Chapter 5 Assessment of physical activity, sedentary behaviors and physical fitness in perimenopausal women

Capítulo 5 Valoración de la actividad física, comportamientos sedentarios y aptitud física de mujeres perimenopaúsicas

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Abstract

Introduction. Promoting active lifestyles to maintain physical functionality in middle-aged women implies field assessments which could sometimes be considered subjective or problematic. The proposal was to analyze physical activity, sedentary behaviors, and physical fitness in perimenopausal women living in the urban area of Monterrey. Methods. An analytical and descriptive study that includes comparative and association aspects with a single measurement. A personal data form was applied, as well as accelerometry with an ActiGraph GT3X+ movement detector, the AMAI Socioeconomic Level Questionnaire, the Sedentary Behavior Questionnaire, and the International Physical Activity Questionnaire (IPAQ)-Long Form. Physical fitness was assessed in relation to strength in the upper limbs (dynamometry) and lower limbs (30 second Sit to Stand Test) in addition to balance (Unipedal Stance Test). Data analysis was performed with the SPPS software, version 21.0; with descriptive and inferential statistics considering a critical value of 0.05 for Cronbach's alpha. Results. According to the IPAQ report, 54.8% of the participants meet the global recommendations for health, whereas, with accelerometry, the result was 52.4% ($p > 0.05$). On average, the participants spend more than 850 minutes a day in sedentary activities. No differences were found between the self-report and the objective accelerometry measurement of PA and sedentary behaviors in the participants of this sample. In more than half of the participants, physical fitness is considered as of a low level for all the tests considered. The participants who are housewives presented more PA in their leisure time than those who work ($p < .05$). Excess weight exerted an effect on overall physical activity and on balance with the eyes open ($p < .05$). Conclusions. Perimenopausal women usually present excess weight, sedentary behaviors, and low level of physical fitness. In this sample, no differences were found between the self-report of PA and sedentary behaviors in relation to the accelerometry measurement. Promoting active lifestyles and physical assessment in the life stage is advisable to maintain physical functionality prior to old age.

Behavior, Muscular strength, Balance, Health risk, Women health

Resumen

Introducción. La promoción de estilos de vida activos para mantener la funcionalidad física de mujeres de mediana edad implica evaluaciones de campo que en ocasiones pudieran ser consideradas subjetivas o problemáticas. Se propuso analizar la actividad física, los comportamientos sedentarios y la aptitud física de mujeres perimenopaúsicas del área urbana de Monterrey. Métodos. Estudio descriptivo analítico, que incluye aspectos comparativos y de asociación con una sola medición. Se aplicaron cédula de datos personales, acelerometría con sensor de movimiento ActiGraph GT3X+, Cuestionario sobre nivel socioeconómico AMAI, Cuestionario de Comportamiento Sedentario y la versión larga del Cuestionario Internacional de Actividad Física (IPAQ por sus siglas en inglés). Se avaluó la aptitud física al respecto de la fuerza de miembros superiores (dinamometría) e inferiores (prueba de la silla) además del equilibrio (prueba de equilibrio unipodal con ojos abiertos y cerrados). El análisis de datos se realizó con el software SPPS versión 21.0; con estadística descriptiva e inferencial considerando un valor crítico para el alfa de .05. Resultados. De acuerdo con el reporte del IPAQ, el 54.8% de las participantes cumple con las recomendaciones mundiales para la salud; mientras que con la acelerometría el dato fue del 52.4% ($p > .05$). En promedio, las participantes presentan más de 850 minutos al día en actividades sedentarias. No se encontraron diferencias entre el autoreporte y la medición objetiva con acelerometría de la actividad física y los comportamientos sedentarios en las participantes de esta muestra. La aptitud física de más de la mitad de las participantes se considera en nivel bajo para todas las pruebas consideradas. Las participantes que se dedican al hogar presentaron mayor actividad física en el tiempo libre que las que trabajan ($p < .05$). El exceso de peso afectó la actividad física total y el equilibrio con ojos abiertos ($p < .05$). Conclusiones. Las mujeres que transitan la perimenopausia presentan habitualmente exceso de peso, comportamientos sedentarios y baja aptitud física. En esta muestra no se encontraron diferencias entre el autoreporte de actividad física y comportamientos sedentarios en relación con la medición con acelerometría. La promoción de estilos de vida activos y la valoración física en esta etapa de la vida resulta aconsejable para el mantenimiento de la funcionalidad física previo a la vejez.

Conducta, Fuerza muscular, Equilibrio postural, Riesgos a la salud, Salud de la mujer

5.1 Introduction

Timely diagnosis of factors that endanger physical functionality and quality of life during the aging process should be initiated in early life stages. Based on the hormonal and physical changes associated with menopause, which manifests itself between the ages of 41 and 55 years old (Torres-Jiménez & Torres-Rincón, 2018), women face a rapid decline in their physical condition during the perimenopausal period (Bondarev et al., 2018). Other factors such as socioeconomic level, schooling, social life, and structural changes at the family level might represent a synergy to increase the trend towards physical inactivity. In Mexico, physical inactivity seems to increase with advancing age: 66.7% of the women aged from 45 to 54 years old's do not engage in PA, whereas from age 55, this percentage rises to 70.5% (*Instituto Nacional de Estadística y Geografía* [INEGI], 2018).

The trend towards a reduction in PA and the increase in the number of post-menopause sedentary behaviors have already been reported in other contexts (Cheng et al., 2009; Colpani, Oppermann, & Spritzer, 2013; Moratalla et al., 2016; Rathnayake, Lenora, Alwis, & Lekamwasam, 2019). Performing moderate to intense PA supposes better physical functionality and less body pain (Dugan et al., 2018), reason why it could be a positive indicator of quality of life. Given the relationship between PA and fitness, it becomes necessary to promote multidisciplinary work to recognize their influence on individual and social quality of life.

