

THE EFFECT OF PREGNANCY ON THE SINGING VOICE

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SUMMARY. In the scientific literature, we noticed that the effect of pregnancy on the singing voice is scarcely investigated. We investigated a well-educated professional mezzo, during the third trimester and after the child-birth. We recorded her singing voice weekly, after 15 minute long warming-up. First we recorded sustained vowels [a, i, u] on a comfortable pitch and volume, for measuring MPT, SNR and SPR. Secondly we surveyed VRP. As third-step she repeated sentences, for analysing the mean of F0 of speaking vowels. We expanded our investigation by observations with rigid endoscopy and fiberscope, and also with spirometry. During the pregnancy the MPT decreased by every vowel. The SNR decreased by every vowel, mostly at the last 3 weeks of pregnancy. The VRP also decreased mostly in the upper range. The F0 of the speaking vowels slightly increased. We found slight oedema on the vocal folds first only on the 37th week. 4 weeks after the child-birth a small polyp was detected on the left vocal fold. 6 weeks after child-birth the oedema and the polyp resolved. With spirometry we found slightly increase of FVC and FEV1 during the third trimester.

Keywords: pregnancy, third trimester, oedema, VRP, nursing.

Introduction

During the overview of scientific literature we noticed that the effect of pregnancy on the singing voice is scarcely investigated. It is understandable because the topic is finical. To find well educated, professional singer with performing experiences is rather difficult. Our assumptions were that because of changes in gender-hormone level, increases:

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- Oedema in the neck, in the vocal folds
- Blood abundance in the larynx
- Symptoms of reflux
- Hindered breathing
- Hindered phonation

In the recent literature Cassiraga¹et.al. investigated 44 pregnant and 45 non-pregnant women. The participants were not singers. They observed:

- Decrease in MPT (Maximal Phonation Time)
- Increase in reflux level
- Increased voice volume in speech
- Increased perturbation of phonation
- Hindered breathing
- Heightened breathing up to clavicle level

La² and Sundberg made a complex research with one singer. They found:

- Hindered phonation,
- Decrease of MPT
- Decrease of alfa-ratio
- Decrease of the brightness of the voice,
- Increase of BMI (Body Mass Index)

Hancock³ and Gross made a complex research with one pregnant speech-language pathologist. Their experiences:

- Decrease of brightness of the voice
- Increase of perturbation of the voice
- Constant MPT

Saltürk⁴ et al. investigated 50 pregnant, non-singer women. Distribution of the participants, were as follows: 18 person was in first, 17 in second, 15 in the third trimester during the inquire. Their results:

- The reflux increased in the first and third, the VHI (Voice Handicap Index) in the third trimester
- The MPT decreased in the third trimester (significantly!)
- The parameters of the voice quality – F0, jitter, shimmer, NHR (Noise to Harmonic Ration), voice range – did not differ significantly!

This overview proved that the results are partly contradictory, and only in one study² was the participant professional singer.

Method: In our investigation a 24 years old mezzo soprano took part. She finished her master degree at the University, as a classical singing student. She belongs to the 4. regional / touring category – according to taxonomy by Bunch and Dayme. She has already significant experiences as an oratorio singer. We investigated her at the third trimester of her pregnancy. We recorded her singing and speaking voice weekly from the 29th to 40th week, with Roland/Edirol R-44R Channel Recorder and AKG 2000B microphones, supplied with 40 cm long distance consol. We used distance consol for insuring the permanent distance, from the lips to the microphones. We supplemented our inquirement with fiberoscopy (70 grad, Karl Storz rigid endoscopy), for observing the function of the vocal gap, and also with spirometry (SensorMedics Vmay), for measuring the breathing capacity. The whole transaction happened from beginning of November 2016 to the end of March 2017.

Procedure: the participant came to the studio at every week without any previous warming-up. There she achieved at every occasion a 15 minute long task-range. The tasks consisted of breathing, humming, texted tasks using consonants formed with lips [b], soft palate [g], throat [h] and different vowels, beginning on middle voice approaching the ends of her tessitura.

