Dynamics of gonadotropic hormones, immunological status and osteometry data in girls in the region of Uzbekistan in the age aspect

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Abstract. Complex investigation was undertaken on 1064 healthy girls to study parameters of physical and pubertal development age indications of physical and pubertal development of Uzbek girls. This data is correlated with normative indicators of girls living in the European part of the ISU that allowed considering them as standard for all republics. Analysis of the results showed significant redactor of hormonal activity and level of immunologic resistance, as well as high percentage of identification of pathology of reproductive system at girls and young women in Curlen district of Khoresm province that confirms ecologically unfavorable situation in this region of Uzbekistan.

1 Introduction

The formation of the reproductive system is a process of puberty; in this regard, this work was carried out to establish standards for the hormonal and immunological status of girls in an age aspect.

The study of reproductive health of adolescent children is a pressing problem in modern gynecology. Its solution is not only of scientific and practical importance, but also social, since timely detection and treatment of gynecological diseases in girls will be the basis for preserving reproductive function in adult women[1-3].

Numerous academic works have established gonadotropin-releasing hormone (GnRH) as the primary core regulator of human reproduction since its discovery. Nevertheless, the cellular apparatus necessary for the complete integration of developmental, environmental, endocrine, and metabolic elements influencing its secretion is absent from the GnRH neural network itself.

For instance, the primary estrogen receptor alpha (ER-alpha), which is necessary for sex-steroid mediated regulation of gonadotropin production, is not expressed by GnRH neurons. Thus, the mediating role of intermediate signaling pathways in gonadal steroid feedback must exist.

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Since the Kisspeptin-Neurokinin B-Dynorphin (KNDy) neuronal network was discovered ten years ago, evidence has been gathered that indicates this network plays a crucial role in controlling the downstream hypothalamic-pituitary-gonadal (HPG) axis by integrating endocrine, nutritional, and environmental signals to regulate pulsatile GnRH secretion[4-6].

In order to objectify scientific data and develop medical and preventive measures, comparative studies were carried out in two areas: in the zone of environmental distress - in the Gurlen district of the Khorezm region and in Tashkent. A total of 5,000 children and adolescents under the age of 17 were examined, of which 1,064 were girls (female gender), who, according to specialists, were considered somatically healthy. Vertebrates have a variety of GnRH and its receptor forms, with over twenty basic structures seen in different species.

These variations imply that the GnRH system evolved early in the evolutionary process. Since the GnRH structure was initially discovered to be mammalian, it is known as GnRH I. Later, a separate vertebrate GnRH sequence with a distinct structural variation was discovered in chicken brain; this is now known as GnRH II (pGlu-His-Trp-Ser-His-Gly-Trp-Tyr-Pro-Gly-NH2). Fish have also been reported to have a third type, GnRH III. Since GnRH I is the only hormone in animals with hypophysiotropic properties, GnRH I is referred to as GnRH in human contexts[7-9].

The conviction in the presence of a follicle stimulating hormone and a luteinizing hormone has increasingly diminished due to many factual reasons. It was discovered that the most refined follicle stimulating preparations, derived from the urine of postclimateric women, may induce luteinization when administered in high doses or over a prolonged length of time.

In addition, no individual achieved success in isolating two components either from pregnancy urine or from pituitary tissue. As a result, it became widely accepted that there was only one gonadotropic hormone, and that any variations in dosage or absorption rate would affect its physiological effects. The reaction obtained would be determined by the status of the end organ [10].

The examination complex included the study of hormonal levels and indicators of cellular and natural immunity and phagocytosis in comparative age and regional aspects.

2 Methods

The data obtained showed that the content of pituitary gonadotropic hormones (LH and FSH) in girls in the city of Tashkent during the neutral period (2-6 years) was: LH - 1.9 ± 0.4 mIU/ml and FSH - 1.3 ± 0, 4 m IU/ml, and the progesterone concentration was 1.6 ± 0.21 n/mol/l.

Significantly lower rates ($P < 0.05$) were also found in healthy girls in the Khorezm region. Large changes in the quantitative content of hormones in the peripheral blood were noted at puberty.

In girls in the city of Tashkent, the LH level was 2.7±0.5 mIU/ml at 11 years old and reached 7.9±0.5 mIU/ml with fluctuations from 5.2±0.4 mIU/ml to 7.2±0.4 mIU/ml.

