


ORIGINAL RESEARCH ARTICLE

The strength of the patellar and Achilles tendon reflexes is not affected in uncomplicated pregnancy

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Abstract

Introduction: Research on healthy pregnant women's reflexes is almost unheard of, even if an estimation of reflexes is a conventional part of the physical examination of preeclamptic patients, and hyperreflexia is generally considered to be a warning sign of eclampsia. The aim of the present study was to investigate the possible impact of gestation on tendon reflexes and the Babinski response, as examined in a clinical bedside manner.

Material and Methods: A prospective, single-blind, cross-sectional study. Three study groups comprised non-pregnant ($n=20$), 14–18 weeks ($n=16$), and 34–38 weeks ($n=15$) healthy pregnant women respectively. Two experienced neurologists examined separately each participant's patellar reflexes, Achilles reflexes, and Babinski response and rated them on two different scales, National Institute of Neurological Disorders and Stroke (NINDS) scale and Mayo Clinic Scale for Tendon Reflex Assessment. Inter-observer estimations between the patient groups and the neurologists were made by mixed effect model methodology.

Results: The patellar and Achilles reflexes' strengths were rated similarly in all three groups ($p>0.05$). The inter-observer difference was non-significant between the neurologists' estimations ($p>0.05$). The neurologists estimated the Babinski response in a few cases as neutral (0), otherwise down (normal).

Conclusions: The patellar and Achilles reflex strengths are not affected in uncomplicated pregnancy. There is good concordance between neurologists' estimations of tendon reflex strengths rated on the NINDS and Mayo scales.

KEYWORDS

Achilles reflex, Babinski reflex, hyperreflexia, patellar, pregnancy

Abbreviation: NINDS, National Institute of Neurological Disorders and Stroke.

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1 | INTRODUCTION

Repeated inspection of tendon reflexes has been, for a long time, a part of the obstetric physical examination of preeclamptic women. A study conducted in Cape Town in 1991 showed that patellar reflexes were increased in imminent eclamptic patients.¹ This is in accordance with the general comprehension among obstetricians that increased tendon reflexes in preeclampsia are a warning sign of eclampsia.² A study by Brussé et al in 2015 (using an electromyographical method) concluded that there seems to be no difference between a non-pregnant and a normotensive pregnant woman's patellar reflex.³ Moreover, we are not aware of any additional research on tendon reflexes in normal pregnancy and comparison with non-pregnant women.

The motivation for the study arose when the authors realized that evidence was lacking for the common opinion among obstetricians through generations, that is, that some degree of hyperreflexia is to be expected and accepted in healthy pregnant women. We started by asking (anonymously) a group of obstetricians and obgyn residents at our hospital department if and how they expected reflexes to change during normal pregnancy. Almost half of them (8 of 18) assumed that reflex strength would increase. However, knowing normal reflexes is essential for being able to assess and detect the abnormal ones. The aim of the present study was to look at the possible impact of gestation and gestational length on tendon reflexes as examined in a clinical bed-side manner (the Babinski response included).

2 | MATERIAL AND METHODS

This was a prospective, single-blind, cross-sectional study, that is, each participant was examined only once. Three study groups comprised healthy non-pregnant women ($n=20$), 14–18 weeks ($n=16$), and 34–38 weeks ($n=15$) healthy pregnant women. The pregnant women were recruited consecutively among those having appointments at the antenatal care service at the Department of Obstetrics and Gynecology of Landspítali University Hospital, Reykjavik. The study was performed (i.e., the examinations) in March 2021, all participants, randomly mixed, pregnant (2nd and 3rd trimesters) and non-pregnant controls, were examined in two sessions, separated by 2 weeks. Excluded were women with pre-existing neurological disease and pregnant women with preeclampsia or risk factors that were an indication for acetylsalicylic acid (“aspirin”) as a prophylactic therapy according to guidelines.⁴ Non-pregnant participants (all at reproductive age) were mostly employees of the hospital, recruited by an informal advertisement.