After this three tasks were recorded: 1. sustained vowels [a, i, u] on f#4, (in the middle of her voice range) on a comfortable volume. 2. decrescendo on sustained vowels [a, i, u], from forte to piano on the whole tessitura, in little second steps. 3. reading two artificial, but meaningful Hungarian sentences with normal speaking voice. One sentence consisted of only syllables with deep, velar vowels, the other only with high, palatal vowels.

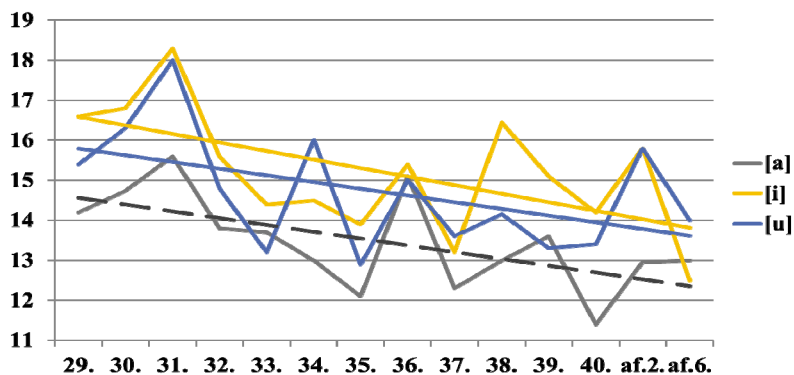
From the three recordings we analysed undermentioned parameters: MPT (Maximal Phonation Time), Range of voice, VRP (Voice Range Profile), SNR (Signal To Noise Ratio), SPR (Singing Power Ratio = [2-4 kHz/0-2 kHz]), F0 (mean of speaking fundamental frequency). For analysing the records we used SIGVIEW 2.4. acoustic program. We observed the function and the condition of the vocal folds four times – on the 31th, 37th of pregnancy, and on 4th, 6th weeks after child-birth – with rigid endoscopy, and fiberoscopy, while the participant formed [a, i] vowels. For analysing the FVC (Forced Vital Capacity) and FEV1 (Forced Expiratory Volume in 1 second) we used spirometry three times before – on the 31th, 34th, 38th weeks – and one time after – on 4th week – child-birth.

Results: The MPT decreased at all vowels, during the third trimester definitely, but the reconstruction of the conditions before, did not began unambiguous, during the first 6 weeks after child-birth. The tendencies are the same at every vowel. Look at the Table 1. and the

E.g. 1

Weeks	MPT [sec]		
	[a]	[i]	[u]
29 th	14,20	16,60	15,40
30 th	14,74	16,80	16,30
31 th	15,60	18,30	18,00
32 th	13,80	15,60	14,80
33 th	13,70	14,40	13,20
34 th	13,00	14,50	16,00
35 th	12,10	13,90	12,90
36 th	15,10	15,40	15,00
37 th	12,30	13,20	13,60
38 th	13,00	16,45	14,15
39 th	13,60	15,10	13,30
40 th	11,40	14,20	13,40
2 th	12,95	15,80	15,80
6 th	13,00	12,50	14,00

Table 1: MPT values in [sec]

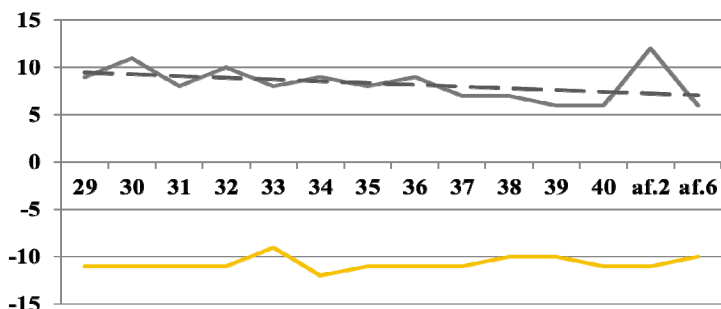


Graphic 1: trends in MPT alterations

On the horizontal axis the number of the weeks, on the vertical axis the alteration of the range of voice (values show the distance from the middle tone [f#4] in semitones) is visible. The range of voice decreased during the third trimester step by step, mainly in the upper part of the range. Look at Graphic 2.

