and easily administrable method, future research can use the tools provided by this Doctoral Thesis for improve clinical practices, and develop epidemiologic and large population studies among pregnant women.
In addition, we carefully recommend the combined use of self-reported and objective tools in the assessment of physical activity and sedentary behavior in order to improve the knowledge about physical activity and sedentary behaviors patterns of pregnant women.

The identification of the main determinants of health-related quality of life during pregnancy allows the establishment of non-pharmacologic treatments in prenatal care with the aim to ameliorate the decline of health-related quality of life caused by the normal course of pregnancy. Future studies assessing the effectiveness of a multidisciplinary intervention in order to ameliorate the negative effect of pregnancy on health-related quality of life and daily living activities are needed.
In addition, the identification of high-risk groups of pregnant women with worse health-related quality of life will likely help to the development of researches focus on these high-risk groups, improving multidisciplinary treatments and, consequently, the HRQoL perceived by pregnant women.

In the assessment of lifestyle we wanted to specifically focus on daily activities behavior, including sedentary behaviors and physical activity in order to analyze how an active lifestyle could improve pregnancy-related symptoms and health-related quality of life perceived by pregnant women. Future research including the assessment of nutrition and alcohol and smoking habits may improve the assessment of healthy lifestyle during pregnancy and their impact on pregnancy-related symptoms and health-related quality of life during pregnancy.

Future studies including biomedical outcomes, as glucose and lipid serum levels, in the assessment of the relationship between daily activities behavior and health during pregnancy

are needed in order to improve the knowledge of the impact of objectively measured lifestyle on health during pregnancy.

The present Doctoral Thesis supports the role of physical activity and sports sciences professionals on the prenatal care supervision, highlighting the association of cardiorespiratory fitness on health-related quality of life perceived by pregnant women. Exercise programs specifically development for pregnant women is necessary to ameliorate the decline on cardiorespiratory fitness produced by the course of normal pregnancy. The assessment, prescription and direction of these exercise programs should be made by physical activity and sports sciences professionals coordinated in a multidisciplinary team compound by obstetrics and gynecology, and medical professionals.

The inclusion of strength, flexibility and agility levels on the assessment of functional fitness of pregnant women is necessary in order to improve the knowledge about the evolution of functional fitness during pregnancy and its association with health. Complementary to laboratory test, field test are important in order to guarantee the assessment of functional fitness in the majority of contexts due to its inherent characteristics as easy administration and minimal equipment requirements. In this sense, functional fitness protocols as the proposed by the Senior Fitness test may be a good possibility to assess functional fitness among pregnant women. Future research with the aim to assess the validity and reliability of functional fitness test protocols among pregnant women should be developed.

The cross-sectional design of the studies of the present Doctoral Thesis precludes the description of the evolution of the main outcomes along the course of pregnancy. Future research using longitudinal design are also needed to further understand the evolution of the association between the main outcomes at different stages of pregnancy and the predictive value of them along the course of pregnancy.

CONCLUSIONS

- Spanish version of Pregnancy Symptoms Inventory is a brief, conceptually equivalent and satisfactorily reliable tool to assess the wide range of symptoms during pregnancy. The most prevalent symptoms in Spanish pregnant women are urinary frequency, poor sleep, increased vaginal discharge and tiredness.
- Spanish version of Pregnancy Physical Activity Questionnaire is a brief and easy to interpret questionnaire with a good reliability and ability to rank pregnant women respect to their physical activity, and a poor validity compared against multi-sensor monitor.
- The main barriers to physical activity during pregnancy are related with temporal restrictions, physiological, anatomical and psychological changes-related complaints, lack of information, advice and supports, no previous habits of physical activity, adverse weather conditions, and difficulties to access to sports facilities. The main supports to physical activity during pregnancy are previous habits of physical activity, adequate information and advice, flexible schedule, and environment with sports facilities.
- Sedentary Behavior Questionnaire shows a low validity of average day sedentary time compared with multi-sensor monitor, being stronger for weekdays than for weekend days, but a strong ability to rank individuals with respect to their sedentary activities. Pregnant women experience high amount of sedentary time, approximately for the 64% of their waking hours. Women aged ≥ 30 years, with a pre-pregnancy BMI > 25 kg/m2, with tertiary education, and in their third trimester of pregnancy are identified as high-risk groups of high amount of sedentary time.
- An active lifestyle at later pregnancy, determining as meeting physical activity recommendations, has a positive effect on mental component of HRQoL. An active lifestyle, although does not avoid the apparition of psychological pregnancy-related symptoms, decreases the frequency and limitation on daily activities perceived by pregnant women which are related with better HRQoL.
- Younger age, a lower level of musculoskeletal symptoms, and a high level of cardiorespiratory fitness contribute to an increased physical component of HRQoL at midpregnancy. Low levels of psychological and musculoskeletal symptoms and high levels of light-intensity physical activities contribute to an increased mental component of HRQoL at midpregnancy. Pregnant women who are older, parous, of non-tertiary educational backgrounds, non-workers, overweight and obese, experiencing high numbers of pregnancy symptoms, and have low cardiorespiratory fitness levels are at high risk of

low levels on the physical component of HRQoL. Younger pregnant women and those with high numbers of pregnancy symptoms are at high risk of low levels on the mental component of HRQoL.

- Pregnancy-related symptoms have a negative impact on pregnant women's HRQoL at midpregnancy. Back pain, a musculoskeletal symptom, and shortness of breath, a respiratory symptom, are the main determinants of the PCS of HRQoL. Psychological symptoms as feeling depressed and anxiety are the main determinants of the MCS. The impact of others symptoms on HRQoL could be explained by the interaction between them.

