International Journal of Early Childhood Special Education (INT-JECS)
DOI: 10.48047/INTJECSE/V14I7.259 ISSN: 1308-5581 Vol 14, Issue 07 2022

FEATURES OF THERMAL CONTROL OF CHILDREN OF THE FIRST YEAR OF LIFE AND INTERRELATION WITH GROWTH AND DEVELOPMENT OF THE TOTAL, SEGMENTARY SIZES OF THE BODY

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Annotation. It have beeninvestigated healthy children in dynamics of first year of life are. It have beenstudied indicators of thermotopography and the right-left gradients of temperature of skin on different parts of body at children of the first year of life in dynamics of growth and development depending on a sex. Conclusions are drawn that gradients of temperatures at children of the first year of life depend on a geterochroniya of growth of extremities depending on a sex and also at increase in a gradient of temperature of the upper extremities divergence and sexual dimorphism is obviously observed.

Keywords: thermal control, dynamic research, total sizes of a body, segmentary sizes of a body, children of the first year of life .

Relevance. It is known that there are few works devoted to thermoregulation in early human ontogenesis [1, 2, 4, 7, 8, 22], and studies that studied the relationship of thermoregulation with the growth and development of children in the first year of life have not been found in the literature we studied. Outside of the research work in these sources, the connections of the physiological functions of thermoregulation with the size and shape of the body of children, the relationship of the size of the body of children with the physical factor of the external environment (ambient temperature) have not been studied) [3, 4, 10, 11, 12, 19, 26] and gravity gravity in connection with the locomotor development of children, as well as the effect of body size on heat production , etc . [1, 5, 9, 14, 16, 24, 27, 28].
In connection with the above, the aim of the study was to study the indicators of thermotopography and right-left gradients of skin temperature in certain areas of the body in children of the first year of life in the dynamics of growth and development depending on gender.
Materials and methods of research. 106 healthy children from the neonatal period to one year were studied. Thermotopography was carried out on a portable thermotopograph of the ETMP-01 type. Thermotopography of the skin of newborns was carried out at 15 points. The right-left (transverse), longitudinal (craniocaudal), as well as segmental gradients of newborn skin temperature, average body temperature (CTT) and weighted average skin temperature (SVTK) of newborns were studied. Anthropometric parameters were studied on the basis of standardized WHO research methods [18, 25, 26].
Research results and discussion.
We studied the thermotopography of the skin of children of the first year of life, the results of which are shown in Tables 1 and 2 and Figure 1a-D.

Table 1
Thermotopography of children's skin in the dynamics of the first year of life (boys) (M±m)

Body areas	Newborn N-48	III month N-44	VI month N-41	IX month N-32	XII month N-16
1.Forehead	33,2±0,01	33,7±0,22	33,9±0,09	34,3±0,11*	34,2±0,17
2. E.A.C	34,5±0,32	35,5±0,21*	35,6±0.01	35,7±0,09	35,4±0.02
3.Neck	33,7±0,24	35,5±0,07*	35,91±0,08*	35,4±0,01	35,6±0,01
4. Chest	34,0±0,01	34,2±0,08	34,9±0,07*	34,9±0,01	34,4±0,02*
5. Back	34,1±0,29	34,6±0,07	35,31±0,06*	34,9±0,05	35,8±0,03
6. Belly	34,1±0,27	34,1±0,08	35,14±0,07*	35,0±0,05	35,23±0,07

7. Lower back	34,1±0,29	34,8±0,06	35,56±0,08*	35,2±0,14	33,4±0,03
8. Buttock	30,5±0,10	32,7±0,07	30,9±0,11*	30,7±0,04	29,7±0,16*
9. Hip	33,8±0,28	33,5±0,25	33,4±0,05	32,9±0,07*	32,7±0,14
10. Shin	33,7±0,17	33Д±0,04*	33,4±0,07	32,8±0,06*	32,6±0,04
11. Foot	33,5±0,25	32,7±0,05*	32,9±0,04	32,6±0,14	32,0±0,04*
12.Stomach	37,7±0,01	37,8±0,08	37,4±0,05	37,8±0,05	37,6±0,13
13. Shoulder	33,2±0,26	33,8±0,08*	34,3±0,10*	32,7±0,12	34Д±0,04*
14. Forearms	34,1±0,21	33,7±0,06*	33,8±0,2	33,8±0,13	33,5±0,21
15. Brush	33,9±0,26	31,2±0,06*	33,4±0,01*	33,4±0,09	33,5±0,21