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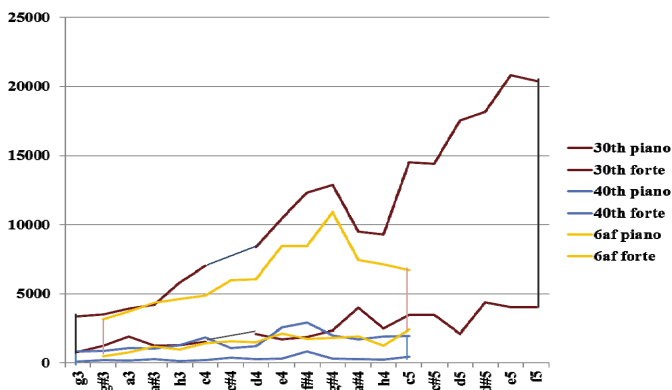
E.g. 2



Graphic 2: The alteration of voice range

The Graphic 3. shows that the VRP during the third trimester drops down dynamically. During the first six weeks after child-birth the range of voice stays diminished, but the volume capacity of the singing voice began to increase. We have to emphasize also that the so called “appoggio”-gap between g#4 and c5 is permanently visible on the figures, but before child-birth a second gap appears between c4 and e4 as well. It seems that the energy for well balancing diminishes at the end of the third trimester.

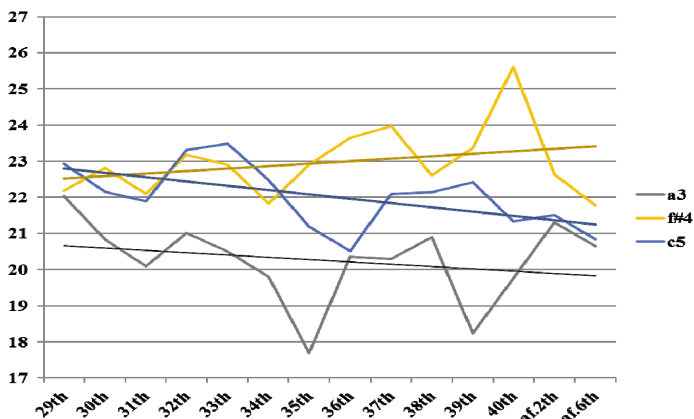
E.g. 3



Graphic 3: The alteration of voice capacity (VRP)

VRP (on vertical axis [sign strength] - proportional with volume - on horizontal sound levels)

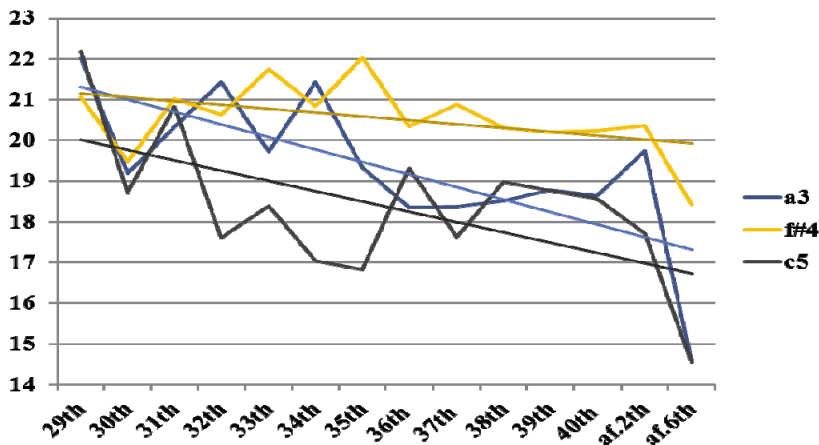
E.g. 4



Graphic 4: SNR at forte volume (vertical axis [dB], horizontal [weeks])

We analyzed the Signal to Noise Ratio (SNR) at vowel [a] on forte volume. On the middle [f#4] sound level the ratio increases, but on the extreme sound levels [a3, c5], as we assumed decreases. During short period – 6 weeks – after child-birth resolved alterations do not appear (Graphic 4).