CONCLUSIONES

- La versión española del Cuestionario de Síntomas del Embarazo es una herramienta breve, conceptualmente equivalente y satisfactoriamente fiable para evaluar un amplio rango de síntomas del embarazo. Los síntomas del embarazo más prevalentes en embarazadas españolas son la frecuencia urinaria, sueño alterado, secreción vaginal aumentada y cansancio.
- La versión española del Cuestionario de Actividad Física en el Embarazo es un cuestionario breve y fácilmente interpretable con una buena fiabilidad y habilidad para clasificar embarazadas respecto a su actividad física, y con baja validez comparado con un monitor multisensor.
- Las principales barreras para la práctica de actividad física durante el embarazo se relacionan con restricciones temporales, afecciones de los cambios fisiológicos, anatómicos y psicológicos del embarazo, falta de información, consejos y apoyos, no poseer hábitos previos de actividad física, condiciones atmosféricas adversas, y dificultad de acceso a entornos facilitadores para la práctica. Los principales apoyos para la práctica de actividad física durante el embarazo son poseer hábitos de actividad física previos al embarazo, poseer información y apoyos, disponer de un horario flexible, y fácil acceso a entornos facilitadores para la práctica de actividad física.
- El Cuestionario de Comportamientos Sedentarios presenta una baja validez para la media diaria del tiempo sedentario comparado con el monitor multisensor, siendo superior para los días entre semana que para los días de fin de semana, pero con una gran habilidad para clasificar individuos respecto a sus actividades sedentarias. Las embarazadas experimentan una gran cantidad de tiempo sedentario, aproximadamente el 64% de sus horas despiertas. Mujeres con edades ≥ 30 años, con un IMC pre embarazo > 25 kg/m2, con educación terciaria, y en su tercer trimestre de embarazo son identificadas como grupos de alto riesgo para grandes cantidades de tiempo sedentario.
- Un estilo de vida activo en la etapa final del embarazo, determinado por el cumplimiento de las recomendaciones de actividad física, posee un efecto positivo en el componente mental de la calidad de vida relacionada con la salud. Un estilo de vida activo, aunque no evita la aparición de síntomas psicológicos del embarazo, disminuye la frecuencia y limitación en las actividades diaria percibida por las embarazadas, lo cual se relaciona con una mejor calidad de vida relacionada con la salud.

- Una edad joven, un bajo nivel de síntomas músculo-esqueléticos, y un alto nivel de condición física cardiorrespiratoria contribuyen a un incremento del componente físico de la calidad de vida relacionada con la salud en la etapa central del embarazo. Bajos niveles de síntomas psicológicos y músculo-esqueléticos y altos niveles de actividad física de intensidad suave contribuyen a un incremento del componente mental de la calidad de vida relacionada con la salud en la etapa central del embarazo. Embarazadas con mayor edad, con hijos, con niveles educativos no terciarios, no trabajadoras, con sobrepeso y obesidad, que experimentan un alto número de síntomas del embarazo, y tienen un bajo nivel de condición física cardiorrespiratoria poseen un alto riesgo de bajos niveles en el componente físico de la calidad de vida relacionada con la salud. Embarazadas jóvenes y que perciben un alto número de síntomas del embarazo están en un alto riesgo de bajos niveles en el componente mental de la calidad de vida relacionada con la salud.
- Los síntomas del embarazo tienen un impacto negativo en la calidad de vida relacionada con la salud en la etapa central del embarazo. El dolor de espalda, un síntoma músculo-esquelético, y la dificultad respiratoria, un síntoma respiratorio, son los principales determinantes del componente mental de la calidad de vida relacionada con la salud. Síntomas psicológicos como sentimientos depresivos y ansiedad son los principales determinantes del componente mental de la calidad de vida relacionada con la salud. El impacto de otros síntomas en la calidad de vida relacionada con la salud pueden ser explicado por la interacción entre ellos.

SHORT CV [CURRICULUM VITAE ABREVIADO]

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Formación académica.

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- Máster en Actividad Física y Salud. Universidad Pablo de Olavide - Universidad Internacional de Andalucía (2011-2012).
- Estancia de investigación en Escola Superior de Desporto de Rio Maior, Rio Maior, Portugal (abril 2017-junio 2017).

Participación en proyectos de investigación.

- Niveles de condición física funcional, estilo de vida y gasto energético en embarazadas y su influencia en la sintomatología del embarazo y la calidad de vida: The Pregnactive Project. Universidad Pablo de Olavide. (2013-2017).
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ANNEXES [ANEXOS]

Original articles published on JCR journals.

I. Oviedo-Caro MA, Bueno-Antequera J, Munguía-Izquierdo D. Spanish version of Pregnancy Symptoms Inventory: transcultural adaptation and reliability. J Matern Fetal Neonatal Med. 2017; 30(18):2185-2192.

Final version of transculturally adapted questionnaires.

I. Spanish version of Pregnancy Symptoms Inventory.
II. Spanish version of Physical Activity Questionnaire.

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ORIGINAL ARTICLE

Spanish version of Pregnancy Symptoms Inventory: transcultural adaptation and reliability

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Abstract

Aim: To transcultural adapt and analyze the reliability of Spanish version of Pregnancy Symptoms Inventory (PSI) and assess the prevalence of pregnancy symptoms in Spanish pregnant women.
Materials and methods: A subsample of 120 healthy pregnant women answered the PSI twice and a sample of 280 report the prevalence and limitation of pregnancy symptoms. The reliability was examined by means of percent agreement and weighted Kappa coefficients. The prevalence of pregnancy symptoms was evaluated by the frequency of answers.
Results: Perfect and perfect-acceptable agreement was observed in 82% and 96% of the pregnant women, respectively. Weighted Kappa coefficients ranged from 0.589 to 0.889, indicating a good reliability. The most frequent symptoms perceived by Spanish pregnant women were urinary frequency, poor sleep, increased vaginal discharge and tiredness.
Conclusion: Spanish Pregnancy Symptoms Inventory is a brief, conceptually equivalent and satisfactory reliable tool that allows an early assessment of the wide range of pregnancy symptoms in the health care practices.

Keywords

Pregnancy symptoms, pregnancy discomfort, health-related quality of life, prenatal care, prenatal diagnosis

History

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Introduction

Pregnancy involves the appearance of physical symptoms that reflect the anatomical, physiological and psychological changes occurring during pregnancy, and affect pregnant women health-related quality of life [1,2]. Thirty-eight symptoms appeared during normal pregnancy have been described [3].

During pregnancy, pharmacological treatment is limited due to their effects on the fetus development [4] and nonpharmacological methods may be useful to alleviate pregnancy symptoms and discomforts [5]. An early detection of the appearance of pregnancy symptoms and the limitation on pregnant women daily life is essential to initiate an effective nonpharmacologic treatment. In this way, a specific tool has been designed to quantify the prevalence, frequency and severity of several symptoms and has been used in pregnant women [6–14].

Lifestyle interventions have the potential to modify the frequency and severity of the pregnancy symptoms [15,16]. Most of the studies were focused on specific symptoms individually [17,18], but do not examine the range of potential symptoms during pregnancy [19].

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The use of specific tools to assess the wide range of potential pregnancy symptoms may imply a large amount of time and could be exhausted for pregnant women. A valid and robust tool, Pregnancy Symptoms Inventory (PSI) [19], was developed to assess the wide range of pregnancy symptoms and to evaluate the impact of pregnancy interventions on the pregnancy symptoms.