In menstruating girls, the level of secretion of both LH and FSH does not differ from the levels that occur during the anovulatory period. At the same time, there was a significant decrease ($P<0.05$) in the amount of gonadotropic hormones in children with late puberty, the LH level was 2.7±0.5, and FSH 2.4±0.76 mIU/ml (Table No. 1).

Table 1. Concentration of gonadotropic and steroid hormones in the blood of healthy girls 2-17 years' old.

Age of the patients	Number of observations	LH M±m ME/l	FSH M±m ME/l	Estradiol M+m Kmol/l	Progesterone M+m N/l
2-6 years	30	1,9±0,3	1,3±0,4	76,7+6.8	1,6+0,27
7-10 years	30	1,7±0,2	1,6±0,4	97±8,7	1,89,27
11-13 years	44	-	**-**	-	-
Anovulation cycle					
10-11 days	10	4,4±0,8	4,7±0,8	215+19,1	2,5+0,5
20-22 days	10	5,1 ±0,6	5,1+0,5	439+29,6	3,4+0,4
Ovulation cycle					
1 phase	12	5,2±0,8	5,6+0,9	331+19,1	3,5+0,4
2 phase	12	7,9±0,7	7,2±0,4	495+31,5	20,4+1,2
14-15 years	46	-		**-**	-
Anovulation cycle					
10-11 days	8	4,1 ±0,7	3,1±0,3	196+16,2	2,6+0,4
20-22 days	8	9,5±0,8	4,2±0,9	384+29,2	4,9+0,6
Ovulation cycle					
1 phase	15	4,2±0,7	3,6±0,3	266+18,3	2,6+0,4
2 phase	15	10,3±0,6	4,2+0.9	565+29,2	16,9+1,8
16-17 years	30				
Anovulation cycle					
10-11 day	2	4,0±0,6	3,0±0,2	198+16,0	2,4+0,4
20-22 day	2	9,4±0,8	4,2±0,4	390+28,2	4,8+0,6
Ovulation cycle					
1 phase	13	4,4±0,4	3,8±0,5	270+18,5	2,8+0,4
2 phase	13	10,5±0,6	4,2+0.9	570+32,2	17,0+1,9

3 Results and discussion

An increase in gonadotropic activity was naturally accompanied by an increase in the level of estradiol to 495±31.5 N/mol/l and progesterone to 20.4±1.2 N/mol/l. There was also a decrease ($P<0.05$) in the amount of these hormones (estradiol 106±0.31 and progesterone

1.9±0.31) in girls with amenorrhea, as one of the leading manifestations of late puberty [1,5,11].

A comparative study of hormonal activity indicators in healthy girls in the Khorezm region did not reveal significant differences in any age group, despite the tendency to decrease the activity of gonadotropic and ovarian hormones at puberty.

A study of indicators of cellular immunity in healthy girls in the city of Tashkent showed that the percentage of all populations reflecting the functions of cellular

(T and B cells) and natural (phagocytosis) immunity did not have significant deviations from the norm and corresponded to the known literature data [2,3,8] (Table. 2).

Table 2. Formatting sections, subsections and subsubsections

Groups of patients (years old)	Number of observations	Content of the lymphocyte population in peripheral blood				
		T-lymphocytes M±m%	B-lymphocytes M+м%	T Helpers M+m %	T supressors M+m %	Fagocytosis M+M %
2-6	30	44,1±4,7	21,6±3,9	32,1+4,5	-7,3+2,3	41,6++4,7
7-10	30	49,3±4,6	19,1 ±3,6	34,4+4,4	-9,7+2,7	46,3+4,6
11-15	103	58,8±1,7	29,3±2,8	31,6+3,4	-11,4 ±2,4	49+3,7
16-17	30	52,1±4,4	3,4±3,9	38,4+4,1	9,5+2,6	58,9+4,3

The results of a survey of girls in the Khorezm region revealed a significant decrease in cellular immunity in most of them. Analysis of the data obtained indicates a lower body resistance of girls in this region as a whole.

In all cases, the detection of one or another pathological process was accompanied by a change in the immunological resistance of the body. In particular, a violation of cellular immunity indicators was expressed in a significant ($P<0.05$) decrease in the number of T and B cells, and an increase in T-suppressors was noted in tumors and malformations of the reproductive system.