Promoting active lifestyles implies field assessments which could sometimes be considered subjective or problematic. Measuring PA with adequate tools such as accelerometry can impose multiple difficulties and be onerous for epidemiological research studies. On the other hand, measurements with questionnaires have given rise to the development of standardized methods to increase their precision, reason why they have turned into an additional element for knowledge application. The Mexican adults' trend to over-report PA levels has been pointed out (Gutiérrez et al., 2012). In the search to develop the study phenomenon, in recent years PA measurement has expanded to other related characteristics such us: sedentary behaviors; physical fitness; and the benefits, motivations, barriers and social support to physical exercise, only to mention some related themes. Validating the versions of the different questionnaires in relation to objective measurements is a current research topic for most of the contexts. The general theme of this paper is PA behavior in perimenopausal women. Aspects related to measurement in research and to the influence of the personal characteristics on the status of this population group are addressed. The findings from this type of analysis are the basis to design effective strategies for adherence to active lifestyles and for health promotion in general. This paper intends to evaluate the use of questionnaires to assess PA and sedentary behaviors in perimenopausal women. The proposal was to analyze the influence of the personal characteristics on the PA level, sedentary behaviors, and physical fitness in a group of perimenopausal women from an urban community in northeastern Mexico, during the second semester of 2019.

Four specific objectives were established to such end, namely:

1. To describe the differences between the self-report and the objective measurement of compliance with the global recommendations regarding the participants' PA.

2. To compare the sedentary behaviors on weekdays and during the weekend obtained through the participants' self-report and from the accelerometry report.

3. To evaluate the association between the participants' PA, sedentary behaviors, and physical aptitude.

4. To analyze the influence of the personal characteristics on the participants' PA, sedentary behaviors, and physical fitness.

5.1.1 Characteristics of perimenopausal women

Throughout their lives, women go through different growth and development stages related to their reproductive cycle. One of these stages is menopause, which, according to the World Health Organization (1995) “is permanent interruption of menstruation, determined in a retrospective manner after 12 consecutive months of amenorrhea, without any pathologic cause” (as cited in Torres-Jiménez & Torres-Rincón, 2018). Mexican women experience menopause approximately at the age of 47.6 years old (Vázquez-Martínez et al., 2015).

Perimenopause, or menopausal transition, is the period in which certain physiological changes, such as reduction in the follicle-stimulating hormone levels, indicate that the woman is close to experiencing her last menstruation (Delamater & Santoro, 2018). For Delamater and Santoro (2018), perimenopause begins with the onset of irregularities in the menstrual cycle and finishes when the woman reaches menopause, or up to one year after this event. According to Mexican Official Standard (*Norma Oficial Mexicana*, NOM) 035-SSA2-2012, perimenopause encompasses the five years prior to menopause and the year after it (*Diario Oficial de la Federación*, 2012).

During menopausal transition, the changes in the hormone levels trigger a series of symptoms and alterations in the functioning of the musculoskeletal system, which might represent a risk for the woman's health. Among the symptoms associated with perimenopause are hot flashes, vaginal dryness, sleep disorders, skin atrophy, psychosocial problems, psychiatric symptoms and diseases resulting from prolonged estrogen deprivation, such as osteoporosis and cardiovascular diseases (Delamater & Santoro, 2018; Thurston et al., 2018).

In relation to the musculoskeletal system, the main changes observed are reduction in bone mineral density and muscle mass loss (Sipilä et al., 2020). Monteleone et al. (2018) indicate that bone mineral density is rapidly reduced during late perimenopause and that its annual losses after menopause vary between 1.8% and 2.3% in the spine and from 1% to 1.4% in the hip. Muscle mass loss is related to muscle strength condition (Devries & Phillips, 2015). According to Abdulnour (2016), during menopause women lose a greater proportion of muscle mass and strength when compared to men of similar ages.

5.1.2 Physical activity and its measurement in research

PA is any body movement produced by the skeletal muscles which generates an energy expenditure that is higher than that of a rest state (World Health Organization [OMS], 2010). For Pettee-Gabriel, Morrow and Woolsey (2012), PA is a behavior involving human movement, which induces physiological changes such as increased energy expenditure and improvement in physical fitness. As it is a behavior, PA can be performed in different domains: during leisure time, as part of the work or school activity, while performing house chores, and as transportation means (Pettee-Gabriel, Morrow, & Woolsey, 2012).

Depending on its intensity, PA can be classified as light, moderate and vigorous. Moderate and vigorous intensity PA offers greater benefits for health (Salvo et al., 2018; Warburton & Bredin, 2017) and, in middle-aged women, it can mitigate the impact of physical decline associated with the aging process, as it helps to maintain an adequate muscle mass level during perimenopause (Juppi et al., 2020). According to the WHO Guidelines on PA and sedentary habits (WHO, 2020), adults aged from 18 to 64 years old should accumulate 150-300 weekly minutes of moderate aerobic PA, 75-150 weekly minutes of vigorous aerobic PA, or a combination of both. In addition, muscle strengthening activities must be performed at least twice a week.

Due to the numerous benefits for health reported by PA, different instruments to measure this behavior in different population groups have been developed over time. The instruments to measure the PA levels can be classified as objective, such as accelerometry, and as subjective, such as self-reported questionnaires (Aparicio-Ugarriza et al., 2015).

Regarding accelerometry, it is a method that allows measuring body acceleration in the three-movement axis and expressing it as counts per time unit through portable devices called accelerometers, which can be used around the hip or the wrist (Ainsworth et al., 2015). By using cutoff points based on the accelerometer's counts, it is possible to measure the minutes of PA performed based on its intensity: light, moderate, vigorous, or very vigorous (O'Neill et al., 2017). In Mexican adults (Table 5.1), the cutoff points that have been used to estimate the PA level are those proposed by Freedson et al. in 1998 (Salvo et al., 2015).

Table 5.1 Cut-off points for the classification of the intensity of physical activity

Activity counts	Classification
0-99	Sedentary
100-759	Very Ligth
760-1951	Ligth
1951-5724	Moderate
5725-9498	Hard
9499 and more	Very hard

Source: Freedson, P. S., Melanson, E., & Sirard, J. (1998). Calibration of the Computer Science and Applications, Inc. accelerometer. Medicine & Science in Sports & Exercise, 30(5), 777-781. https://doi.org/10.1097/00005768-199805000-00021

Accelerometry offers the advantages of allowing to evaluate with precision and in a minimally invasive manner the PA level throughout days, weeks, or even longer periods of time. Among its limitations is lack of homogeneity in the protocols used to validate the data obtained; Aparicio-Ugarriza et al. (2017) indicate that the accelerometers must be used during seven days for a minimum of 10 hours a day; however, studies have been found in which they were only used for three days at a rate of eight hours a day. In addition, accelerometers do not quantify activities that are not related to walking, such as riding a bicycle or weightlifting (Ainsworth et al., 2015).