The consenting women came to the antenatal care unit in a session set up for this study (i.e., not regular antenatal visits). There were two sessions including all participants, 51 women. They were examined in a relaxed sitting position on a bench. A blanket covered the upper part of their bodies (Figure 1). Two experienced neurologists examined all participants and no more than 10 min went

Key message

There is no difference in the patellar or Achilles reflexes responses between healthy pregnant and non-pregnant women, nor any difference in the reflex response between women in early second or late third trimesters.

between their separate examinations of the same participant. The neurologists had no consultation with each other and did not know which group each woman belonged to, pregnant or non-pregnant. They examined each woman's patellar and Achilles reflexes bilaterally as well as the Babinski response.

As shown in Table 1 the tendon reflexes were rated on two well-known scales, NINDS (National Institute of Neurological Disorders and Stroke) and the Mayo Clinic Scale for Tendon Reflex Assessment.⁵ The third column in Table 1 shows the classification of the big toe (Babinski) response.

2.1 | Statistical analyses

The statistical analysis was carried out in R 4.05 through RStudio development environment 1.4.1106. Since there are multiple reflex measurements for each patient, it was necessary to take into



FIGURE 1 Setup for neurological examination.

TABLE 1 Tendon reflex assessment according to two scales, NINDS (National Institute of Neurological Disorders and Stroke) and the Mayo Clinic Scale for Tendon Reflex Assessment.⁵ The third column shows the classification of Babinski responses.

NINDS (National Institute of Neurological Disorders and Stroke)		Mayo Clinic Scale for Tendon Reflex Assessment		Babinski	
0	Reflex absent	-4	Absent	1	Big toe up
1	Reflex slight, less than normal	-3	Just elicitable	-1	Big toe down
2	Reflex in lower half of normal range	-2	Low	0	Neither up nor down
3	Reflex in upper half of normal range	-1	Moderately low		
4	Hyperreflexia/clonus	0	Normal		
		1	Brisk		
		2	Very brisk		
		3	Exhaustible clonus		
		4	Continuous clonus		

