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IS THERE ANY EFFECT OF THE SEASONAL CHANGES ON THE PITUITARY GLAND MORPHOMETRY?

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Abstract

The aim of this study was to determine retrospectively whether the seasonal changes were an effect on the pituitary gland volume by examining magnetic resonance imaging taken during summer and winter seasons of same person. Adaptation to seasonal changes is important for survival in all living things. Although, it is known that the pituitary gland activity may vary in different seasons, the articles examining the effects of seasonal changes on the pituitary morphometry is very few in the literature. Magnetic resonance imaging examinations taken in summer and winter months for same person and morphometric measurements of pituitary gland were performed on magnetic resonance images of 29 male adult person who had no pathological findings. We determined that the increase in the pituitary gland volumes in the summer months was statistically significant compared to the winter. There was statistically insignificant an increasing in pituitary gland height and transverse diameter in summer months. The effects of seasons on hormones and glands are known. However, the effect of the seasonal cycle on the pituitary gland morphometry has not been sufficiently investigated. The results of our study show that the pituitary gland volume increases in summer. We believe that this information will lead to physicians working on the pituitary.

Keywords: Pituitary gland volume, Seasonal changes, Morphometry

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1. Introduction

Adaptation to the seasonal changes in the environment is critical to survival in all living things. Important seasonal changes such as temperature and light duration are important environmental variables that must be adapted by living things. Seasonal temperature changes play an important role in the physiology and behavior of many mammals (reproduction, hibernation, food intake, physiological adaptations, etc.). These physiological events are controlled by the pituitary hormones released in response to annual environmental changes. The annual oscillations in the hypophyseal hormones are the basis of seasonal physiology. In temperate regions, the primary environmental hint that directs seasonal cycles is the change in day length (i.e., photoperiod) encoded by melatonin secretion from the pineal gland (Morgan and Mercer 1994; Schwartz et al., 1997; Castle-Miller et al., 2017).

Changes in day length constitute seasonal cycles and the task of the hormones is great in these cycles. Therefore, significant changes occur in the glands depending these cycles or adaptations.

It is known that the volume of pituitary gland may change in cases such as neuroendocrine and psychiatric diseases, major depression (Ertekin et al., 2011). Therefore, in response to clinical conditions involving hormonal changes, the pituitary gland undergoes changes in both size and function. Therefore, the hormonal effect of photoperiod and temperature is obvious. At the same time, we think that seasonal changes will also affect pituitary gland volume.

Although there are studies in the literature that examine the seasonal changes of hormones, the number of articles examining the effects of photoperiod on human pituitary gland volume changes is rather limited. In our study, we aimed to determine whether the seasonal changes were an effect on the pituitary gland volume by examining magnetic resonance imaging (MRI) images taken during the summer and winter seasons of the same person. We believe that the results obtained from our work will lead to physicians working on the pituitary gland.

2. Material and Method

This study was approved by the Clinical Research Ethics Committee of the Afyon Kocatepe University and this is a retrospective study.

Cranial MRI examinations taken in the summer (June, July, August) and winter months (December, January, February) for the same person and for any reason during the same year were retrospectively screened. As a result of this screening, morphometric measurements of the pituitary gland were performed on MRI images of 29 male subjects aged between 18 and 65 years who had no pathological findings. Because confounding situations such as pregnancy, menstrual cycle, breastfeeding can change the pituitary gland volume seriously in women, MRI images of female subjects are not included for more objective results. In addition, those younger than 18 and older than 65, those with pituitary gland disease (tumors, cysts, hemorrhage etc.), those with head trauma, those with masses forming the pressure in the brain (tumors, cysts, hemorrhage etc.) and those with cerebrovascular disease not included.

The height and length of the pituitary gland were measured in the sagittal sections (Figure 1). Furthermore, the pituitary gland width was measured over the cross section where the boundary of the pituitary gland was most prominent in transverse images (Figure 2). All morphometric measurements were made using transverse and sagittal sections; was measured over the cross section where the diameter is largest. The ellipsoidal formula was used for pituitary gland volume measurements (ellipsoid formula: volume = 0.523 × length × width × height) (Pavlik et al., 2000).