On the other hand, among the self-reported questionnaires are the global questionnaires, which are easy to apply and estimate the PA performed in each of their domains by means of simple questions. The International Physical Activity Questionnaire (IPAQ) is an example of a global questionnaire and has two versions: its Long Form, in which the PA patterns are fully and detailly investigated in the four domains; and its Short Form, which only includes seven global questions about PA. In Latin America, Hallal et al. (2010) report that the IPAQ presents high reliability and a moderate validity index when compared to accelerometers; however, they recommend that, in the Latin American population, only the PA during leisure time and during transportation domains from its long version be used to measure the PA levels, since PA modules such as part of the house chores and in the work or school environment overestimate the amount of PA performed.

5.1.3 Sedentary behaviors and their measurement in research

Sedentary behavior encompasses the activities that imply an energy expenditure below 1.5 METs, while in a sitting position, reclined or lying down (Magnon et al. 2018) and bears no relation to the PA level, as a person can meet the PA recommendations for their age and, at the same time, be considered as sedentary for spending long periods of time in a sitting position, either due to work, school and recreational reasons or to transportation. It is known that sedentary behavior increases the risk of suffering some non-communicable chronic disease such as obesity, diabetes, metabolic syndrome and cardiovascular diseases, even in the case of individuals who meet the moderate to vigorous PA recommendations (Same et al., 2016). Blümel et al. (2016) report that the prevalence of sedentary behaviors among Latin American women aged from 40 to 59 years old is high and that it is associated with more severe menopausal symptoms and with high anxiety and obesity rates in that population group.

Given the high prevalence of sedentary behavior in contemporary society and its adverse effects on health, its assessment has gained greater relevance. As is the case with the measurement of the PA level, there are subjective and objective methods to estimate sedentary behavior. Among the subjective methods are the printed questionnaires and the interviews (Headley et al., 2018).

The subjective methods allow identifying different types of sedentary behaviors and the contexts in which they occur, which is not possible with the objective methods. For example, the **Sedentary Behavior Questionnaire (SBQ)** (Rosenberg et al., 2010) measures the time spent on nine sedentary activities during a given week and weekend, which serves as the basis to ease the design of specific and individualized interventions to reduce sedentary time (Kang & Rowe, 2015). One of the limitations of the subjective methods is that they depend on the person' ability to accurately record the time spent on sedentary activities, which can be difficult, given that the behavior occurs throughout the day and does not pursue any objective or follow any structure, as is the case with PA (Headley et al., 2018).

It is also possible to estimate sedentary behaviors through accelerometry, which provides more reliable estimates of the total sedentary time in an everyday context when compared to the subjective methods. In addition, it allows identifying patterns, such as the presence of sedentary blocks throughout the day and their average duration (Kang & Rowe, 2015). One of the inconveniences of using accelerometers is the great diversity in terms of monitoring protocols, which can under- or over-estimate the sedentary behaviors. The cutoff point most frequently used to measure sedentary time is the accumulation of <100 counts per minute and, for a day of use to be valid, the accelerometer should have been employed for a minimum of 10 hours (Tudor-Locke, Camhi, & Troiano, 2012). However, Kang and Rowe (2015) indicate that the cutoff point seems to underestimate sedentary behavior in overweight adults and that using the accelerometer for the minimum time (10 hours) reduces sedentary time by 28% when compared to situations in which it is used 14 hours a day.

5.1.4 Assessment of physical fitness in perimenopausal women

Health-Related Physical Fitness (HRPF) is defined as the ability to perform work, recreational and everyday activities without feeling fatigue (Kaminsky, 2010). The physical abilities that comprise HRPF are as follows: cardiorespiratory resistance, musculoskeletal fitness (which encompasses muscle strength and resistance), weight and body composition, flexibility and balance (Heyward, 2010). Chrismas et al. (2019) mention that the adults who habitually perform moderate to vigorous PA enjoy better physical fitness and present lower morbidity and mortality rates. Strength and balance are of main interest in this paper.

Regarding muscle strength, which is the maximum tension level that any given muscle group can exert (Heyward, 2010), it is known that it presents an inversely proportional relation with metabolic risk and with mortality, regardless of cardiorespiratory resistance. From the third decade of life and until age 85, a 50% muscle strength loss is estimated, more pronounced in women, which might be associated with the hormonal changes experienced during menopause, as well as with the reduction in the PA levels at different life events, such as marriage, motherhood, and menopause (Skelton & Mavroeidi, 2018).

Because of strength loss in the lower limbs, women can experience changes in their balance, which is defined as the ability to maintain the body's gravity center based on support while in a static position, performing voluntary movements or in the face of external unbalancing forces (Heyward, 2010). Changes in balance increase the risk of falls and fractures in older adults. In addition, muscle strength loss is the main limiting factor for the development of the activities of daily living, since it exerts an effect on skills such as climbing stairs and getting up from a chair, as well as on gait speed (Skelton & Mavroeidi, 2018).

To assess the HRPF physical abilities there are test and field tests available, the latter being the most frequently used in studies involving large sample sizes (Kaminsky, 2010). Among the field tests to assess muscle strength in the upper and lower limbs are the 30 second Sit to Stand Test (30 SST) and manual dynamometry. 30 SST consists in getting up from and sitting on a chair as many times as possible during 30 seconds with the arms crossed against the chest (Bergamin et al., 2015; Pullybank et al., 2020) and, although it is part of the Senior Fit Test battery (Rikli & Jones, 2001), which assesses physical condition in older adults, has been used to assess physical fitness in middle-aged women (Moratalla-Cecilia et al., 2016; Pullybank et al., 2020). Regarding manual dynamometry, it is a test that assesses the forearm muscles' static strength (Kaminsky, 2010) and consists in exerting as much pressure as possible on a manual dynamometer while the elbow is kept flexed at 90° to ensure maximum force application (Bergamin et al., 2015). To interpret this test, Wang et al. (2018) established different cutoff points based on gender and age for the population aged from 18 to 65 years old.

To assess balance, Heyward (2010) proposes the statistic balance tests on one leg in their two modalities: with the eyes open and with the eyes closed. In both tests, the participant must maintain their balance with unipedal support during a maximum of 45 seconds while keeping the arms crossed against the chest; the test ends when the participant changes the arms' posture, moves their supporting foot or opens the eyes in the eyes-closed modality. This test has been applied in populations aged from 18 to 90 years old and includes different cutoff points by gender and age (Springer et al., 2007).