Despite the large amount of Spanish-speaking people in the world [20], to our knowledge there is currently no available Spanish version of this tool. Consequently, the aim of this study was to transculturally adapt the PSI into Spanish, analyze the reliability and operational qualities of this tool, and assess the prevalence of pregnancy symptoms on Spanish pregnant women.

Materials and methods

Healthy singleton pregnant women, aged 18–45 years old, were recruited at the first visit from health clinics of the Sanitary Area of Seville (Spain). The exclusion criteria included physical illnesses or disabilities that affect normal daily routine and high risk pregnancy (i.e. diabetes or hypertension). A subsample of 120 and a total of 280 eligible Spanish pregnant women were recruited, after gave their informed consent, to analyze test–retest reliability and prevalence of pregnancy symptoms, respectively. The study protocol was performed in two stages: transcultural translation process from English to Spanish, and analysis of

reliability, operational qualities and practical use of the Spanish version of the PSI (PSI-S). Ethical approval was obtained from the Medical Research Ethics Committee of the University Hospital Virgen del Rocio (Seville, Spain), approval number 2014PI-066.

As prescribed the scientific literature [21], the adaptation process for the PSI uses the direct and reverse translation. Supplementary Figure S1 shows the steps followed in this process. Subsequently, individual interviews were conducted for the pregnant women to evaluate the understanding comprehensibility and feasibility of the questionnaire (cognitive debriefing), as described by previous studies [22]. The final version of the questionnaire is shown in Appendix A.

Two face-to-face sessions, separately by an interval of 8 days, were performed to complete the study protocol. At first session, pregnant women completed the first PSI-S, sociodemographic and anthropometrical characteristics, weight and height were evaluated, following the standard procedures with calibrated digital scale and stadiometer (Tanita Corporation BC-420, Tokio, Japan). Body mass index (kg/m^2) was calculated. In addition, pre-pregnancy BMI was calculated using the weight and height measuring by sanitary professional at first pregnancy visit. At the second session, the second PSI-S was completed.

PSI [19] is a 41-item Likert inventory that assesses how often symptoms occurred and what effect they had.

Statistical analysis

Test–retest reliability of the PSI-S was examined by means of percent agreement and weighted Kappa coefficients. For the analysis of percent agreement, the difference between the first (T1) and second PSI-S (T2) administration was calculated. A difference (T2 − T1) equal to 0 was considered ''perfect'' agreement equivalent to the same test–retest answer, a difference of 0 ± 1 and 0 ± 2 was considered ''perfect-acceptable'' and ''moderate'' agreement, respectively. Linear weighted K-coefficients [23] were calculated, which are more appropriate when dealing with ordered categorical data, because not only account for strict agreement (as does the ''unweighted'' K), but also provide weighting to adjacent categories. Pearson correlation coefficient was used as additional information to compare with original version.

To assess the prevalence of pregnancy symptoms, we calculated the frequencies of answer determined by the number of those women experiencing these symptoms, as explain in original version [19]. In addition, the prevalence of pregnancy symptoms was calculated across sociodemographic and clinical variables, as age, BMI, trimester of gestation, parity, occupational status and educational level, stratifying groups.

Data were analyzed using SPSS version 20.0 for windows (IBM Corp., Armonk, NY) with statistical significance set at $p < 0.05$. Cohen's weighted K-coefficients were analyzed using STATA version 12 for windows (Stata Corp., LP, College Station, TX).

Results

A previous sample of 16 pregnant women, with ages from 21 to 37 years, gestational ages between 9 and 35 weeks and all different education levels from no schooling to university education, was used for the transcultural translation process. Table 1 shows the sociodemographic characteristics of subsample and sample.

Table 1. Demographic characteristics of total sample ($n = 268$) and subsample ($n = 110$).

Variables	Mean (SD)	Mean (SD)
Age, years	32.5 (4.4)	31.8 (4.5)
Pre-pregnancy BMI, kg/m^2	24.8 (4.5)	23.7 (3.9)
	n (%)	*n* (%)
Age		
18–30 years old	73 (27.2)	38 (34.5)
31–44 years old	195 (72.8)	72 (65.5)
Trimester of gestation		
Second trimester	160 (59.7)	75 (68.2)
Third trimester	108 (40.3)	35 (31.8)
Pre-pregnancy BMI*		
<25 kg/m^2	164 (61.2)	75 (68.2)
>25 kg/m^2	104 (38.8)	35 (31.8)
Marital status		
Single without couple	3 (1.1)	1 (0.9)
Single with couple	81 (30.2)	36 (32.7)
Married	179 (66.8)	69 (62.7)
Divorced or separated	5 (1.9)	4 (3.6)
Parity		
0	137 (51.1)	68 (61.8)
1	115 (42.9)	36 (32.7)
>1	16 (6.0)	6 (5.5)
Highest level of education		
Nontertiary	150 (56.0)	64 (58.2)
Tertiary	118 (44.0)	46 (41.8)
Occupational status*		
Workers	122 (45.8)	52 (47.3)
Nonworkers		
Unemployed	75 (28.4)	32 (29.1)
Sick leave from work	68 (25.8)	26 (23.6)

BMI, body mass index; SD, standard deviation.

*Three students excluded of occupational status on total sample.

During the process of the direct and reverse translation, the range of difficulty for the translators varied between 1 and 3, whereas the conceptual equivalence varied between 8 and 10. Items of PSI with the greatest difficulty and/or the least conceptual equivalence were discussed during the consensus meeting. Subsequently, the most problematic items were analyzed specifically in individuals interviews to rate the subjects' comprehension of the questionnaire (cognitive debriefing), as shown in Supplementary Table S1. Supplementary Table S2 shows the complete process of transcultural adaptation for the seven items, selecting the term with lower comprehension difficulty and higher conceptual equivalence. Respect to the degree of questionnaire acceptance and formality, the results showed that all pregnant women found the format comfortable and considered their comprehension of the items sufficient to allow them to suggest changes in specific items on the questionnaire.

Attending average frequency of perceived symptoms reported, perfect agreement was observed in 82% (range 63–98%) and perfect-acceptable agreement in 96% (range 89–100%) of the pregnant women (Table 2). Respecting average perceived limitation reported, perfect agreement was observed in 84% (range 69–98%) and perfect-acceptable agreement in 97% (range 93–100%) of the pregnant women. Test–retest weighted K-coefficients ranged from 0.589 to 0.889 ($p < 0.001$ for all) for frequency of perceived symptoms

Table 2. Test–retest percent agreement of PSI scores.

