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Investigation of the effect of changes in muscle strength in gestational age upon fear of falling and quality of life

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Background/aim: The aim of this study is the investigation of the effect of changes in muscle strength in gestational age upon fear of falling and quality of life.

Materials and methods: This longitudinal, descriptive study included a sample of 37 pregnant women who volunteered to participate. The research data were collected at 20 and 32 weeks of gestation. Data collection instruments included a newly developed questionnaire form, the Tinetti Falls Efficacy Scale, a visual analog scale, and the Turkish language version of the WHO Quality of Life Scale. Upper body flexibility was measured by the back scratch test, while muscle strength was measured by a handgrip dynamometer and balance by the unipedal stance test.

Results: It was found that, as pregnancy advanced, pregnant women had an increased fear of falling, as well as elevated systolic and diastolic blood pressure levels. Participants suffered significant impairments in their balance, handgrip strength, and quality of life within the physical, psychological, and environmental domains.

Conclusion: As pregnancy advances, muscle strength decreases and the fear of falling experienced by pregnant women increases, which significantly impairs the quality of life in the domains of environment, physical, and mental health.

Key words: Pregnant, fear of falling, quality of life

1. Introduction

Pregnancy is a critical period during which women experience major psychological, physical, physiological, and social changes in their lives (1,2). These significant changes may also lead to various health problems (3). The center of gravity in a woman's body shifts due to an enlarged uterus and increased body mass, which results in posture changes, as well as excessive lumbar and cervical lordosis (4). Venous return to the heart decreases, especially in the standing position, and pregnant women may suffer from dizziness and occasional fainting (2). All these physiological changes contribute to an increased susceptibility to trauma during pregnancy (5).

About 7% of all pregnant women sustain trauma during the gestational period (6). Falls, one of the major causes of trauma that may compromise both maternal and fetal life (7), account for 25% of all trauma cases occurring in pregnancy (6). The majority of falls during pregnancy occur while pregnant women carry an object or a child, turn, bend, reach for something, push or pull an object, or walk/run at a fast pace (8).

It is a fact that physical activity level significantly declines during the pregnancy period (9,10). Limiting physical activity to prevent any possible falls ironically increases the risk of falling while impairing the individual's perceived quality of life (11). Another factor directly impairing the quality of life in pregnant women are overwhelming emotional and psychological issues. The gestational period is a time of psychosocial changes that may pose serious risks, including anxiety and maternal stress. Genetic predisposition and biological, environmental, and hormonal factors may increase susceptibility to prenatal depression. Any form of depression felt by the expectant mother impairs the individual's functionality, creativity, overall happiness, and satisfaction with life, which adversely affects the mother's quality of life (12). The incidence of mental-health problems has been reported to be higher during the first and third trimesters of pregnancy (13).

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In the literature, it is reported that during pregnancy many changes occur. Muscular-skeletal transformations and physical, physiological, social, and emotional changes come at the beginning of this period. It is a fact that these maternal changes increase the risk of falling, significantly impairing the women's quality of life. Most of the research to date has generally covered the above-mentioned aspects. However, there have been no studies attempting to investigate the impact of pregnancy on fear of falling, with little research into the influence of pregnancy on health-related quality of life. The main objective of this research was the investigation of the effect of changes in muscle strength in gestational age upon fear of falling and quality of life.

2. Materials and methods

2.1. Study design

This descriptive study employed a longitudinal research design, collecting data between 1 March and 30 May 2012.

2.2. Universe and sampling

The target population of the study was all pregnant women registered at the family health centers in the city of Isparta. According to the data from the Isparta Local Health Authority, there were 3037 registered pregnant women in the city. Using the relevant formula to determine sample size, the appropriate sample size was calculated as 341 people. After the exclusion of those following certain exercise programs, those with exercise restrictions, and those under 20 weeks of gestation as of the day the research protocols started, the study included a sample of 37 pregnant women who agreed to participate in the research.

Prior to the initiation of any study protocols, written approvals were obtained from the research ethics committee (Decree No: B.30.2.SDU.0.28.00.00.050.99/556) and the relevant local health authority. The participants were given information about the aim and content of the study, and the informed consent of participants was obtained before starting the study.

2.3. Data collection method and instruments

The research team collected the relevant data during home visits that were performed at 20 and 32 weeks of gestation.