In addition to standardizing procedures among the evaluators, the assessment with physical tests requires considering appropriate cutoff points for the study population. This aspect represents an opportunity area in most of the populations, as many tests used in research have generated cutoff points considering gender and age; however, we must now acknowledge the major influence of body composition and even of anthropometry regarding the trunk's and legs' size on the physical performance results. Hence the need to develop cutoff points considering race and, when possible, it is even recommended to work on the development of specific cutoff points for each context.

5.2 Methodology

According to the quantitative approach and considering the objectives pointed out in the previous section, the study design is descriptive, comparative, correlational, analytical, and cross-sectional (Hernández-Sampieri, Fernández and Baptista, 2014). The study population corresponds to women belonging to several social groups from a community in the urban area of northeastern Mexico. Women aged from 45 to 59 years old who were able to walk without the assistance of another person were included, as well as those without any medical contraindication for physical exercise and who accepted to voluntarily participate in the study. The participants excluded were those who stated suffering from any acute disease during the previous week, as well those who indicated having a history of acute myocardial infarction, use of pacemaker, surgery, or fractures in the past three months. To avoid risks during the assessment of balance, it was decided to exclude those participants who stated suffering from any neuromuscular disease with use of medications that can alter habitual physical performance. The data of the participants who did not finish the physical tests were removed.

A formula was used to assess the difference of two proportions in an infinite population based on a value of 60% of physical inactivity reported in the literature. Based on the above, a necessary sample of 95 participants was considered. The proportional cluster sampling technique was employed to attain a more homogeneous representation of the study universe.

5.2.1 Characteristics of the group of perimenopausal women

A personal data form was used to collect personal information, namely: age, occupation, marital status; and the socioeconomic characteristics were surveyed with the Socioeconomic Level Questionnaire elaborated by AMAI (*Asociación Mexicana de Agencias de Inteligencia de Mercado y Opinión*, 2018). This questionnaire assesses six variables associated with the usual income in Mexican households: schooling level of the head of the house, number of full bathrooms in the house, number of cars in the household, Internet connection in the home, number of working family members aged over 14 years old, and number of bedrooms in the house. These variables are studied through six questions that yield a score from zero to 300 points, to later classify the socioeconomic level in one out seven possible levels. The socioeconomic levels proposed by AMAI are as follows: A/B (205 points or more) = High level; C+ (166-204 points) = Mid-high level; C (136-165 points) = Typical mid-level; C- (112-135 points) = Emerging mid-level; D+ (90-111 points) = Typical low level; D (48-89 points) = Extreme low level; E (0-47 points) = Very extreme low level. The questionnaire was validated by AMAI with data from the 2016 National Income and Expense Survey (*Encuesta Nacional de Ingreso y Gasto*, ENIGH).

Weight and height were measured to estimate the Body Mass Index (BMI). A SECA stadiometer and an OMRON HBF-514c scale were used. The individuals with BMI values between 18 and 25 kg/m^2 were classified as with normal weight, overweight corresponded to BMI values between 25 and 29 kg/m^2 and obesity was considered for BMI values over 30 kg/m^2 (Governor's Office Secretariat, 2018). The recommendations set forth in the manual by Lohman, Roche and Martorell (1998) were followed for these measurements.

5.2.2 Physical activity self-report

It was initially measured with the International Physical Activity Questionnaire-Long Form, which was designed to assess PA in adults aged from 18 to 69 years old, distinguishing four domains from overall PA, namely: PA at work, due to active transportation, at home, and during leisure time (International Physical Activity Questionnaire Group, no date). The version in Spanish has been validated by Caravali et al. (2016). It was designed in 1998 by a group of experts in Geneva and its long version was validated to monitor PA levels in adults aged between 18 and 65 years old (Craig et al., 2003); and the IPAQ group recommendations were followed for its assessment. The METs/minutes/week used in the activities from each domain of the questionnaire were calculated; subsequently, the total METs/minutes/week were added up. To classify the PA level between low and acceptable, the cutoff point recommended by the authors was used: 3,000 METs.

5.2.2.1 Physical activity with accelerometry

PA was quantified by means of ActiGraph™ wGT3X accelerometers (Actigraph, Pensacola, Florida, USA), which measure body acceleration in the three movement axis and express it as counts per time unit; with the use of cutoff points based on the accelerometer's counts, it is possible to measure the amount of PA performed based on its intensity: light, moderate, vigorous or very vigorous, as well as the number of steps walked (O'Neill et al., 2017). The Actigraph GT3X accelerometers have been validated to quantify PA in adults aged from 40 to 55 years old (O'Neill et al., 2017; Santos-Lozano et al., 2013). In Mexico, they have been used to assess PA level in adults aged between 20 and 65 years old (Salvo et al., 2015). Caravali et al. (2016) mention that the triaxial accelerometers such as those used in this study provide a more accurate estimate than their uniaxial counterparts.

The cutoff points used to measure PA intensity were those proposed by Freedson et al. (1998), which have been validated to measure moderate to vigorous PA in postmenopausal women (Diniz et al., 2017). The protocol used to validate the data was that described by Salvo et al. (2015), and the ActiLife v6.8.2 software (Actigraph, Pensacola, Florida, USA) was used. The variables that were considered to estimate the amount of PA performed are the following: daily average of moderate to vigorous PA (DAMVPA) expressed in minutes, and time devoted to light PA per day and per week. The criterion to verify if the participants met the moderate to vigorous PA (MVPA) recommendation for their age was multiplying the DAMVPA variable by 7 - the number of days in a week (Braun et al., 2016); if the participants accumulated ≥ 150 minutes of MVPA, they were considered active; otherwise, they were considered as inactive (WHO, 2020).

5.2.3 Sedentary behavior self-report

The instrument applied to measure this variable was the Sedentary Behavior Questionnaire (Rosenberg et al., 2010), which, by means of the self-report, quantifies the time spent to perform 11 sedentary activities (watching television, eating in a sitting position, resting in a lying position, playing videogames or with the cell phone, talking over the phone or with other people while seated, reading in a sitting position, playing some musical instrument, making handicrafts or craftwork, remaining in a sitting position while traveling or driving a car, bus or subway formation) during weekdays (from Monday to Friday) and, separately, the weekend activities. The total time in minutes of each aspect is reported to estimate sedentary behavior. The version in Spanish of this questionnaire has been validated by Munguía et al. (2013). To complement the information from the PA and sedentary behavior self-reports, accelerometry was applied in a percentage of the total sample (n = 42, 50%).