Note: *-statistically significant (p<0.05-0.001) in relation to the newborn period

As can be seen from these tables, both boys and girls in the dynamics of the first year of life have a tendency to unidirectional increase in skin temperature in the areas of the forehead (p<0.05-0.01), the external auditory canal (p<0.01), the cervical and spinal region (p<0.01-0.001), the lower back (p<0.05-0.01) and a decrease in skin temperature on the upper and lower extremities (p<0.05-0.01). It is shown that the topography of skin temperature in children during the first year of life in various parts of the body is higher (p<0.05-0.01) than in adults and older children and lower than in premature infants [1, 6, 9, 23, 29]. From the data in Tables 1 and 2 and Fig.1a-d, it can be traced that the skin temperature in various parts of the body is heterogeneous and its level on the trunk from the newborn period to 12 months of life prevails over other parts of the body, especially over the temperature of the segments of the upper and lower extremities. The highest values of skin temperature are observed in the rectum (p<0.01), neck, back and lower back (p<0.05-0.01). The most "cold" points were the buttock (p<0.001), hand (p<0.01), foot (p<0.05-0.01). With age, the level of skin temperature in different parts of the body changes differently, i.e. at the points of the forehead, external auditory canal, neck, chest, back, lower back increases (p<0.05-0.01), in the rectum - does not change (p>0.05), and in the buttocks, hips, lower legs, feet, forearms, hands - decreases (p<0.05-0.01), i.e.e. the difference in skin temperature between the central and peripheral parts of the body increases. The sixth month of life was especially crucial in this regard (Table. 1 and 2).

There is evidence in the literature that the role of brown fat in increasing physical thermoregulation is noticeably activated in children aged 5-6 months [21, 23]. In this regard, the fact of an increase in skin temperature in this period in the neck and back area (p<0.01), where brown fat is most topographically accumulated, is noteworthy. Apparently, at this age there is an improvement in thermoregulation and metabolism [11, 13, 20, 29].

Table 2.

Thermotopography of children's skin in the dynamics of the first year of life (girls) M ± m

Body areas	Newborn N-48	III month N-44	VI month N-41	IX month N-32	XII month N-16
1.Forehead	32,6 ±0,22	33,14±0,17	34,42±0,12*	33,2±0,07	34,4±0,09*
2. E.A.C	34,5±0,24	34,69±0,22	35,15±0,09	33,9±0,08	36,4±0,08*
3.Neck	33,2 ±0,29	34,08±0,21*	35,09±0,08*	34,4±0,05*	34,9±0,03*
4. Chest	33,4±0,27	33,68±0,19	34,98±0,04*	33,95±0,02*	34,2±0,05
5. Back	33,7±0,17	33,9±0,21	35,2±0,02*	34,25±0,04	34,81±0,03
6. Belly	33,7±0,14	33,98±0,20	35,21±0,08*	35,1±0,04	35,2±0,08
7. Lower back	33,7±0,18	33,86±0,22	35,33±0,17*	34,6±0,06*	35,8±0,01
8. Buttock	30,7±0,14	30,96±0,15	31,3±0,18	30,93±0,03*	28,89±0,09*
9. Hip	33,3±0,25	32,58±0,17	33,28±0,01*	32,72±0,06	32,95±0,04
10. Shin	33,1±0,24	32,35±0,26*	34,28±0,09*	32,83±0,07	32,93±0,05
11. Foot	32,1±0,22	32,16±0,19	33,12±0,08*	32,88±0,09	32,77±0,04
12.Stomach	36,7±0,10	36,8±0,15	37,2±0,05	37,7±0,02	37,2±0,05
13. Shoulder	33,1±0,26	32,81±0,06*	34Д±0,08*	33,2±0,09	33,63±0,04

DOI: 10.48047/INTJECSE/V14I7.259 ISSN: 1308-5581 Vol 14, Issue 07 2022

14. Forearms	33,3±0,24	32,71±0,06*	33,9±0,02	32,75±0,06	32,74±0,04
15. Brush	32,6±0,25	32,72±0,18	33,5± 0,06*	32,9±0,05	32,4±0,08

Note: *-statistically significant (p<0.05-0.001) in relation to the newborn period