	Frequency of perceived symptoms			Limitation of perceived symptoms		
Item	*N*	Perfect agreement	Perfect-acceptable agreement	*N*	Perfect agreement	Perfect-acceptable agreement
Average	110	82.0	96.0	97	84.0	97.4
Range	105–111	62.7–98.2	89.1–100	89–99	69.1–98.0	92.7–100
Tiredness or fatigue	111	73.0	92.8	99	78.8	97.0
Nausea	111	89.2	99.1	98	86.7	94.9
Vomiting	111	88.3	96.4	99	88.9	97.0
Reflux	105	82.9	95.3	93	84.9	96.8
Constipation	111	75.7	95.5	99	81.8	99.0
Hemorrhoids	110	94.5	98.1	98	92.9	99.0
Dry mouth	111	75.7	94.6	97	79.4	97.9
Food cravings	111	78.4	98.2	98	83.7	98.0
Poor sleep	111	71.2	92.8	97	69.1	94.9
Restless legs	110	83.6	95.5	98	78.6	97.0
Leg cramps	108	81.5	97.2	96	84.4	96.9
Snoring	110	86.4	98.3	98	85.7	96.9
Urinary frequency	110	82.7	97.3	97	79.4	99.0
Incontinence/leaking urine	111	88.3	97.3	98	88.8	97.0
Increased vaginal discharge	108	78.7	97.2	93	83.9	100
Thrush	111	95.5	99.1	99	93.9	99.9
Changes in libido	109	80.7	96.3	94	85.1	95.7
Painful veins in vagina	110	98.2	98.2	98	98.0	99.0
Carpel tunnel (numb hands)	111	86.5	95.5	99	87.9	97.0
Sciatica	111	82.0	97.3	99	83.8	95.0
Back pain	110	67.3	95.5	97	72.2	95.9
Hip or pelvic pain	111	75.7	94.6	96	76.0	92.7
Breast pain	111	71.2	91.9	98	78.6	97.0
Headache	111	72.1	94.6	97	74.2	92.7
Sore nipples	109	86.2	98.2	94	89.4	100
Dizziness	108	79.6	98.1	96	79.2	93.8
Fainting	108	97.2	99.1	96	97.9	97.9
Heart palpitations	109	84.4	95.4	96	85.4	96.9
Shortness of breath	111	77.5	94.6	99	79.8	97.0
Taste/smell changes	111	75.7	91.0	99	82.8	98.0
Forgetfulness	111	87.4	99.1	99	88.9	97.0
Feeling depressed	111	75.7	96.4	97	80.4	97.9
Anxiety	111	83.8	95.5	97	82.5	95.9
Vivid dreams	109	83.5	100	96	86.5	99.0
Altered body image	108	80.6	92.7	94	79.8	97.9
Greasy skin/acne	108	89.8	98.1	94	89.4	99.0
Varicose veins	111	87.4	95.5	98	90.8	99.9
Brownish marks on face	111	92.8	98.2	98	92.9	99.0
Itchy skin	110	71.8	92.7	96	79.2	99.0
Changes in nipples	110	62.7	89.1	93	74.2	97.9
Stretch marks	110	87.3	95.4	97	88.7	99.0
Swollen hands or feet	105	81.9	96.2	89	84.3	97.8

PSI, Pregnancy Symptoms Inventory.

and from 0.576 to 0.869 ($p < 0.001$ for all) for perceived limitation (Table 3).

Pearson's coefficients ranged from 0.619 to 0.943 ($p < 0.001$ for all) for frequency of perceived symptoms, the majority of items (38 items) scoring higher than 0.700. Attending to perceived limitation, Pearson's coefficients ranged from 0.659 to 0.936 ($p < 0.001$ for all), being the majority of items (35 items) higher than 0.700.

The mean time required to complete the PSI-S was 6 min 48 s ± 3 min 54 s per pregnant women (ranged 3–15 min). None of the pregnant women requested external help to complete the questionnaire. In some items, any pregnant women did not responded it, so these items the percentage of prevalence was calculated displaying the denominator with the number of responders

The top four of ''often'' reported symptoms were urinary frequency, poor sleep, increased vaginal discharge and tiredness. Table 4 shows the prevalence of self-reported pregnancy symptoms reported ''often'' and ''sometimes''.

Attending the limitation of the perceived symptoms on the activities of pregnant women daily life, the top four ''limit a lot'' symptoms were poor sleep, back pain, urinary frequency and tiredness. The total number responding to questions on ''limit'' is less than prevalence of symptoms because only those experienced that symptom was required to give an answer. Table 5 shows the prevalence of self-reported limitation on the activities of pregnant women daily life.

Focus on stratified subgroups, Supplementary Table S3 shows the prevalence of often self-reported pregnancy symptoms across clinical and sociodemographic variables. On BMI groups, anxiety and increased vaginal discharge substantially had higher prevalence in normal weight than overweight and obese pregnant women, and snoring had higher prevalence in overweight and obese than normal

Table 3. Test–retest Cohen's K of PSI prevalence scores.

	Frequency of perceived symptoms			Limitation of perceived symptoms		
Item	*N*	Weighted Kappa	*r* Pearson	*N*	Weighted Kappa	*r* Pearson
Average	110	0.748	0.811	97	0.735	0.789
Range	105–111	0.589–0.889	0.619–0.943	89–111	0.576–0.869	0.659–0.936
Tiredness or fatigue	111	0.641	0.682	99	0.733	0.787
Nausea	111	0.889	0.943	98	0.810	0.851
Vomiting	111	0.775	0.837	99	0.821	0.892
Reflux	105	0.780	0.805	93	0.776	0.792
Constipation	111	0.774	0.866	99	0.776	0.845
Hemorrhoids	110	0.838	0.844	98	0.748	0.728
Dry mouth	111	0.724	0.809	97	0.642	0.659
Food cravings	111	0.765	0.849	98	0.699	0.697
Poor sleep	111	0.677	0.735	97	0.668	0.763
Restless legs	110	0.763	0.800	98	0.689	0.779
Leg cramps	108	0.790	0.863	96	0.773	0.824
Snoring	110	0.840	0.903	98	0.731	0.761
Urinary frequency	110	0.668	0.694	97	0.715	0.770
Incontinence/leaking urine	111	0.828	0.870	98	0.818	0.858
Increased vaginal discharge	108	0.797	0.874	93	0.778	0.843
Thrush	111	0.853	0.884	99	0.869	0.936
Changes in libido	109	0.792	0.861	94	0.782	0.811
Painful veins in vagina	110	0.745	0.783	98	0.662	0.800
Carpel tunnel (numb hands)	111	0.752	0.811	99	0.770	0.822
Sciatica	111	0.818	0.889	99	0.808	0.853
Back pain	110	0.694	0.809	97	0.730	0.828
Hip or pelvic pain	111	0.722	0.810	96	0.653	0.696
Breast pain	111	0.692	0.771	98	0.681	0.692
Headache	111	0.672	0.769	97	0.691	0.769
Sore nipples	109	0.829	0.897	94	0.831	0.883
Dizziness	108	0.647	0.713	96	0.661	0.738
Fainting	108	0.589	0.619	96	0.658	0.662
Heart palpitations	109	0.725	0.777	96	0.697	0.748
Shortness of breath	111	0.689	0.761	99	0.730	0.821
Taste/smell changes	111	0.707	0.790	99	0.766	0.838
Forgetfulness	111	0.828	0.906	99	0.779	0.814
Feeling depressed	111	0.679	0.761	97	0.705	0.775
Anxiety	111	0.696	0.729	97	0.658	0.725
Vivid dreams	109	0.754	0.855	96	0.679	0.706
Altered body image	108	0.672	0.741	94	0.613	0.697
Greasy skin/acne	108	0.846	0.892	94	0.766	0.809
Varicose veins	111	0.807	0.868	98	0.839	0.896
Brownish marks on face	111	0.859	0.908	98	0.814	0.846
Itchy skin	110	0.655	0.730	96	0.752	0.842
Changes in nipples	110	0.601	0.694	93	0.576	0.660
Stretch marks	110	0.774	0.799	97	0.782	0.836
Swollen hands or feet	105	0.787	0.873	89	0.749	0.796