5.2.3.1 Sedentary behaviors with accelerometry

They are also quantified with ActiGraph™ wGT3X accelerometers (Actigraph, Pensacola, Florida, USA), which measure body acceleration in the three-movement axis and express it as counts per time unit. The following criteria were applied to assess sedentary behaviors by means of accelerometry: the accelerometer was used around the hip for seven days; the *epoch* used to integrate the data lasted 60 seconds; the days on which the participants accumulated a minimum use time of 10 hours were considered as valid, and only data from the participants who attained four valid days during weekdays and on one weekend day were included (Healy et al., 2011; Schlaff et al., 2017).

The cutoff point used to distinguish between sedentary activity and light PA was that proposed by Freedson et al. (1998). The data were validated using the ActiLife v6.8.2 software (Actigraph, Pensacola, Florida, USA).

To measure this variable, the minutes accumulated in average sedentary blocks per day, per weekday and per weekend day were considered (Schlaff et al., 2017). A sedentary block was defined as any period ≥ 30 minutes with ≥ 80% of minutes < 100 counts per minute with not more than 5 consecutive minutes with ≥100 counts per minute (Tudor-Locke, Camhi, & Troiano, 2012). The sedentary blocks per day variable is reported based on the daily average of sedentary minutes as a function of the time of accelerometer use; while the variables of sedentary blocks on weekdays (average of the sedentary blocks per day accumulated from Monday to Friday) and during the weekend (average of the sedentary blocks per day accumulated on Saturday and Sunday), are reported according to the recommendation by Schlaff et al. (2017).

5.2.4 Assessment of physical fitness: strength and balance

Strength in the upper and lower limbs and two balance tests were considered to measure physical fitness.

Strength in the upper limbs

As an indicator of the strength in the upper limbs, the hand grip test with a TAKEI digital dynamometer was used to assess the forearm muscles' strength. Rathnayake et al. (2019) mention that, in women, muscle mass loss starts during the fourth decade of life and that muscle strength suffers a 21% reduction between ages 25 and 55. Savva et al. (2018) state that the hand grip test presents an intraclass correlation coefficient of 0.94 to assess hand grip strength in adults aged from 18 to 59 years old with subacromial impingement syndrome. The test was applied in both hands and in duplicate with a minimum rest interval of two minutes between measurements; the highest value of the four attempts was considered to represent this variable (Table 5.2).

Table 5.2 Reference values for hand grip strength test in women aged 40 to 59 years

Variable	40-44	45-49	50-54	55-59
Dominant hand	29.9±6.2	28.8±7.2	28.2±6.3	25.1±6.2
Non dominant hand	28.9±6.4	27.4±7.0	26.5±6.5	23.6±6.4

Source: Wang, Y. C., Bohannon, R. W., Li, X., Sindhu, B., & Kapellusch, J. (2018). Hand-Grip Strength: Normative Reference Values and Equations for Individuals 18 to 85 Years of Age Residing in the United States. The Journal of Orthopaedic and Sports Physical therapy, 48(9), 685–693. https://doi:10.2519/jospt.2018.7851

Strength in the lower limbs

The 30 second Sit to Stand Test was applied: the participant is asked to get up from and sit on a chair for 30 seconds and the number of repetitions is counted. It is part of the battery included in the *Senior Fitness Test*, which was developed by Rikli and Jones (2001). The tests from the Senior Fitness Test present intraclass correlation coefficients from 0.8 to 0.98, and some of them have been validated in relation to the recognized *gold standard* (Langhammer & Stanghelle, 2015). Acosta et al. (2018) mention that the tests are safe, adaptable, and feasible for clinical populations, such as perimenopausal women. For normality, the cutoff point of 13 repetitions was applied, based on the publication by Moratalla-Cecilia et al., 2016.

Balance

The Unipedal Stance Test was applied, which is used to assess static balance and, according to Heyward (2010), validity of this test has been proven due to its relationship with gait, risk of falls and performance in the activities of daily living in older adults. Its intraclass correlation coefficient is 0.74 if performed with the eyes closed and 0.91 if conducted with the eyes open; and it provides a reliable measure of static balance in adults and adolescents (Heyward, 2010). To perform the test, the person to be evaluated is placed on an orthostatic position using only one leg, with the eyes open and then closed.

The test is scored based on the seconds that the person can maintain balance on the dominant leg; the assessment lasts a maximum of 45 minutes. To assess this variable, the scalar value of the time per participant in the two versions of the test (eyes open and eyes closed) will be considered. Additionally, with the results, performance will be classified as of acceptable or low level according to cutoff points recommended by the author of this test: Eyes open, 42.1 seconds for 40-49 years old and 40.9 seconds for 50-59 years old; Eyes closed, 13.5 seconds for 40-49 years old and 7.9 seconds for 50-59 years old.

Procedures

This project was registered at the Research Coordination Office of the *Facultad de Organización Deportiva* at the *Universidad Autónoma de Nuevo León* and has been approved by the authorities of the institutions involved, adhering to the ethical criteria for research with human beings (Health Secretariat, 1987). To publicize the project, information posters were used, and word-of-mouth invitations were made among renowned leaders of the social groups. Participation was made effective with prior scheduling. In the first appointment, the informed consent was signed, the personal data form was filled out, physical condition was assessed, the schedule was defined, and the accelerometer was handed in. A tutorial about using and taking care of the accelerometer during measurements was handed in, as well as ancillary questionnaires to the project. A new appointment was scheduled to return the accelerometer with the promise of delivering the interpretation of the physical condition assessment's results and customized recommendations as a retribution for collaborating with the project. With this, participation in the study was ended.

Data analysis

The SPSS software, version 21.0, was used for data analysis. The scalar variables are described with central tendency and dispersion measures, as well as the data distribution test. The categorical variables are presented as frequencies and percentages. Inferential statistics for the comparison of the qualitative variables was performed with the *Chi-square* test. To compare the results of the continuous variables obtained under different conditions, the *t tests* for related samples or the *Mann-Whitney U* test were performed. *Kruskal-Wallis* tests were used in variables with more than two levels. The association between variables was reviewed with a *Spearman*'s or *Pearson*'s correlation matrix according to data distribution. Statistical significance level was considered with p-value < 0.05.