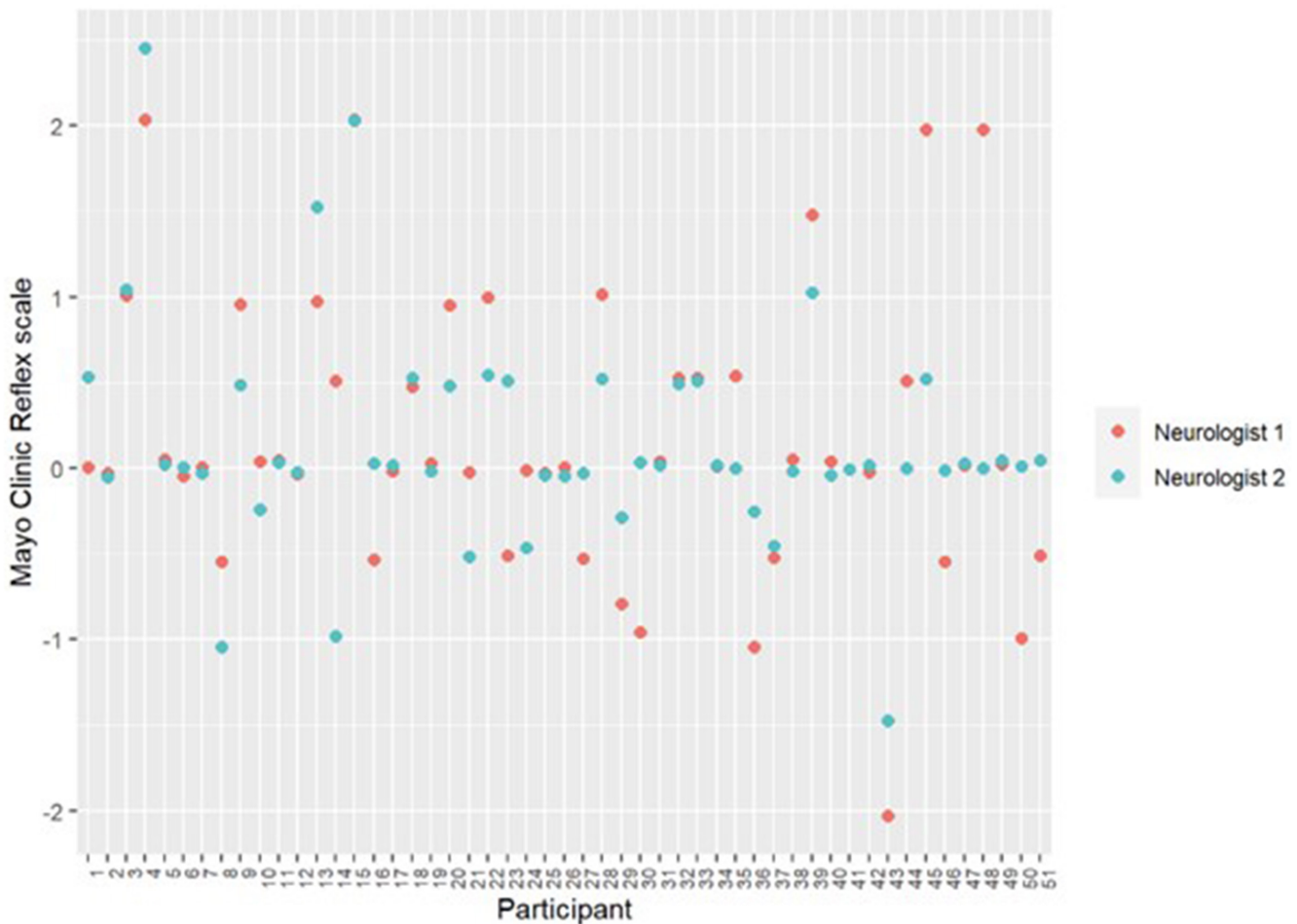


FIGURE 2 Results of the neurologists' estimations of the tendon reflexes by the Mayo Clinic Reflex scale. Two blinded experienced neurologists examined all participants separately and estimated their patellar and Achilles tendon reflexes on the Mayo Clinic Reflex scale from -4 to +4.

account that observations coming from the same patient are not independent. Intuitively, it is expected that observations/measurements from the same woman are correlated or more similar

to each other compared to observations between two different women. For this reason, the mixed effect model was deemed as the best methodology to study the tendon reflexes as a response

to the following variables: gestational length, doctor performing the test, location and side of the measured reflexes. The mixed effect model was fitted using the lmer() function from the lme4 package. As the reflexes were measured using two different scales, one model was fitted using the NINDS scale as a response variable and the other one using the Mayo Scale as the response variable. Significance was set with $p < 0.05$. The random effect

was constrained to the intercept value only and the models fitted were the following:

- MAYO score ~ Gestational_length + Neurologist + Position + Side + (1 | Patient)
- NINDS score ~ Gestational_length + Neurologist + Position + Side + (1 | Patient)