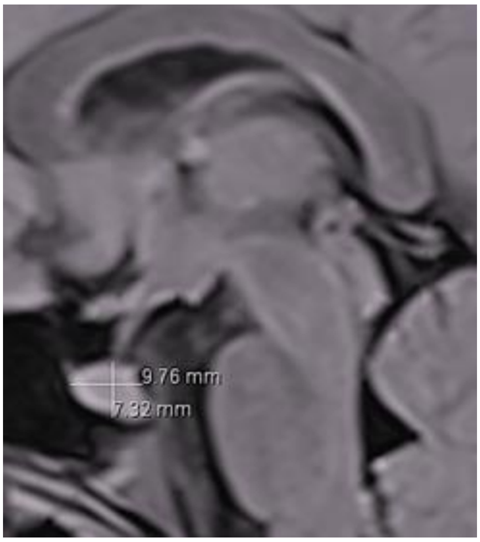

Figure 1. Height and length measurements (anteroposterior diameter)

Figure 2. Width measurement (transverse diameter)

Data obtained without study were assessed using SPSS 20.0 (Statistical Package for the Social Science, version 20.0). The distribution of the data was evaluated by the Kolmogorov-Smirnov test. The distribution of the data was normal and the binary group comparison was done by Student's t test. Correlation analysis between groups was done by Pearson's Correlation test. The results were evaluated as 95% confidence interval and $p < 0.05$ as significance.

3. Results

The pituitary gland measurements of 29 male participants with an average age of 46.76 ± 15.49 were performed.

As a result of measurements, in summer the height was 6.91 ± 1.43 mm, the length (anteroposterior) was 8.96 ± 1.38 mm, the width (transverse diameter) was 14.37 ± 1.78 mm and the volume was 346.75 ± 102.17 mm3. In winter, the height was 6.35 ± 1.04 mm, length (anteroposterior) was 9.11 ± 1.46 mm, width (transverse diameter) was 10.67 ± 1.74 mm and volume was 309.30 ± 85.02 mm^3 (Table 1.).

The statistical significance values between the summer and winter months were p = 0.057 in height, p = 0.567 in length, p = 0,056 in width and p = 0.033 in volume (Table 1.).

According to the measurement results of 29 participants' MR images, the increase in the pituitary gland volumes in the summer months was statistically significant compared to the winter months.

Although there was an increase in the height and width (transverse diameter) of the pituitary gland in the summer, these increases were not statistically significant. There was a statistically insignificant increase in pituitary gland length (anteroposterior diameter) during winter months.

Table 1. Morphometric measurements of summer and winter pituitary gland (* $p < 0.05$)

	Summer	Winter	p
Height (mm)	6.91±1.43	6.35±1.04	0.057
Length-Anteroposterior (mm)	8.96±1.38	9.11±1.46	0.567
Width-Transvers (mm)	14.37±1.78	10.67±1.74	0.056
Volume (mm^3)	346.75±102.17	309.30±85.02	0.033*

4. Discussion

In the literature, the volume change of the pituitary gland was examined in clinical situations such as winter depression (Miranda-Scippa et al., 2008), major depression (Krishnan et al., 1991), adolescent depression (MacMaster and Kusumakar, 2004), bipolar disorder (Sassi et al., 2001). In these studies, normal populations and groups with clinical impairment were compared. However, we could not find enough studies comparing the effects of the seasonal cycles on the pituitary gland morphometry in the normal population, both during summer and winter months. Our study has the feature of being the first in terms of pituitary gland volume comparisons in summer and winter in the normal population.

Clinical conditions such as major depression, various neurological diseases, endocrine disorders affect pituitary gland morphometry because body physiology and hormones are influenced. Likewise, the seasonal cycle is likely to affect the pituitary gland.

Schwartz et al. (1997) studied MRI images in summer and winter months of 19 patients with winter-seasonal affective disorder and 19 control, and neither winter depression nor seasonal changes were associated with a significant change in pituitary gland size. At the same time, they did not find any significant difference between the two groups. However, in women, the pituitary gland volume in summer is the opposite for males.

Miranda-Scippa et al. (2008) measured the volumes of 12 seasonal winter depressed patients and 12 healthy control pituitary gland volumes paired according to gender, age and menstrual cycle. Neither winter depression nor seasonal changes are associated with a significant change in pituitary gland volume. However, it is important to remember that their work, as they have stated, is made in the tropical region. Because in tropical regions neither the change of photoperiod nor the effect of temperature change is felt as much as in the middle zone. Our study was carried out in the middle zone and in the continental climate where the summer / winter temperature difference is high and the volume of pituitary gland is higher in summer months.

As a result of our study, it was determined that the volume of pituitary gland was increased statistically in summer compared to winter months.

5. Conclusions

The effects of seasons on hormones and glands are known. However, the effect of the seasonal cycle on the pituitary gland morphometry has not been sufficiently investigated. The results of our study show that the pituitary gland volume increases in summer. We believe that this information will lead to physicians working on the pituitary gland.

Conflict of interest

The authors declare that there is no conflict of interest.

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