5.3 Results

5.3.1 Characteristics of the group of perimenopausal women

A total of 109 women answered the invitation in the scheduled collection period. Eight of them did not meet some inclusion criterion and another one had to be excluded. Taking into consideration the exclusion criteria, the data of 16 participants (14.67%) were discarded for not having undergone the strength in the upper limbs test. The reasons pointed out for not accepting performance of this test included difficulty or discomfort exerting hand grip (n = 10, 62.5%) and history of surgery (n = 6, 37.5%). The results presented are those of the 84 participants who concluded their participation in the study. Table 5.3 includes the description of the scalar variables and data distribution.

Table 5.3 Descriptive characteristics of participants who are going through perimenopause

Variable	*Mean*	*Median*	SD	*Mín*	*Max*	*K-SL*
Age, years	49.39	49.00	4.51	40.00	59.00	**
Weigth, kg.	71.46	70.30	13.97	42.50	119.40	
Heigth, cm.	156.66	156.00	5.54	145.00	175.00	
BMI, Kg/m^2	29.23	28.20	5.39	19.10	49.06	
AMAI+ points	181.92	181.00	44.35	45.00	294.00	
SBBW, hrs.	899.11	862.50	367.64	250.00	2200.00	
SBWD, hrs.	875.00	875.00	375.39	125.00	1875.00	
PA++, METs	4381.90	3567.57	3197.85	297.00	15240.51	*
Work	498.32	0.00	1080.73	0.00	4590.00	**
Transportation	593.08	346.50	710.75	0.00	2772.00	**
Home	1752.98	1417.36	1406.46	0.00	5460.00	**
Free time	1537.37	959.92	2106.97	0.00	12960.00	**
Physical tests						
UBS, rep.	17.10	17.00	3.75	9.00	27.00	
LBS, kg.	23.80	23.45	4.51	13.10	32.80	
USTOE, s	22.66	19.00	15.41	1.12	46.00	**
USTCE, s	4.91	4.17	2.78	1.00	13.00	**

Note. BMI = Body mass index; SBBW = Sedentary Behavior Between Weekdays; SBWD = Sedentary Behaviors Weekend Days; PA = Physical Activity; METs = energy expenditury units; UBS = Upper body strength; LBS = Lower body strength, USTEO = Unipedal stance test with open eyes; USTCE = Unipedal stance test with closed eyes; *K-SL = Kolmogorov-Smirnov* with Lilliefors' correction. *$p < .05$; ** $p < .01$. +AMAI Level = Socioeconomic status questionnaire AMAI. ++Total physical activity and dimensions in METs. *n*=84.

Source: Sedentary Behavior Questionnaire, International Physical Activity Questionnaire Long form, and physical tests' report

The sociodemographic variables considered include the following: occupation, socioeconomic level, marital status, schooling, and Body Mass Index. Table 5.4 presents the participants' distribution regarding these categories.

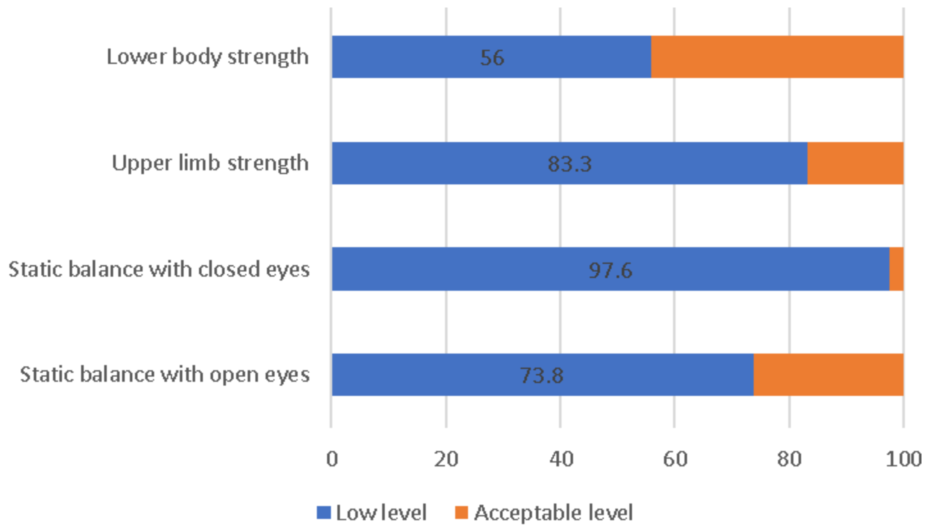
Table 5.4 Distribution of the participants regarding sociodemographic variables

Variables	*n*	*(%)*
Ocupation		
Home	56	66.7
Work	28	33.3
Socioeconomic level		
A/B	24	28.6
C	30	35.7
C+	19	22.6
C-	9	10.7
D+	2	2.4
Marital status		
Single	2	2.4
Married/Free union	74	88.1
Divorced	7	8.3
Widow	1	1.2
Scholarity		
Master's degree/speciality	5	6
Bachelor's Degree	27	32.1
Hight school	27	32.1
Middle school	21	25
Elementary	4	4.8
Body mass index		
Normal weight	16	19
Overweight	33	39.3
Obesity	35	41.7

Source: Personal data card. n = 84

To continue describing the participants, Graphic 5.1 summarizes the meaning of the strength and balance assessment of the study sample. Low values were found in more than half of the participants for all the physical tests.

Graphic 5.1 Summary of results of the evaluation of strength and balance in perimenopausal women (*n* = 84)



Source: Physical tests report

5.3.2 Physical activity

When reviewing the differences regarding the scalar variables between the percentage of the total sample subjected to accelerometry and the participants not subjected to such measurement, significant data were only found in relation to the balance test with the eyes closed ($p = 0.042$). In this test, the participants who did undergo the accelerometry measurement presented lower average values (4.30 vs 5.53, $t = -2.064$, *DoF* = 82). Table 5.5 describes the results obtained with accelerometry.