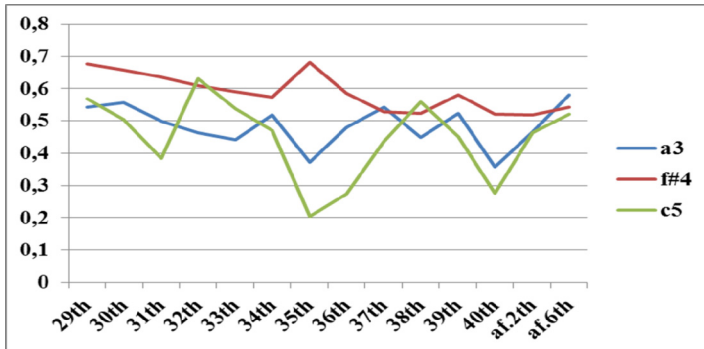
E.g. 5



Graphic 5: SNR at piano volume (vertical axis [dB], horizontal [weeks])

We analyzed the Signal to Noise Ration (SNR) at vowel [a] on piano volume as well. The piano volume seemed to react more sensitive as the forte one. At every sound level showed more strongly resolved decrease as the forte one. During short period – 6 weeks – after child-birth the decreasing trends stayed on (Graphic 5).

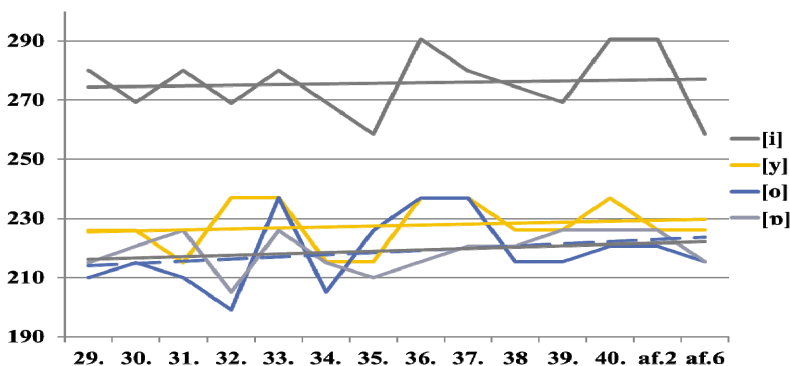
E.g. 6



Graphic 6: SPR forte voice of sustained [a] vowel, on three sound levels

The Graphic 6 above show that the SPR (the ration of the volume of the strongest overtone between 2-4kHz and 0-2kHz) show waving, but unambiguously decreasing during the third trimester. After child-birth the tendency alters immediately.