The data collection tools included a questionnaire form developed by the researchers, the Tinetti Falls Efficacy Scale (TFES), a visual analog scale (VAS), and the Turkish language version of the WHO Quality of Life-BREF (WHOQOL-BREF-TR). The muscle strength of the participants was measured by handgrip strength test using a handgrip dynamometer, while the back scratch test was used to measure the participants' upper body and shoulder flexibility and the unipedal stance test was administered for the assessment of balance.

2.3.1. Questionnaire form

Developed by the research team, this questionnaire form was designed to identify certain variables including sociodemographic characteristics, number of pregnancies, any falls experienced during previous pregnancy, fear of falling during current pregnancy, and body weight, blood pressure, and pulse rate.

2.3.2. Tinetti Falls Efficacy Scale

The TFES is a psychometric instrument originally developed by Tinetti et al. to measure fear of falling in the elderly population, based on the perceived self-efficacy or self-confidence in one's ability to avoid falls while carrying out simple activities of daily living. The questionnaire contains 10 items rated on a scale of 0 to 10, with 0 meaning no confidence and 10 representing full confidence. Based on a 0–100 point scale, an overall scale score is calculated by summing up each item rating, and higher scores reflect greater self-efficacy, or, in other words, less fear of falling (14). In the current study, we used the adapted Turkish language version of this scale (15).

2.3.3. Visual analog scale

A VAS may provide quantitative assessment of certain subjective characteristics or attitudes that cannot be directly measured in numbers. In practice, a VAS often consists of a 100-mm-long horizontal/vertical line with words or statements written at both ends, each describing the extremes of the parameter to be measured. The patients are asked to indicate a point on the line (by drawing a line or putting a dot or pointing at a point) that they feel best represents their current status/rated parameter (16,17). In this study, we administered a VAS to assess the fear of falling experienced while performing everyday activities. The participants were asked to mark a point that corresponded to the degree of their fear of falling along a 10-cm-long line anchored by the statements "No fear of falling at all = 0" on the left and "Extreme fear of falling = 10" on the right.

2.3.4. WHO Quality of Life Scale

The WHOQOL-BREF is a quality of life assessment instrument developed by the World Health Organization. The reliability and validity study of the Turkish language version was conducted by Eser et al. An abbreviated version of the WHOQOL-100, the questionnaire contains 26 items designed to address four broad domains of quality of life, which include physical, psychological, environment,

and social relationship items. It attempts to assess the respondent's perception of his/her position in life, not only in relation to physical concerns caused by disease but also in the context of physical activities, social relationships, and environments. Responses to each item reflect the severity and frequency of the individual's experiences as well as his/her own interpretation of such experiences. The physical health domain contains questions addressing factors such as ability to perform activities of daily living, dependence on medication and medical treatment, energy and fatigue, mobility, pain and discomfort, sleep and rest, and work capacity. The psychological domain consists of items on negative-positive feelings, self-esteem, body image and physical appearance, spirituality/personal beliefs, memory, and concentration. The environment domain of the scale comprises questions about physical safety and security, financial resources, home environment, accessibility to healthcare, recreational activities, physical environment, and transportation. Once the items have been rated on a 5-point scale, the mean score for each domain is calculated, resulting in a mean score of 4 to 20, which is translated to a 0–100 scale with higher scores denoting better quality of life (18–20).

2.3.5. Back scratch test

This test measures the flexibility of upper extremities by determining how close one can bring together his/her hands behind the back. Performed in the standing position, the test involves asking the participant to place the palm of one hand on the back by reaching behind the head and over the shoulder (external rotation), and try to reach as far as possible down the spine, with the palm facing inward and fingers in full extension, while placing his/her other hand on the lower back (internal rotation) and reaching upward as far as possible with palm facing outwards and fingers in full extension and attempting to touch the fingers of each hand. If the hands fail to touch each other, the distance between the middle fingertips is measured and recorded to the nearest centimeter (positive score). If the fingertips overlap, the score is recorded as zero (0), and if tips of the middle fingers overlap, then the distance overlapping is measured and recorded as a negative score (21,22).

2.3.6. Unipedal stance test

Also known as the one-legged stand test, this instrument is widely used to identify an individual's risk of falling (23). In the normal administration procedure, the participant is instructed to stand on both feet on a ground where he/she feels comfortable with eyes open and arms down at sides of the body. Next, the participant is asked to stand on one leg without any assistance with arms remaining at sides for as long as possible. The time elapsed on one foot is recorded in seconds, with longer time indicating better balance (23–25).