Table 5.5 Report of physical activity of a proportion of participating perimenopausal women with accelerometry

Variable	*Mean*	*Median*	SD	*Mín*	*Max*	*KS-L*
MVPA/week	191.82	161.85	141.11	29.17	784.00	*
Ligth activity/day	239.22	241.94	46.36	127.42	322.43	
Ligth activity/week	1674.56	1693.58	324.49	891.92	2257.00	

Note. Data are presented in minutes. MVPA = Moderade to vigorous physical activity; *K-SL* = Kolmogorov-Smirnov with Lilliefors' correction. *$p < .05$. $n = 42$

Source: Accelerometry report

The difference between the self-report and the accelerometry measurement regarding compliance with the PA recommendations for health was reviewed in the percentage of the sample who underwent the two assessments ($n = 42$, 50%). According to the PA self-report obtained through the IPAQ, 54.8% of the participants meet the global recommendations for health, which require at least 150 minutes of moderate to vigorous PA per week, whereas with accelerometry, the percentage was 52.4%. Hence the absence of statistically significant differences between the measurements ($p > 0.05$).

5.3.3 Sedentary behaviors

From the questionnaire applied, the specific description of each of the sedentary behaviors considered by the instrument is presented. The data are presented according to weekdays and to weekend days (Table 5.6).

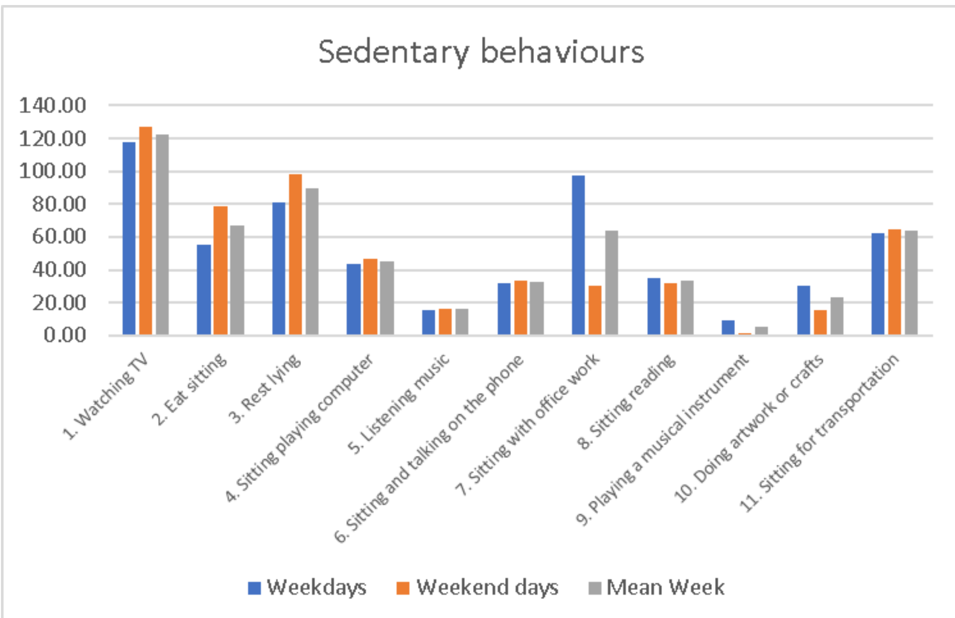
Table 5.6 Descriptive analysis of self-reported sedentary behavior

Behavior	Weekdays		Weekend	
	Mean	*SD*	*Mean*	*SD*
1. Watching TV	117.89	84.02	126.98	77.27
2. Eat sitting	55.26	37.73	78.36	51.96
3. Rest lying	80.79	91.19	98.53	86.70
4.Sitting playing computer	43.68	50.25	46.29	52.36
5. Listening music	15.79	36.68	16.03	33.70
6. Sitting and talking on the phone	32.11	40.73	33.10	40.40
7.Sitting with office work	97.37	126.97	30.26	61.91
8. Sitting reading	35.26	38.5	31.81	45.57
9.Playing a musical instrument	8.95	31.03	1.03	7.88
10.Doing artwork or crafts	30.53	53.63	15.78	39.38
11.Sitting for transportation	62.63	60.54	64.91	70.55

Source: Sedentary Behavior Questionnaire n=58.

Graphic 5.2 shows the average sedentary behaviors by type and regarding the weekend and those reported during the week.

Graphic 5.2



The description of the sedentary behaviors measured with accelerometry by blocks is presented in Table 5.7. As can be seen, on average, more than 850 minutes a day is classified within the sedentary level, which suggests the so-called sedentary lifestyle.

Table 5.7 Sedentary behaviors of a proportion of participating perimenopausal women with accelerometry

Variable	*Mean*	*Median*	*SD*	*Mín*	*Max*	*KS-L*
Sedentary blocks/day	876.18	869.90	96.09	705.50	1119.70	*
Sedentary blocks/BW	893.17	874.00	132.78	646.75	1311.20	
Sedentary blocks/WD	891.57	859.75	207.95	179.00	1245.50	
Note. Data are presented in minutes. BD = Between weekdays; WD = Weekend days. *K-SL* = Kolmogorov-Smirnov with Lilliefors' correction. *p < .05. n = 42.						

Source: Accelerometry report

The data regarding the sedentary behaviors on weekdays and during the weekend obtained through the participants' self-report and from the accelerometry report did not present differences (Table 5.8).

Table 5.8 Comparison of sedentary behaviors evaluated with self-report and accelerometry

				CI 95%				
	Mean	***SD***	***Error***	***Lower***	***Higher***	***t***	***gl***	***p***
SBW, min – SBBW	6.83	387.38	59.77	-113.89	127.54	.114	41	.910
SWD, min – SBWD	4.86	384.61	59.35	-114.99	124.71	.082	41	.935

Note. SBW = Sedentary behaviors between weekdays; SBBW = Sedentary blocks between Weekdays; SWD = Sedentary behaviors in weekend days; SBWD = Sedentary blocks in weekend days. *n* = 42.

Source: Accelerometry report, Sedentary behaviors questionnaire.

5.3.4 Physical activity, sedentary behaviors, and physical fitness

Considering that the self-report and accelerometry data did not present statistically significant differences, the assessment of the association between the participants' PA, sedentary behaviors and physical fitness was reviewed in the entire sample (Table 3.4.1). A direct association was found between PA and strength in the upper limbs ($r = 0.358$, $p < 0.01$). The weekday sedentary behaviors were positively associated with the weekend behaviors ($r = 0.614$, $p < 0.01$); likewise, the two balance tests showed an association ($r = 350$, $p < 0.01$). PA was not associated with the sedentary behaviors on weekdays or during the weekend ($p > 0.05$).