The longitudinal gradients of skin temperature in the children examined by us, reflecting the temperature difference in the central (forehead, chest, abdomen) and peripheral (foot, hand) areas of the body, are shown in Fig.6 a-d,. where it is shown that in children in early postnatal ontogenesis (3 months of life), the longitudinal gradients are not large (p>0.05) and do not exceed 0.3-0.5 ° C, and with age, both boys and girls have longitudinal gradients increase, especially in the forehead-brush areas (p<0.05-0.01), forehead-foot (p<0.01-0.01), chest-hand (p<0.05-0.01), chest-foot (p<0.05-0.01), abdomen-foot (p<0.01). It should be noted that in certain periods of life, skin temperature gradients in the forehead-brush area (in boys at 12 months, in girls at 9 months), forehead-foot (in boys at the age of 9 months), chest-brush (in boys aged 9 and 12 months), chest-foot (in boys at 9 months), the abdomen-foot (in girls at the age of 6 months of life) decrease (p <0.05-0.01). This is probably due either to an increase in the skin temperature of the hand (p<0.05) and foot (p<0.05) in these age periods, or to a decrease in skin temperature in the forehead (p>0.05) and chest (p<0.05-0.01) areas. We assumed that these "differences" in skin temperature gradients are associated either with the asynchrony of limb growth (in length and width), or with the effect of ambient temperature on the exposed surfaces of limb parts.

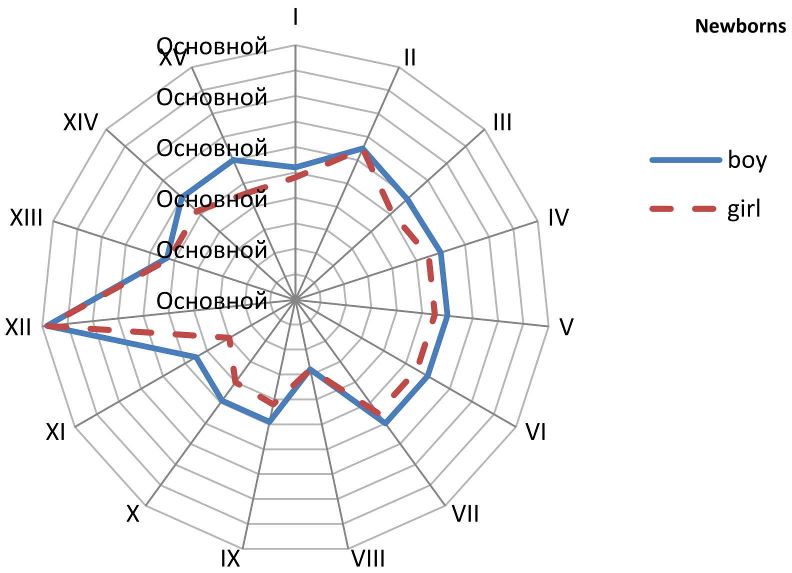

Fig.1 a. Thermotopography-skinofchildreninthedynamicsofthefirstyearoflifenewborns –(1stmonthoflife):

DOI: 10.48047/INTJECSE/V14I7.259 ISSN: 1308-5581 Vol 14, Issue 07 2022

I - Fore head , II - external auditory canal ,III - Neck , IV - chest , V – back , VI – Belly , VII – lover back , VIII – Buttock , IX – hip , X – shin , XI – foot , XII stomach , XIII – shoulder , XIV – Forearms , XV – brush .

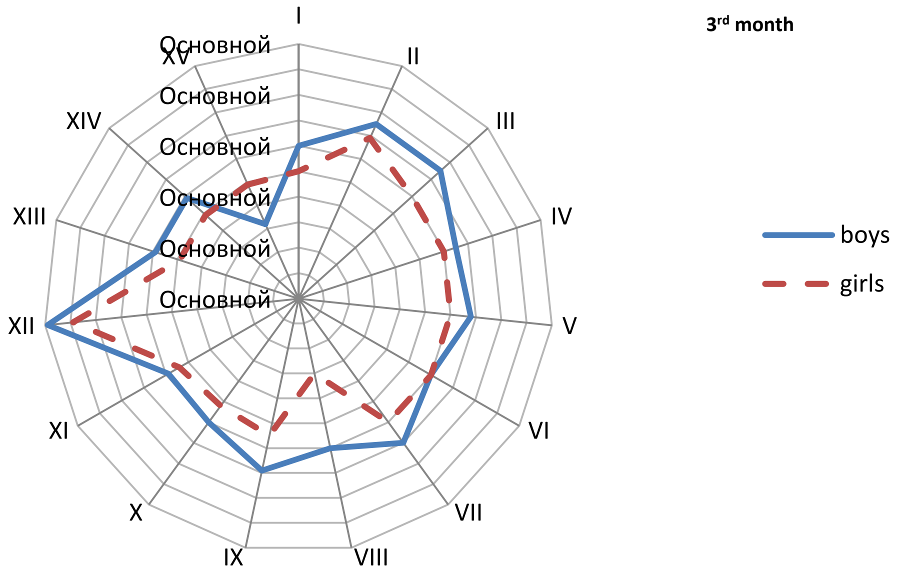

Fig. 1 b. Thermotopography-skin of children in the dynamics of the first year of life (3rd month of life) .