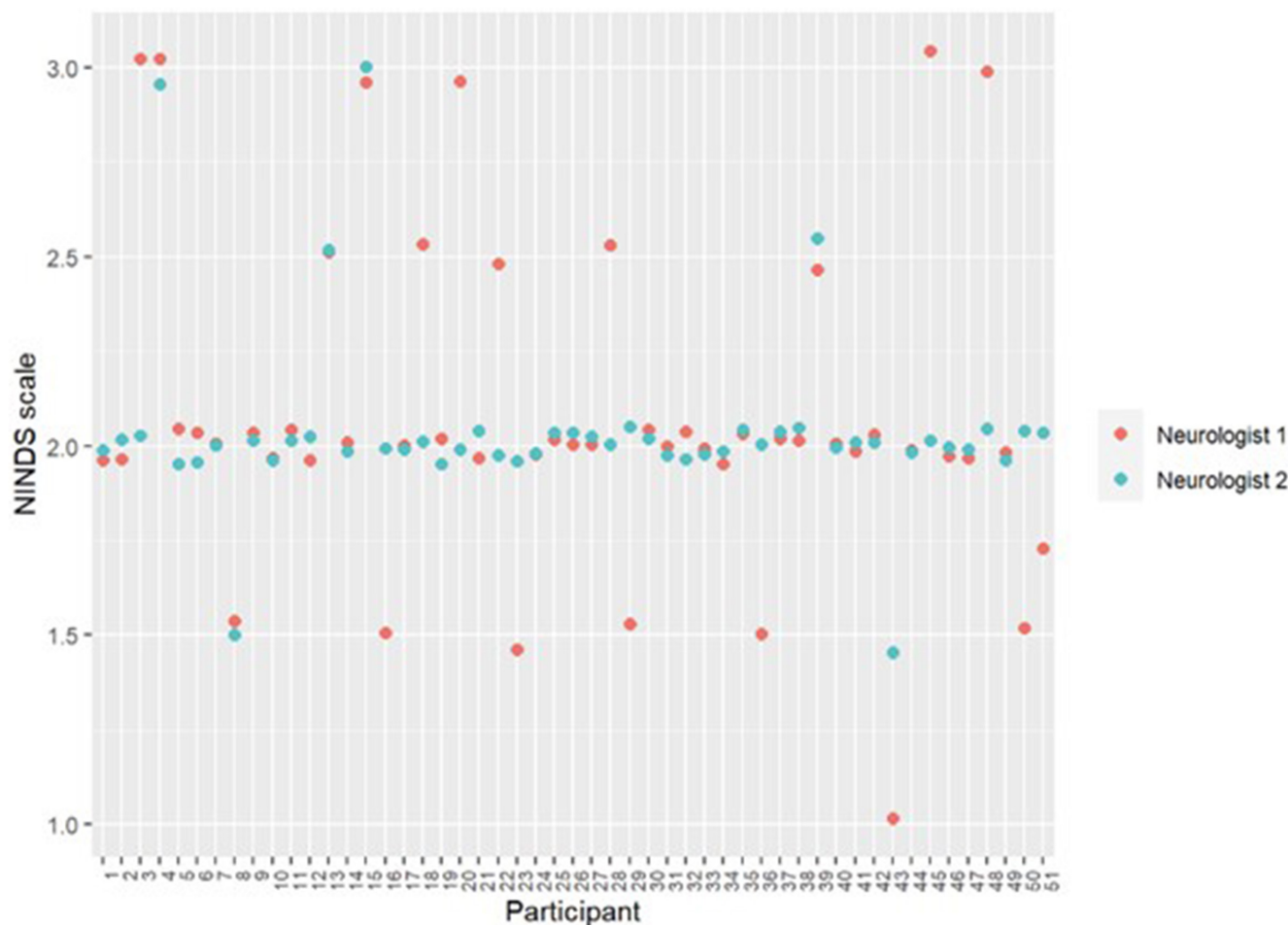


FIGURE 3 Results of the neurologists' estimations of the tendon reflexes by the NINDS scale. Two blinded experienced neurologists examined all participants separately and estimated their patellar and Achilles tendon reflexes on the NINDS scale from 0 to 4.

TABLE 2 Mayo Scale and NINDS conclusion.

Mayo conclusions				NINDS conclusions			
Title	Estimate	Confidence interval	p-value	Title	Estimate	Confidence interval	p-value
Intercept	0.198	-0.16 to 0.56	0.287	Intercept	2.080	1.92-2.25	0.000
34-38 weeks	0.012	-0.48 to 0.50	0.962	34-38 weeks	0.004	-0.22 to 0.022	0.970
Not pregnant	-0.065	-0.53 to 0.40	0.786	Not pregnant	0.004	-0.20 to 0.21	0.969
Neurologist 2	-0.039	-0.14 to 0.06	0.444	Neurologist 2	-0.004	-0.10 to 0.01	0.115
Ankle	-0.010	-0.11 to 0.09	0.848	Ankle	-0.005	-0.06 to 0.05	0.861
Left	0.020	-0.08 to 0.12	0.702	Left	0.005	-0.05 to 0.06	0.861

Note: Two mixed effect models (one using the NINDS scale, one using the Mayo scale) were used to examine the difference between tendon reflexes and the variables shown. The constants are 14-18 weeks, neurologist 1, knee, and right. Significance was set with $p < 0.05$.