Table 5.9 Spearman association matrix between physical activity, sedentary behaviors, and physical fitness

	Mean	***SD***	**2**	**3**	**4**	**5**	**6**	**7**
1. PA, METs	4381.90	3197.85	-.174	-.020	.215	.358**	.145	-.007
2. SBBW, min	899.11	367.64	-	.614** Ŧ	-.126	.038	.059	-.034
3. SBWD, min	875.00	375.39		-	-.132	.009	-.067	-.009
4. UBS, kg	23.80	4.51			-	.100	-.065	-.175
5. LBS, rep	14.67	5.12				-	.099	-.009
6. USTOE, s	22.66	15.41					-	.350**
7. USTCE, s	4.91	2.78						-

Note. PA = Physical activity in METs; SBBW = Sedentary behaviors between weekdays; SBWD = Sedentary behaviors in weekend days; UBS = Upper body strength; LBS = Lower body strength; USTOE =Unipedal stance test with open eyes; USTCE =Unipedal stance test with closed eyes. Ŧ = Pearson's correlation test. *$p < .05$; ** $p < .01$. $n = 84$.

Source: Accelerometry report and Physical test report.

Being a housewife or having a job implied differences regarding the PA during leisure time domain ($p < 0.05$), with higher energy expenditure for the participants who devoted themselves to house chores (46.52 vs 34.46). Marital status generated differences in relation to the weekday sedentary behaviors with greater range for the women who were divorced, single, married or in consensual unions and, finally, widows ($p < 0.05$).

Socioeconomic level and schooling showed to exert an influence on strength in the lower limbs with a lower difference range for the participants belonging to the C+ level ($p < 0.05$). The Body Mass Index categories exerted an effect on the energy expenditure related to overall PA and the balance test with the eyes open: the greater the index, the lower the range recorded ($p < 0.05$).

5.4 Discussion

This paper analyzed the influence of the personal characteristics on the PA level, as well as on the sedentary behaviors, considering measurements through the self-report with questionnaires and the objective accelerometry assessment. In addition, the association with physical fitness was reviewed, which yielded important results for the epidemiological research of different professionals from the multidisciplinary health team, among which medical staff, PA or sports professionals, nutritionists, psychologists and nurses should be considered.

The presence of excess weight in most of the participants is in accordance with other women's reports during this life stage (Abdulnour et al., 2012; Aguilera-Barreiro et al., 2013; Darbandi, Najafi, Pasdar, & Rezaeian, 2020; Rossi et al., 2018; Villaverde-Gutiérrez et al., 2015). Excess weight affects women's physical fitness and cardiovascular health (Acosta-Manzano et al., 2018; Gregorio-Arenas et al., 2016); consequently, the high levels in this parameter might be a determining factor that exerts a negative influence on the physical performance of the participants in this sample. Although the association between PA and strength in the upper limbs has been mainly reported in the aged population, there are reports such as those by Bondarev et al. (2018) and by Leblanc et al. (2015) corroborating that this relationship is present in younger age groups.

At an appropriate level, strength and balance can mark a difference in case of falls or other types of accidents. According to the literature, these two skills can be trained (Chalapud-Narváez & Escobar-Almario, 2017; Otero, Esain, González-Suárez, & Gil, 2017; Vaca-García et al., 2017) and do not necessarily depend on age (Vaca-García et al., 2017). Measuring physical fitness with field tests would be an advisable assessment for consideration within the family consultation activities for everyday review and timely detection of health risks. This justifies the promotion of lifestyles that allow recovery and/or maintenance of these skills during perimenopause or climacteric (Nolting et al., 2019).

In 2020, the percentage distribution by age group in Nuevo León allowed identifying that 39.2% of the state's population is aged between 30 and 59 years old, with an equivalent proportion between men and women (INEGI, 2020). At the social level, maintaining families and/or paid work are an expected constant for the subjects belonging to this age group. The importance of assessing physical fitness for timely detection of health risk factors in stages prior to old age lies not only on protecting the individual as such, but also due to the social repercussions that early disability might present.

The fact that no differences were found between the questionnaires' reports and those obtained by means of accelerometry represents a very useful finding for researching PA behavior in women with similar characteristics to those of this sample. Consequently, the long version of the IPAQ questionnaire and the Sedentary Behavior Questionnaire turn out to be appropriate and advisable to assess these variables in women aged over 45 years old and less than 60 years old, with mid socioeconomic level and complete high school or higher education. It is worth noting that the sample's characteristics regarding schooling correspond to the average of 10.6 years reported for the state, which is slightly above the national mean of 9.7 years (INEGI, 2020).

The difficulty finding participants willing to use accelerometry equipment for a period of seven to nine days, coupled to the “inconvenience” that is for the woman to be evaluated regarding her physical fitness, might be limiting the generation of this type of evidence. The participants of this project faced the need to use a piece of equipment that measures PA level even on the days they knew that their PA was insufficient; the most problematic measurement was that of the two weekend days that was required. Although this is a small sample, it turns out to be representative of the study population; in addition, as can be seen, the sample presents the main distinctive sociodemographic characteristics of this age group at the state level.

In general, the limitations of this project are circumscribed to those inherent to the cross-sectional design and to the lack of laboratory physical tests to assess physical fitness; the findings must be limited to people with similar characteristics as those of this sample. The use of specific cutoff points for women belonging to this age group in this context constitutes an additional research need related to the study theme. Future studies might consider longitudinal analyses to observe the changes in these variables over time. Measuring physical fitness with field tests is considered an appropriate technique for epidemiological studies; this is convenient because it turns out to be economical and accessible, even in the clinical-assistance scope; it is necessary to work on the development of cutoff points adapted to the population characteristics of the context.

5.5 Conclusions

Regarding PA level, sedentary behaviors, and physical fitness in perimenopausal women, it is concluded that little more than half of the participants (54.8%) meet the PA recommendations for health; nevertheless, the amount of sedentary time per day is high.

No differences were found between the self-report and the objective accelerometry measurement of PA and sedentary behaviors in the participants of this sample. In the physical fitness tests applied, performance was low in more than half of the participants.

Excess weight exerts an influence on the total amount of activity, as well as on performance on the unipedal stance test with the eyes open. House chores exert an effect on the PA performed during leisure time. Based on the findings, future study lines can be targeted to the promotion and reinforcement of health-promoting behaviors, as well as to the design of interventions that maintain and/or improve the status of muscle strength and balance during this stage, as it is advisable to maintain physical functionality in old age and, with this, prevent functional limitations and motor disability.

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