weight pregnant women. On age groups, greasy skin or acne and breast pain was more prevalent in young group than older group and snoring was more prevalent in older group than young group. On trimester of gestation groups, breast pain, taste/smell changes, nausea and changes on libido had higher prevalence in second trimester group than third trimester group, opposite snoring had lower prevalence. On educational level, increased vaginal discharge was more prevalent on tertiary education group than nontertiary group. On occupational status groups, reflux, sciatica, hip or pelvic pain, swollen hands or feet had higher prevalence in workers group than nonworkers group. On parity groups, incontinence and anxiety had higher and lower prevalence, respectively, on multiparous group than nulliparous group.

Comment

This study provides an instrument with transcultural adaptation into Spanish conceptually equivalent to original version and good reliability. The urinary frequency, poor sleep, tiredness and back pain were four of the top five pregnancy symptoms with higher prevalence and limitation to daily activities on Spanish pregnant women.

On the adaptation process of PSI, no significant problems were found during the translation into Spanish or during the evaluation of the conceptual equivalence of the items, showing a good ability of pregnant women to comprehend the questionnaire. However, items with lower conceptual equivalence or higher difficulty were analyzed and discussed on cognitive test to improve the comprehension and reach a term with the best acceptance between pregnant women. Similar with the original version [19], the terms painful veins in vagina and brownish marks on face were discussed in this step of the process. The results showed that pregnant women found the format comfortable and comprehensible.

Reliability analysis showed, on average, that the agreements between both applications were perfect on most of pregnant women and perfect acceptable agreement on almost

Table 4. Prevalence of self-reported pregnancy symptoms reported often of sometimes.

Item	*N*	Often	Sometimes	Total
Urinary frequency	267	65.2	23.2	88.4
Poor sleep	268	34.3	34.7	69.0
Increased vaginal discharge	265	34.3	29.8	64.1
Tiredness or fatigue	268	29.5	44.0	73.5
Back pain	268	23.1	29.5	52.6
Changes in nipples	266	22.9	29.7	52.6
Constipation	268	17.2	22.0	39.2
Reflux	266	16.9	20.7	37.6
Breast pain	268	14.6	23.1	37.7
Taste/smell changes	268	14.2	17.9	32.1
Swollen hands or feet	266	11.3	15.0	26.3
Sciatica/pain down the back of your legs	268	11.2	22.8	34
Hip or pelvic pain	267	11.2	21.3	32.5
Itchy skin	266	10.5	19.9	30.4
Changes in libido	265	9.4	26.8	36.2
Nausea	268	9.3	10.8	20.1
Leg cramps	267	8.6	22.5	31.1
Carpel tunnel (numb hands)	268	8.6	13.1	21.7
Snoring	268	8.2	13.1	21.3
Restless legs	267	7.9	18.0	25.9
Headache	267	7.9	23.2	31.1
Shortness of breath	267	7.9	15.4	23.3
Dry mouth	268	7.8	21.3	29.1
Varicose veins	268	7.8	11.6	19.4
Sore nipples	267	6.4	13.5	19.9
Greasy skin/acne	266	6.0	8.6	14.6
Stretch marks	267	5.6	13.5	19.1
Altered body image	263	5.3	11.0	16.3
Incontinence/leaking urine	268	5.2	18.3	23.5
Anxiety	268	4.5	9.3	13.8
Vomiting	268	4.1	6.7	10.8
Hemorrhoids	267	4.1	10.9	15.0
Food cravings	268	4.1	28.4	32.5
Forgetfulness	267	4.1	12.4	16.5
Feeling depressed	267	3.7	15.7	19.4
Brownish marks on face	268	3.7	8.6	12.3
Vivid dreams	267	3.4	12.4	15.8
Thrush	268	2.6	6.3	8.9
Heart palpitations	267	2.6	14.6	17.2
Dizziness	266	1.5	12.8	14.3
Painful veins in vagina	268	1.1	1.1	2.2
Fainting	267	0.4	1.1	1.5

As the number of women responding questions varied, the denominator is displayed for each symptom (*N*).

Table 5. Prevalence of self-reported limitation to activities of daily living.