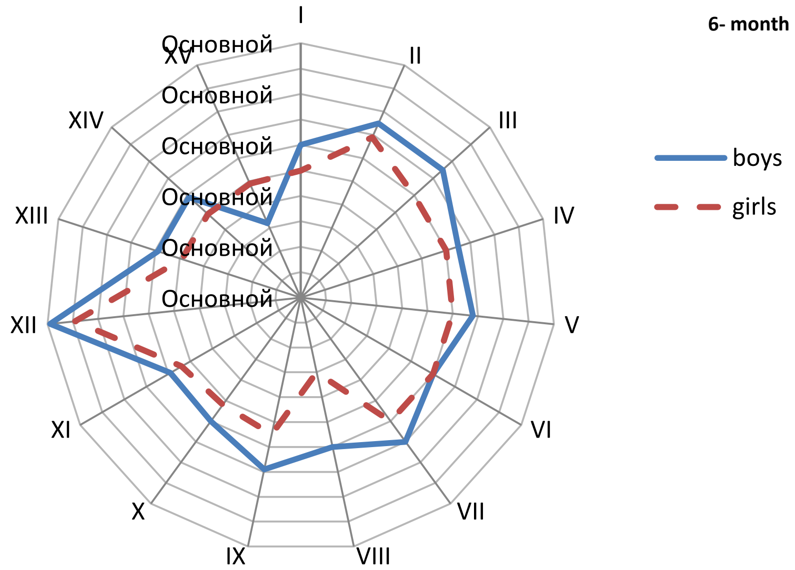

Fig. 1 in. Thermotopography-skin of children in the dynamics of the first year of life (6th month of life) .

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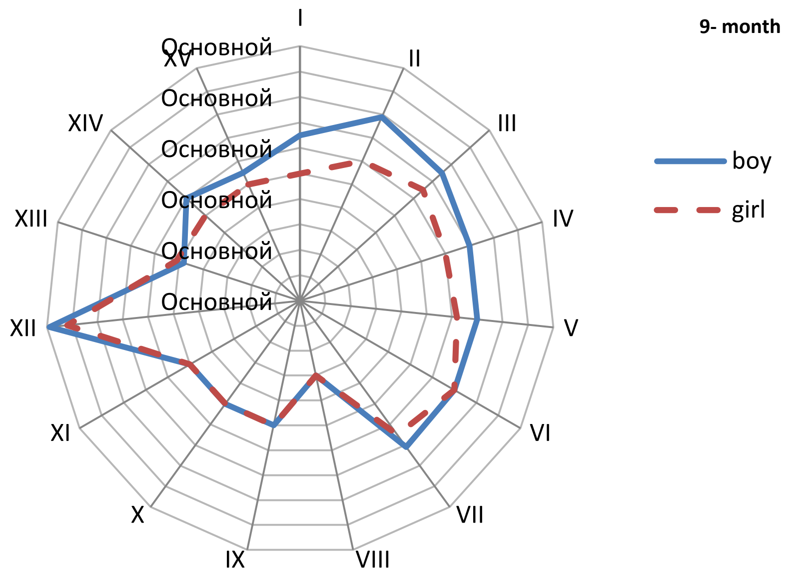

Fig. 1. Thermotopography-skin in children in the dynamics of the first year of life (9th month of life) .