3 | RESULTS

The neurologists' estimations of strength of the tendon reflexes are shown in [Figure 2](#) (the Mayo clinic reflex scale) and [Figure 3](#) (the NINDS reflex scale). The average value was 0 and 2 on the Mayo and NINDS scales, respectively. In [Table 2](#), two set-ups or models are shown for the two different reflex scales; the intercept refers to the base case described by the following values: Gestational length=14–18 weeks, Neurologist=1, Position=knee, and Side=right. The parameter estimates indicate the difference in the groups against the intercept. The *p*-values of all estimates were well above the selected threshold which indicated no differences. The confidence intervals for the estimated parameters were symmetric around the value zero. Accordingly, there were no significant differences in the strength of tendon reflexes between the three groups, non-pregnant and pregnant women, or in the second and third trimesters. The neurologists' estimations of the Babinski response were in no case up, a few were estimated neutral (0), otherwise down.

4 | DISCUSSION

The results of our study reveal no differences in the patellar and Achilles reflexes' strength between pregnant and non-pregnant women, or reflex strength between the early second and late third trimesters. No differences were found between the two experienced neurologists in estimations of reflex strength using the Mayo and NINDS scales.

The scientific literature about this topic is scanty. In the Cape Town study from 1991, no differences in patellar reflexes were noted between three different groups of pregnant women in third trimester (normal pregnancy, hypertension, and preeclampsia).¹ However, the authors showed that women with "imminent eclampsia" in the preeclampsia group had signs of hyperreflexia. Non-pregnant women were not included. What this study and our study have in common is that both studied groups of normotensive pregnant women. In the Cape Town study that group was compared to groups of pregnant women with hypertension or preeclampsia but in our study that group is compared with non-pregnant women. A study from the Netherlands (Brussé et al) included non-pregnant, normotensive women and compared them with preeclamptic and normotensive pregnant women.³ Electromyography techniques were used for recording and measuring patellar reflexes cross-sectionally at different times during pregnancy and after birth. This Dutch study did neither show differences in measurements (latency and amplitude) of the patellar reflex in normotensive pregnancies nor any differences when comparing with non-pregnant women or postpartum women.³ This is in accordance with our results. The pregnant women in our study had no preeclampsia or related risk factors, meaning they were normotensive. They were thus most likely without pathophysiological factors giving rise to exaggerated reflexes or hyperreflexia

and ultimately an eclamptic fit. Those factors would be more expected in a group of preeclamptic women as in the Cape Town study.¹ Although the pathophysiology is not clearly understood, such factors might affect the vasculature of the brain leading to cerebral edema/inflammation.⁶ More studies on reflexes comparing an uncomplicated pregnant group with a preeclamptic group are needed.

Our small sample size restricts the strength of our results. The statistical power might be insufficient to detect hyperreflexia in a normotensive pregnancy. This limitation is though compensated for by the methodology including two neurologists testing the index reflexes, the blinding, the use of two widely accepted reflex scales and sound statistical methods. Also, by designing the study in a "bed-side manner," we aimed to make it applicable to everyday clinical practice.

5 | CONCLUSION

There is no difference in the patellar and Achilles reflex strengths between healthy pregnant and non-pregnant women, or between early and late pregnancy.

AUTHOR CONTRIBUTIONS

Thora Steingrimsdottir and Haukur Hjaltason conceived and designed the study. Isold Nordfjord obtained access to the data and arranged the study. Haukur Hjaltason and Agust Hilmarsson performed the clinical tests. Andrea Valtorta and Isold Nordfjord analyzed the data. All authors interpreted the results and wrote the manuscript.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ETHICS STATEMENT

The study was approved by the Institutional Review Board (ethics committee) of Landspítali University Hospital by March 2, 2021 (no 16–2021). All participants gave written informed consent.

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