Item	*N*	Limit a lot	Limit a little	Total prevalence
Poor sleep	253	21.7	39.9	61.6
Back pain	252	19.8	32.9	52.7
Urinary frequency	255	18.8	43.5	62.3
Tiredness or fatigue	254	18.5	47.6	66.1
Sciatica/pain down the back of your legs	254	14.2	23.2	37.4
Headache	253	11.1	20.9	32.0
Hip or pelvic pain	251	9.6	18.3	27.9
Shortness of breath	251	8.0	19.5	27.5
Nausea	257	7.4	14.4	21.8
Vomiting	257	6.6	8.6	15.2
Swollen hands or feet	250	6.4	14.8	21.2
Incontinence/leaking urine	252	6.0	13.5	19.5
Reflux	254	5.9	23.2	29.1
Carpel tunnel (numb hands)	257	5.8	10.9	16.7
Dizziness	252	5.6	16.7	22.3
Taste/smell changes	255	5.1	12.5	17.6
Feeling depressed	251	4.8	13.9	18.7
Constipation	256	4.3	17.2	21.5
Leg cramps	254	4.3	18.5	22.8
Increased vaginal discharge	249	4.0	22.5	26.5
Restless legs	256	3.9	15.6	19.5
Anxiety	252	3.6	13.9	17.5
Itchy skin	251	3.6	17.1	20.7
Thrush	256	3.5	6.3	9.8
Changes in libido	251	3.2	17.9	21.1
Varicose veins	253	2.4	8.3	10.7
Fainting	254	2.0	1.6	3.6
Altered body image	246	2.0	6.9	8.9
Changes in nipples	250	2.0	15.6	17.6
Heart palpitations	255	1.6	12.9	14.5
Stretch marks	253	1.6	5.9	7.5
Hemorrhoids	255	1.2	5.9	7.1
Breast pain	252	1.2	17.5	18.7
Forgetfulness	252	1.2	12.7	13.9
Dry mouth	251	0.8	8.4	9.2
Food cravings	252	0.8	4.8	5.6
Snoring	251	0.8	5.2	6.0
Sore nipples	252	0.8	10.3	11.1
Greasy skin/acne	249	0.8	7.6	8.4
Brownish marks on face	254	0.8	3.9	4.7
Painful veins in vagina	257	0.4	0.8	1.2
Vivid dreams	251	0.0	6.4	6.4

As the number of women responding questions varied, the denominator is displayed for each symptom (*N*). Women who did not experience a symptom did not answer limit question.

all pregnant women. This results indicate that this tool may be repeatable with a good capacity of detect changes on pregnant women perceived frequency of symptoms and perceived limitation on daily activities.

Attending weighted Kappa coefficients, this ranged from 0.589 to 0.889 for perceived frequency of symptoms and 0.576 to 0.869 for perceived limitation on daily activities, indicating a moderate to good agreement of both application of the questionnaire. We used Cohen's weighted Kappa coefficients due to more appropriate when dealing with ordered categorical data, because not only account for strict agreement, but also provide weighting to adjacent categories [23]. Nevertheless, in order to compare with the original version Pearson's correlation coefficients were also calculated and show that the majority of items scored higher than 0.700 in line, though slightly higher, than the original version [19]. Focus on perceived limitation to daily activities, items with lower reliability were anxiety, hip or pelvic pain, dry mouth, altered body image and changes in nipples. This may be due because the clinical characteristics of these symptoms, which the perception of them could be more steady or changeable in short term.

Top and bottom five pregnancy symptoms with higher and lower prevalence reported as often by Spanish pregnant women were similar with the founded in the original version [19] and other studies [2,24], except dizziness which in original version was a higher prevalence [19]. Attending the prevalence of pregnancy symptoms reported as limit a lot, the top and bottom five symptoms with higher and lower prevalence were also similar with the founded in previous studies [2,19], except painful veins in vagina, which was a higher prevalence in original version [19].

Focus on stratified groups, the majority of symptoms did not substantially differ between stratified groups. Substantially differences were found on snoring, anxiety,

increased vaginal discharge and breast pain. Snoring was more prevalent in overweight, third trimester and older pregnant women, similar with previous studies [25,26] and indicating that the screening of this symptom need to be focalizing in this specific subgroups. On its behalf, anxiety was more prevalent on normal weight, similar with previous study [27] and nulliparous pregnant women, contrarily with previous study [7], suggesting that pregnant women with lower BMI have a high risk of suffering anxiety and may be caused by the physiological changes on body shape and weight that could be more pronounced on these subgroups, so specific studies to confirm this aspects are needed. Increasing vaginal discharge was more prevalent on normal weight and tertiary educational level pregnant women, from our knowledge there are no previous studies that analyze the prevalence of this symptom on these subgroups, so are needed studies that focalizing the attention on this aspect. In case of breast pain, this symptom was more prevalent in third trimester group, in line with previous studies [24] and young group, indicating that the maturity of female's physiology and the course of pregnancy influence the prevalence of this symptom.

This study presents several limitations, such as none of the participants were in the first trimester because the recruitment starts at the first visit of health clinics and pregnant women gave the written informed consent at the second visit, placed in the second trimester. Future researches analyzing PSI properties should focus on first trimester pregnant women. Another limitation of this study is the exclusion of the high risk pregnant women and the participation only of pregnant who voluntarily gave their informed consent, which may have resulted in self-selection bias. In addition, stratified groups across clinical and sociodemographic variables present almost equal number of pregnant women in groups, except age group that have more pregnant women in older than younger group. This difference is explain because the median age of pregnant women on Spain was 32.4 years old [28], so the majority of Spanish pregnant women overtaken 30 years.

The systematic and rigorous process of the transcultural adaptation process was strength of this study, which allow discuss with pregnant women about the comprehensibility and feasibility of the items and the questionnaire. Another strength of this study is the utilization of various statistical tests to analyze the reliability of the questionnaire, which allow analyzing the reliability with recommended test for ordered categorical items and to compare with previous studies. The stratification of groups across clinical and sociodemographic variables imply the analysis of the prevalence of pregnancy symptoms which allow widen the knowledge of symptoms occurring during pregnancy.

Taking into account that self-report inventories are an easy administration, noninvasive and relatively inexpensive methods, PSI provides a brief and useful method to assess the wide range of pregnancy symptoms on clinical practices that may detect the symptoms perceived by pregnant women early and allow initiate the treatments or derived to specific health care providers. The existence of transcultural adaptation versions of PSI allows the utilization of this tool in multi-languages epidemiologic and large population studies assessing the prevalence of the wide range of pregnancy symptoms and the impact of interventions on pregnant women perceived health and quality of life.

In conclusion, PSI-S is a brief, conceptually equivalent and satisfactorily reliable tool that assesses the wide range of symptoms during pregnancy, allowing an early detection on clinical practices. The symptoms most prevalent and with higher limitation in Spanish pregnant women were urinary frequency, poor sleep, increased vaginal discharge and tiredness. The prevalence of pregnancy symptoms across clinical and sociodemographic stratified groups did not differ substantially except on anxiety, breast pain, snoring and increased vaginal discharge.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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Appendix A

Pregnancy Symptoms Inventory – Spanish version

Gracias por su consentimiento a completar las siguientes preguntas. Hay dos partes para cada pregunta. En el lado izquierdo, por favor indique la frecuencia de cada síntoma. Si su puntuación es mayor o igual a 1 en esta sección, por favor indique en la parte sombreada (lado de derecho) cuanto limitó cada síntoma sus actividades diarias.
Todas las respuestas son estrictamente confidenciales. Responder a cada pregunta es voluntario.

1. ¿De cuantas semanas está usted embarazada?: _____
2. ¿Cuál es su altura?: _____. **3. ¿Cuál es su peso aproximadamente?** _____.