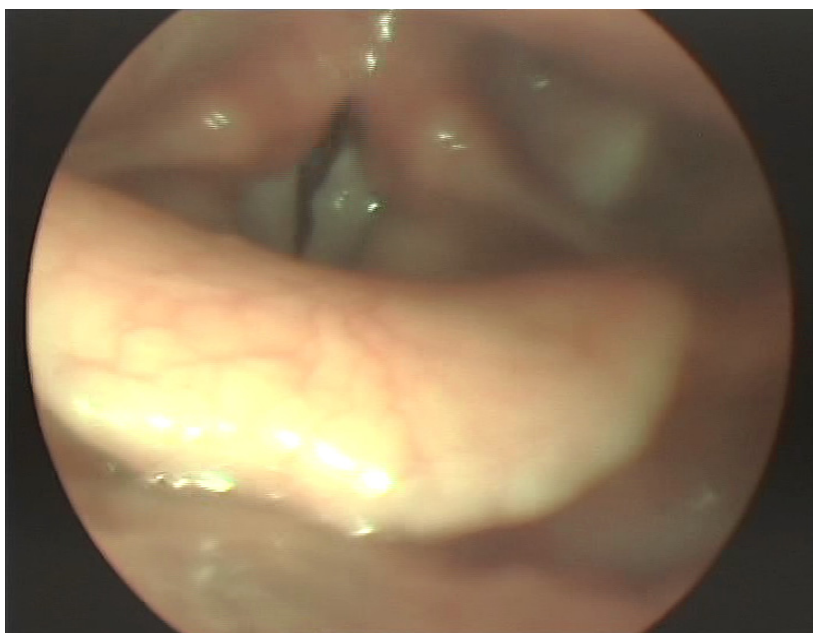
E.g. 7



Graphic 7: the alteration of F0 [Hz] of different speaking vowels. (On the vertical axis the sound level [Hz], on the horizontal the weeks are visible)

We noticed a slightly elevation of the tuning of every vowel – both palatal and velar - during the pregnancy, and a slowly sinking after child–birth. The elevation tendency is stronger for deep, velar vowels (Graphic 7).

E.g. 8



Picture 1: view of Endoscopy four weeks after child-birth: polyp is visible on the left vocal fold.

It was a real surprise – appearance of the polyp - four weeks after child birth, because at former inquiry, on the 37th week of pregnancy only little oedema was visible on the vocal folds. We assumed that after child birth the condition of the vocal folds will be regenerated in few weeks. After this inquiry we offered voice relaxing for the participant. Two weeks later the polyp disappeared, the condition and the function of the vocal folds were already again healthy (Picture 1).

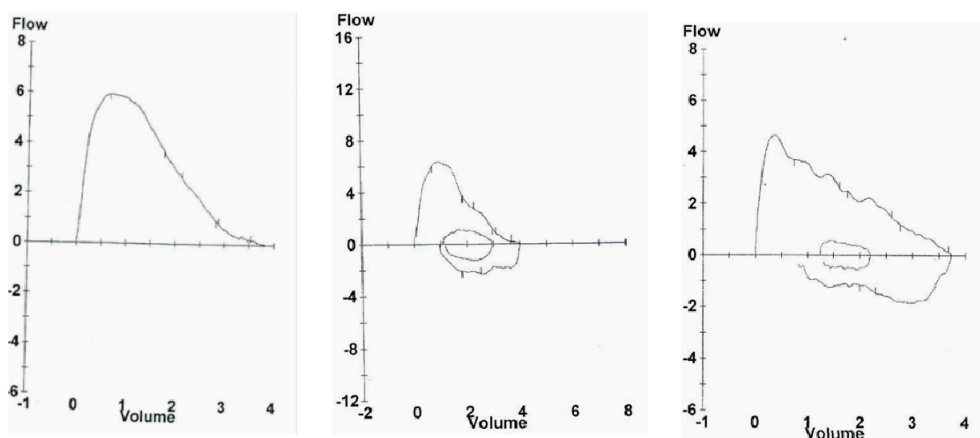
Spirometry: we found slightly increase of FVC (Forced Vital Capacity), and FEV1 (Forced Expiratory Volume in 1 second) during the third trimester, and expressed decrease four weeks after the child-birth (Table 2).

E.g. 9

	Reference	31th week	34th week	38th week	Aft.4 week
FVC	3,73	3,81	3,89	4,03	3,74
FEV1	3,25	2,90	2,98	3,13	2,65

Table 2: the values measured with spirometry in [lit]

E.g. 10



Graphic 8: the expiration functions on the 31th, 38th week of pregnancy, and on the 4th week after child birth are visible

We noticed that the expiration calms down steep before and mild after child-birth (Graphic 8).

Conclusion: Of course from a case study only we may conclude only deliberate conclusions. We experienced, that a well-educated singer with good singing technic is able to use her voice during the third trimester, accepting the decreasing of her voice capacity. But during intensive nursing, in the first six weeks after child-birth is not recommended. Of course the suggestion pertains to intensive voice practise, stage performing, not to cradle-songs, child-songs, volk-songs at home for the new-born baby.

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