2.3.7. Handgrip strength test

Hands are one of the major components determining the functionality of upper extremities. One of their functions, the standard grip, appears to play a key role in performing instrumental activities of daily living. For this reason, measuring grip strength is considered to provide an objective index in assessing the general upper extremity strength (26). In our study, the grip strength of the participants was measured with a Jamar dynamometer, as recommended by the American Society of Hand Therapists as it has proven to be a highly reliable and valid instrument and is accepted as the gold standard for documenting grip strength (27). The readings are obtained while the participant is in a sitting position, with the shoulder in adduction and neutral position, the elbow placed on a flat surface (such as a table) and flexed at 90°, and the forearm and wrist in a neutral position (28,29).

2.3.8. Measurement of blood pressure

Blood pressure was measured from the brachial artery. The level of sensitivity was set at 0.1 mmHg.

2.4. Statistical analysis

Data processing and statistical analysis were performed using SPSS for Windows. Descriptive statistics were used to summarize participant variables with means and standard deviations. Continuous data were compared by one-way analysis of variance (ANOVA), independent samples t-test, paired samples t-test, and correlation analyses. For all statistical analyses, differences with a P-value of less than 0.05 ($P < 0.05$) were considered significant.

3. Results

The pregnant women participating in our study varied in age from 17 to 43 years, with a mean age of 29.6 ± 5.9 years. The mean age at first marriage varied between 16 and 33 years, with a mean age of 21.6 ± 3.8, while the mean age at first conception was 22.8 ± 4.2.

The proportion of primary school graduates among all pregnant women in our study was calculated as 45.8%. All of the participants had social security, while only 64.9% reported having a regular income. The majority of the participants were pregnant with their second child. Approximately 5.4% of the women reported having fallen (for any reason) during their previous pregnancy period. The proportion of those reporting fear of falling in the current pregnancy was 51.4% (Table 1).

Table 1. Comparison of selected participant characteristics and variables.

Variables	Number	Percentage
Education level		
Illiterate	2	5.4
Primary school	18	45.9
High school	13	35.1
College/university	5	13.5
Regular income status		
Regular income	24	64.9
No regular income	13	35.1
Current pregnancy		
First pregnancy	6	16.2
Second pregnancy	15	40.5
Third pregnancy	12	32.4
Fourth pregnancy	3	8.1
Sixth pregnancy	1	2.7
Fall experience during previous pregnancy		
Yes	2	5.4
No	35	94.6
Fear of falling during current pregnancy		
Has fear of falling	19	51.4
Has no fear of falling	18	48.6
Total	37	100

Measurements taken at the first and second observations showed that the mean weight of the participants significantly increased, and their systolic and diastolic blood pressure levels had elevated while they had significant losses in balance, flexibility, and grip strength. Apart from scores for back scratch flexibility test, the differences between the measurements taken at weeks 20 and 32 were all statistically significant ($P < 0.05$) (Table 2).

Based on the mean scores for VAS, it was determined that the pregnant women included in our study had a statistically significant increase in their fear of falling as pregnancy advanced from the week 20 to week 32 ($P < 0.05$). The mean overall score for the TFES obtained at week 20 showed a statistically significant decline at week 32 ($P < 0.05$). There were differences between all domain scores for the quality of life scale derived from the first and second observations, with statistically significant drops in the mean scores for physical health, psychological health, and environment domains ($P < 0.05$) (Table 3).

4. Discussion

This study has shown that the psychological, physical, and physiological changes that the body goes through during pregnancy, which is one of the major events in one's life, are severe enough to have a negative impact on biomotor abilities, fear of falling, and quality of life.

The results of our study showed that no significant changes occurred in the flexibility of the participants, whereas there was significant impairment in their balance and handgrip strength. The previous research in the literature noted that the level of physical activity gradually declined as pregnancy advanced into the second and third trimesters (9,10). Based on these literature findings, we may suggest that the losses in balance and handgrip strength are associated with the decreased physical activity level.

The current research also showed that pregnant women experienced a significantly increased fear of falling at the end of the 12-week period, which was confirmed both by

Table 2. Comparison of the first and second measurement results of anthropometric, physiological, and flexibility-strength tests in pregnant women.