En el último mes, con qué frecuencia ha experimentado usted: (Por favor marque la casilla apropiada)					**¿Cuánto le ha limitado esto sus actividades diarias?** (Conteste sólo si su respuesta es 1–3)		
Síntoma	***Nunca 0***	***Raramente 1***	***Algunas veces 2***	***Con frecuencia 3***	***No limita del todo***	***Limita poco***	***Limita mucho***
Cansancio o fatiga							
Nauseas							
Vómitos							
Reflujo							
Estreñimiento							
Hemorroides							
Boca seca							
Antojos de alimentos							
Sueño alterado							
Piernas inquietas							
Calambres en las piernas							
Ronquidos							
Aumento de la frecuencia urinaria							
Incontinencia/pérdidas de orina							
Aumento de la secreción vaginal							
Candidiasis							
Cambios en la libido							
Varices en la vagina							
Túnel carpiano (manos adormecidas)							
Ciática/dolor en la parte posterior de los muslos							
Dolor de espalda							
Dolor pélvico o de cadera							
Dolor de mamas							
Dolor de cabeza							
Pezones irritados							
Mareos							
Desmayos							
Palpitaciones cardíacas							
Dificultad respiratoria							
Cambios en el gusto/olfato							
Pérdidas de memoria							
Sentimientos depresivos							
Ansiedad							
Sueños reales							
Imagen corporal alterada							
Piel grasa/acné							
Venas varicosas (varices)							
Marcas marrones en la cara							
Picor en la piel							
Cambios en los pezones							
Estrías							
Manos o pies hinchados							
Otros (Por favor indíquelos)							

Supplementary material available online

PREGNANCY PHYSICAL ACTIVITY QUESTIONNAIRE

Instrucciones:
Por favor utilice un bolígrafo. Rellene el círculo completamente. La pregunta puede ser leída por una máquina, así que si necesita cambiar su respuesta borre la marca incorrecta completamente. Si desea realizar comentarios, escríbalos en la parte trasera del cuestionario.

Ejemplo:
Durante este trimestre, cuando no está trabajando, cuánto tiempo emplea habitualmente:

Cuidando a una persona mayor.

Si usted cuida de una persona mayor durante 2 horas cada día, entonces su respuesta debe ser como la siguiente:

- o Ninguno
- o Menos de 1/2 horas al día
- o De 1/2 a casi 1 hora al día
- o De 1 hora a casi 2 horas al día
- ● De 2 horas a casi 3 horas al día
- o 3 o más horas al día

Es muy importante que responda honestamente. No existen respuestas correctas o incorrectas. Sólo queremos saber las actividades que realiza durante este trimestre.

1. Fecha Actual: ☐☐ / ☐☐ / ☐☐☐☐ (Día / Mes / Año)

2. ¿Cuál fue el primer día de su último periodo? ☐☐ / ☐☐ / ☐☐☐☐ (Día / Mes / Año) o No se

3. ¿Cuándo nace su bebé? ☐☐ / ☐☐ / ☐☐☐☐ (Día / Mes / Año) o No se

Durante este trimestre, cuando no está trabajando, cuánto tiempo emplea habitualmente:

4. Preparando comidas (cocinar, poner la mesa, lavar los platos)
   - o Ninguno
   - o Menos de 1/2 horas al día
   - o De 1/2 a casi 1 hora al día
   - o De 1 hora a casi 2 horas al día
   - o De 2 horas a casi 3 horas al día
   - o 3 o más horas al día

5. Vistiendo, bañando, alimentando a niños mientras está sentada.
   - o Ninguno
   - o Menos de 1/2 horas al día
   - o De 1/2 a casi 1 hora al día
   - o De 1 hora a casi 2 horas al día
   - o De 2 horas a casi 3 horas al día
   - o 3 o más horas al día

6. Vistiendo, bañando, alimentando a niños mientras permanece de pie.
   - o Ninguno
   - o Menos de 1/2 horas al día
   - o De 1/2 a casi 1 hora al día
   - o De 1 hora a casi 2 horas al día
   - o De 2 horas a casi 3 horas al día
   - o 3 o más horas al día

7. Jugando con los niños mientras permanece sentada o de pie.
   - o Ninguno
   - o Menos de 1/2 horas al día
   - o De 1/2 a casi 1 hora al día
   - o De 1 hora a casi 2 horas al día
   - o De 2 horas a casi 3 horas al día
   - o 3 o más horas al día

8. Jugando con niños mientras está caminando o corriendo.
   - o Ninguno
   - o Menos de 1/2 horas al día
   - o De 1/2 a casi 1 hora al día
   - o De 1 hora a casi 2 horas al día
   - o De 2 horas a casi 3 horas al día
   - o 3 o más horas al día

9. Transportando niños
   - o Ninguno
   - o Menos de 1/2 horas al día
   - o De 1/2 a casi 1 hora al día
   - o De 1 hora a casi 2 horas al día
   - o De 2 horas a casi 3 horas al día
   - o 3 o más horas al día

10. Cuidando a una persona mayor.
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 1 hora al día
    - o De 1 hora a casi 2 horas al día
    - o De 2 horas a casi 3 horas al día
    - o 3 o más horas al día

11. Sentada y usando un ordenador o escribiendo, mientras no está trabajando.
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 1 hora al día
    - o De 1 hora a casi 2 horas al día
    - o De 2 horas a casi 3 horas al día
    - o 3 o más horas al día

12. Viendo la televisión o el video.
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 2 horas al día
    - o De 2 hora a casi 4 horas al día
    - o De 4 horas a casi 6 horas al día
    - o 6 o más horas al día

Durante este trimestre, cuando no está trabajando, cuánto tiempo emplea habitualmente:

13. Sentada y leyendo, hablando o telefoneando, mientras no está trabajando.
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 2 horas al día
    - o De 2 hora a casi 4 horas al día
    - o De 4 horas a casi 6 horas al día
    - o 6 o más horas al día

14. Jugando con mascotas.
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 1 hora al día
    - o De 1 hora a casi 2 horas al día
    - o De 2 horas a casi 3 horas al día
    - o 3 o más horas al día

15. Haciendo limpieza ligera (hacer camas, lavar, planchar, ordenar cosas).
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 1 hora al día
    - o De 1 hora a casi 2 horas al día
    - o De 2 horas a casi 3 horas al día
    - o 3 o más horas al día

16. Comprando (alimentos, ropa, otros artículos).
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 1 hora al día
    - o De 1 hora a casi 2 horas al día
    - o De 2 horas a casi 3 horas al día
    - o 3 o más horas al día