In chronic inflammatory processes, regardless of age, there was a clear inhibition of the phagocytic activity of leukocytes (on average up to 18.2 ± 1.6) against the background of a decrease in the number of T and B cells and an increase in T suppressors.

In girls with late puberty and amenorrhea, the level of T-lymphocytes ranged from 27 to 38%, B-lymphocytes from 8 to 21%, T-helpers from 17 to 31%, T-suppressors from 4 to ± 21%, phagocytosis from 5 up to 32%.

Thus, the study conducted to study immunity indicators in healthy girls in Tashkent allows us to conclude that their immunological reactivity is sufficient. The study of the parameters of the immunological status corresponds to the literature data relating to residents of a similar age in the European part of Russia [9,10].

At the same time, it should be noted that changes in cellular immunity parameters were correlated with disorders in the reproductive system, which can be used as a trigger test for a more in-depth examination of the genital area [4,6,7,10-13].

The results of the study of bone density using ultrasonic osteometry showed that the speed of ultrasound propagation in the main bones studied in Tashkent girls is 3344.5±0.52 m/s, which should be considered as normal indicators (Table No. 3), on the contrary, in Khorezm girls region, this figure was 2835.1±0.41 m/s, which is due to the environmental problems of this region.

Table 3 Speed of propagation of ultrasound in various bones of the skeleton for girls and young women from 2-17 years old

Age (years old)	Number of observations	Clavicle	Humeral bone	Greater - tibia	Lower jaw	Rib
2-6	108	3221,4± 17,3	2528,4±34,2	3194,2±44,9	3291,8±41,5	3023,1±59,7
7	39	3336,8±22,49	2552,8±24,2	3210,5±42,28	3325,6±13,7	3027±56,1
8	39	3358,1±22,1	2560,3±16,1	3257,6±35,41	3361 Л±40,1	3042,7± 8 7,5
9	39	3387,2±42,2	2608,1±46,7	3282,7±29,1	3337,1±38,3	3045,2±33,1
10	39	3391,3±43,3	2621,4±37,6	3294,5±27,9	3352,3±37,8	3359,5±32,7
11	39	3421,2±34,5	2642,5±41,5	3327,7±29,3	3392,5±41,1	3084,8±29,1
12	39	3442,4±30,34	2661,4±60,9	3344,7±38,7	3434,2±38,1	3123,5±12,1
13	39	3456,7±38,9	2685,6±51,7	3387,7±31,9	3441,7±32,9	3135,6± 18,7
14	39	3470,1±30,5	2709,1±32,4	3403,4±37,9	3452,7±31,2	3144,6±42,3
15	39	3483,5±27,2	2731,5±39,2	3432,5±29,3	3463,5±32,7	3165,7±32,9
16	39	3533,8± 17.12	2755,5±42,6	3462,3±24,28	3490,1±27,3	3180,3±36,2
17	40	3623,1±21,8	2812,5±29,5	3619,5±23,1	3592,3±23,1	3256,7±29,5

The data obtained indicate ($P<0.05$) a decrease in the speed of propagation of ultrasound in the tubular bones of the skeleton. This indirectly confirms the presence of disturbances in ossification processes in girls and women of the Khorezm region. A decrease in bone tissue density, according to the results of our study, is associated not only with a lack of calcium in the body, but also with a change in the ratio of organic and mineral components of the skeletal system, a lack of vitamin D, which is involved in regulating the process of calcium absorption in the intestine [12], and with a decrease in the level of estrogen hormones, which was detected in girls of the Aral region. A detected decrease in the speed of ultrasound in bones in all age groups in girls of the Khorezm region, compared with girls in Tashkent is another fact indicating a decrease in the functions of these systems in the body, which indirectly confirms the environmental distress of this region.

4 Conclusion

Thus, to assess the physical and sexual development of girls, it is recommended to include in the examination complex, along with general clinical methods, the study of hormonal status, cellular immunity and osteometry. We have established the dynamics of the formation and development of the immunological, hormonal and osteometric status of girls in the age aspect, indicating the unidirectional course of these processes. The obtained age-related normative indicators of hormonal, immunological status and osteometry data of girls and young women in Tashkent can be used for individual and screening assessment of the development of girls' bodies and for the development of preventive measures.

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