	First observation		Second observation			
	Min–max	Mean	Min–max	Mean	t*	r**
Body weight (kg)	50–100	69.6 ± 11.8	53–110	75.0 ± 12.5	t = –12.416 P = 0.000 P < 0.05	0.978
Systolic blood pressure (mmHg)	90–130	108.1 ± 10.4	100–130	114.5 ± 8.6	t = –5.514 P = 0.000 P < 0.05	0.737
Diastolic blood pressure (mmHg)	50–80	68.9 ± 7.4	60–90	73.9 ± 8.4	t = –4.362 P = 0.000 P < 0.05	0.621
Pulse (/min)	72–96	82.3 ± 5.5	72–96	83.7 ± 5.5	t = –1.771 P = 0.085 P > 0.05	0.624
Back scratch test scores (cm)	0–40	7.5 ± 8.7	0–43	8.4 ± 9.8	t = –1.359 P = 0.183 P > 0.05	0.915
Balance test scores (s)	5–72	26.1 ± 18.2	3–68	22.5 ± 15.5	t = 2.917 P = 0.006 P < 0.05	0.912
Handgrip strength test scores (kg)	7.8–30	19.5 ± 6.0	6.9–28	17.7 ± 5.3	t = 4.838 P = 0.000 P < 0.05	0.930

A paired sample test was performed; *Statistically significant correlation; **Correlation coefficient.

a subjective assessment tool and an objective and reliable instrument to measure the fear of falling (30). According to the literature, higher orthostatic hypotension, protuberant abdomen, decreasing ankle stiffness, pelvic joint laxity, and fatigue increase pregnant women's risk for falls (31,32). The risk of falling increases even more with the duration of pregnancy (33). In this context, advanced maternal age may be considered an independent cause of elevated fear of falling among pregnant women. It is well established that any fall accident during pregnancy may result in severe damage to both the mother and the fetus (7). The stress caused by the possibility of sustaining such damage, especially to the unborn baby, might heighten the fear of falling in expectant mothers.

One of the key findings of the current study was that pregnancy significantly impaired the expectant mother's health-related quality of life. In our study, we found that, by the end of week 32, the pregnant women had significantly decreased quality of life in the physical, psychological, and environmental domains, while no significant changes were observed in their social relationships. This lack of difference in this quality of life domain (social relationships) may be explained by the common cultural attitude that pregnant women are not be left alone and unsupported. Some sources introduce genetic predisposition and psychological, biological, environmental, and hormonal factors as predisposing causes of prenatal depression. Depression is known to have a negative impact on an individual's social life (34). In this regard, prenatal depression may therefore be expected to impair the quality of life. Consistent with our research findings, previous studies also demonstrated that physical incapacity is another major factor adversely affecting the perceived quality of life in pregnancy (35,36).

In conclusion, as pregnancy further advances, the accompanying changes within the physical structure of the body lead to lower levels of physical activity and biomotor performance, thus resulting in an increase in the subjective fear of falling. Accordingly, the heightened fear of falling usually forces expectant mothers to restrict their activities in order to avoid any possible falls, which inevitably impairs their quality of life.

Finally, the generalizability of our research findings to a broader population may be subject to limitations. The sample of the study is relatively small and represents only

Table 3. Subjective and objective measures of fear of falling and changes in perceived quality of life in pregnant women.

	First observation		Second observation			
	Min–max	Mean	Min–max	Mean	t*	r**
Visual analog scale scores (subjective measure of fear of falling)						
	0–10	3.9 ± 2.8	0–10	5.1 ± 2.8	t = –4.779 P = 0.000 P < 0.05	0.853
Tinetti Falls Efficacy Scale Scores (objective measure of fear of falling)						
	14–100	72.1 ± 22.1	23–95	60.7 ± 18.5	t = 4.589 P = 0.000 P < 0.05	0.736
WHOQOL-BREF-TR domain scores						
Physical health	12–19	15.5 ± 1.7	9–18	13.5 ± 2.0	t = 5.943 P = 0.000 P < 0.05	0.395
Psychological health	9–19	14.6 ± 2.2	9–17	13.9 ± 2.2	t = 2.827 P = 0.008 P < 0.05	0.788
Social relationships	7–20	15.1 ± 2.7	9–20	14.8 ± 2.6	t = 0.807 P = 0.425 P > 0.05	0.528
Environment	10–20	15.4 ± 2.3	9–19	14.5 ± 2.7	t = 3.725 P = 0.001 P < 0.05	0.824

A paired sample test was performed; *Statistically significant correlation; **Correlation coefficient.

a miniscule portion of the population. Additionally, the participants significantly restricted their level of activity due to fear of falling and gained more weight than usual. Therefore, it is suggested that similar studies with diverse samples of people from different cultural backgrounds should be carried out using a customized exercise intervention program.

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