17. Haciendo la limpieza profunda (pasar la aspiradora, fregar, barrer, limpiar las ventanas)
    - o Ninguno
    - o Menos de 1/2 hora a la semana
    - o De 1/2 a casi 1 hora a la semana
    - o De 1 hora a casi 2 horas a la semana
    - o De 2 horas a casi 3 horas a la semana
    - o 3 o más horas a la semana

18. Cortando el césped montada en una máquina cortacésped.
    - o Ninguno
    - o Menos de 1/2 hora a la semana
    - o De 1/2 a casi 1 hora a la semana
    - o De 1 hora a casi 2 horas a la semana
    - o De 2 horas a casi 3 horas a la semana
    - o 3 o más horas a la semana

19. Cortando el césped usando una cortadora manual, rastrillando, haciendo labores de jardinería.
    - o Ninguno
    - o Menos de 1/2 hora a la semana
    - o De 1/2 a casi 1 hora a la semana
    - o De 1 hora a casi 2 horas a la semana
    - o De 2 horas a casi 3 horas a la semana
    - o 3 o más horas a la semana

Desplazándose a lugares…

Durante este trimestre, cuánto tiempo emplea habitualmente:

20. Caminando lentamente para ir a lugares (como el autobús, trabajo, visitas). No por diversión o ejercicio.
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 1 hora al día
    - o De 1 hora a casi 2 horas al día
    - o De 2 horas a casi 3 horas al día
    - o 3 o más horas al día

21. Caminando rápidamente para ir a lugares (como el autobús, trabajo, colegio). No por diversión o ejercicio.
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 1 hora al día
    - o De 1 hora a casi 2 horas al día
    - o De 2 horas a casi 3 horas al día
    - o 3 o más horas al día

22. Conduciendo o montada en un vehículo a motor.
    - o Ninguno
    - o Menos de 1/2 horas al día
    - o De 1/2 a casi 1 hora al día
    - o De 1 hora a casi 2 horas al día
    - o De 2 horas a casi 3 horas al día
    - o 3 o más horas al día

Por diversión y ejercicio…

Durante este trimestre, cuánto tiempo emplea habitualmente:

23. Caminando lentamente por diversión o ejercicio
    - o Ninguno
    - o Menos de 1/2 hora a la semana
    - o De 1/2 a casi 1 hora a la semana
    - o De 1 hora a casi 2 horas a la semana
    - o De 2 horas a casi 3 horas a la semana
    - o 3 o más horas a la semana

24. Caminando más rápidamente por diversión o ejercicio.
    - o Ninguno
    - o Menos de 1/2 hora a la semana
    - o De 1/2 a casi 1 hora a la semana
    - o De 1 hora a casi 2 horas a la semana
    - o De 2 horas a casi 3 horas a la semana
    - o 3 o más horas a la semana

25. Caminando rápidamente cuesta arriba por diversión o ejercicio.
    - o Ninguno
    - o Menos de 1/2 hora a la semana
    - o De 1/2 a casi 1 hora a la semana
    - o De 1 hora a casi 2 horas a la semana
    - o De 2 horas a casi 3 horas a la semana
    - o 3 o más horas a la semana

26. Corriendo suavemente.
- o Ninguno
- o Menos de 1/2 hora a la semana
- o De 1/2 a casi 1 hora a la semana
- o De 1 hora a casi 2 horas a la semana
- o De 2 horas a casi 3 horas a la semana
- o 3 o más horas a la semana

27. En clases de ejercicio pre-parto.
- o Ninguno
- o Menos de 1/2 hora a la semana
- o De 1/2 a casi 1 hora a la semana
- o De 1 hora a casi 2 horas a la semana
- o De 2 horas a casi 3 horas a la semana
- o 3 o más horas a la semana

28. Nadando
- o Ninguno
- o Menos de 1/2 hora a la semana
- o De 1/2 a casi 1 hora a la semana
- o De 1 hora a casi 2 horas a la semana
- o De 2 horas a casi 3 horas a la semana
- o 3 o más horas a la semana

29. Bailando.
- o Ninguno
- o Menos de 1/2 hora a la semana
- o De 1/2 a casi 1 hora a la semana
- o De 1 hora a casi 2 horas a la semana
- o De 2 horas a casi 3 horas a la semana
- o 3 o más horas a la semana

Haciendo otras actividades por diversión o entretenimiento. Por Favor, indíquenos que actividades son

30. ……
Nombre de la actividad
- o Ninguno
- o Menos de 1/2 hora a la semana
- o De 1/2 a casi 1 hora a la semana
- o De 1 hora a casi 2 horas a la semana
- o De 2 horas a casi 3 horas a la semana
- o 3 o más horas a la semana

31. ……
Nombre de la actividad
- o Ninguno
- o Menos de 1/2 hora a la semana
- o De 1/2 a casi 1 hora a la semana
- o De 1 hora a casi 2 horas a la semana
- o De 2 horas a casi 3 horas a la semana
- o 3 o más horas a la semana

En el trabajo…
Durante este trimestre, cuánto tiempo emplea habitualmente:

32. Sentada en el trabajo o en clase.
- o Ninguno
- o Menos de 1/2 horas al día
- o De 1/2 a casi 2 hora al día
- o De 2 hora a casi 4 horas al día
- o De 4 horas a casi 6 horas al día
- o 6 o más horas al día

33. De pie o caminando lentamente en el trabajo mientras sostiene cosas (más pesadas que 4 kg).
- o Ninguno
- o Menos de 1/2 horas al día
- o De 1/2 a casi 2 hora al día
- o De 2 hora a casi 4 horas al día
- o De 4 horas a casi 6 horas al día
- o 6 o más horas al día

34. De pie o caminando lentamente en el trabajo sin sostener nada.
- o Ninguno
- o Menos de 1/2 horas al día
- o De 1/2 a casi 2 hora al día
- o De 2 hora a casi 4 horas al día
- o De 4 horas a casi 6 horas al día
- o 6 o más horas al día

35. Caminando rápidamente en el trabajo mientras transporta cosas (más pesadas que 4 kg).
- o Ninguno
- o Menos de 1/2 horas al día
- o De 1/2 a casi 2 hora al día
- o De 2 hora a casi 4 horas al día
- o De 4 horas a casi 6 horas al día
- o 6 o más horas al día

36. Caminando rápidamente en el trabajo sin transportar nada.
- o Ninguno
- o Menos de 1/2 horas al día
- o De 1/2 a casi 2 hora al día
- o De 2 hora a casi 4 horas al día
- o De 4 horas a casi 6 horas al día
- o 6 o más horas al día

Muchas Gracias