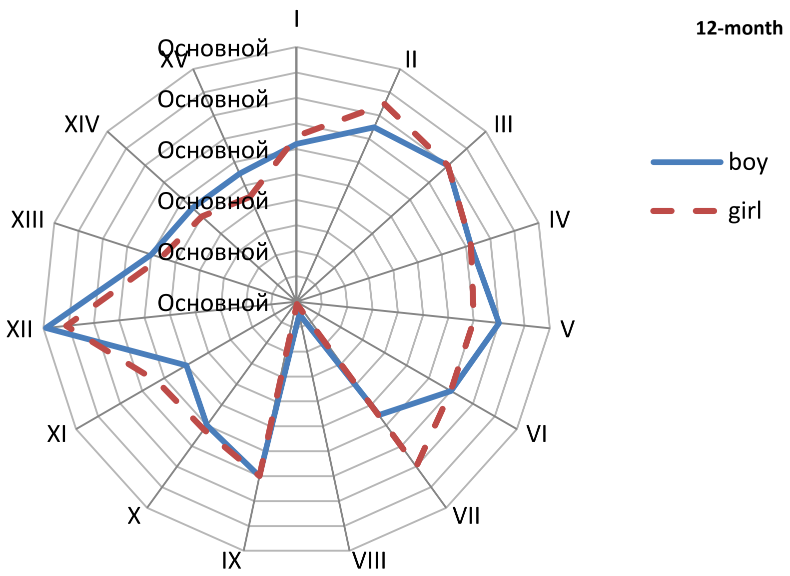

Fig. 1 d. Thermotopography-skin of children in the dynamics of the first year of life (12th month of life) .

In order to confirm this thesis, we have studied the correlation of longitudinal gradients of skin temperature with an external gradient of body temperature (Tkozhi-Tvozduha).

It is known that at high ambient temperature, the external gradient (Skin-Moisture) decreases, and at low temperature, the study of the correlation of the external gradient (Skin-Moisture) and the longitudinal gradients of skin temperature in the forehead-brush and chest-brush areas of the examined children revealed their dependence on the ambient temperature (r=+0.504 and r=+0.450), and in the forehead-foot and chest-foot areas, it was not detected (r=+0.152 and r=+0.149). Consequently, a decrease in skin temperature gradients in the forehead-brush and chest-brush areas is associated with the influence of ambient temperature on the exposed parts of the body (forehead, brush). According to the literature [7, 8, 13, 15, 17, 24, 29] it is noted that on some days the temperature of the extremities increases to quite high figures (increases by +1.0 ° C and +2.0 ° C), and decreases in the chest area, and these phenomena are associated with features hot climatic conditions that do not correspond to our data. The temperature gradients of the chest-foot and forehead-foot, as can be seen from the correlation results, do not have such a dependence on the ambient temperature due to the peculiarities of care (i.e., the foot is closed most of the

DOI: 10.48047/INTJECSE/V14I7.259 ISSN: 1308-5581 Vol 14, Issue 07 2022

time than the brush) in children of the first year of life, and apparently depends on the heterochrony of the growth of the lower extremities (Fig. 7a-e).

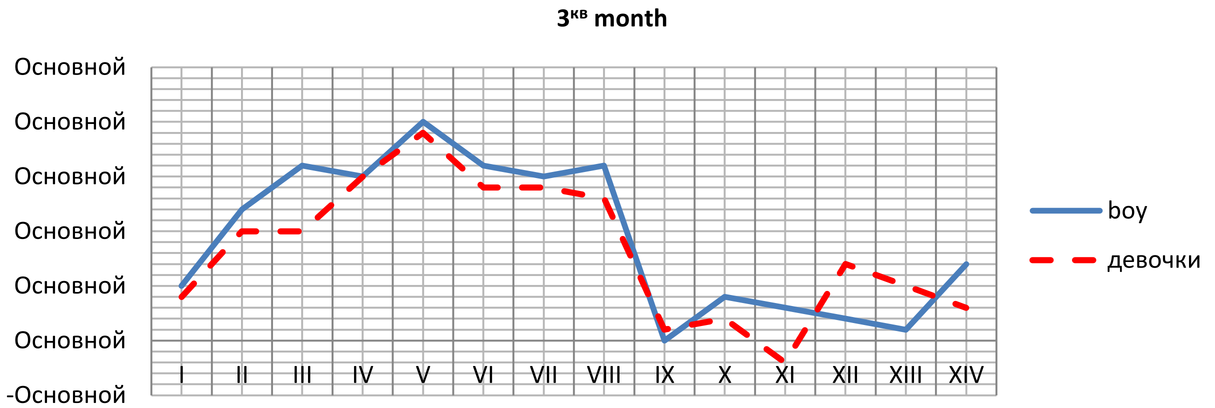

Fig. 7. a. Longitudinal temperature gradients in children in the dynamics of the first year of life (3 months). Note: I-X1V- gradients (Dt°C) at the points: forehead-hand (I); forehead-foot (II); chest-hand (III); chest-foot (IV); abdomen-foot (V); neck-shoulder (VI); neck-forearm (VII); neck-hand (VIII); shoulder-forearm (IX); shoulder-hand (X); forearm-hand (XI); hip-shin (XII); hip-foot (XIII); shin-foot (XIV).

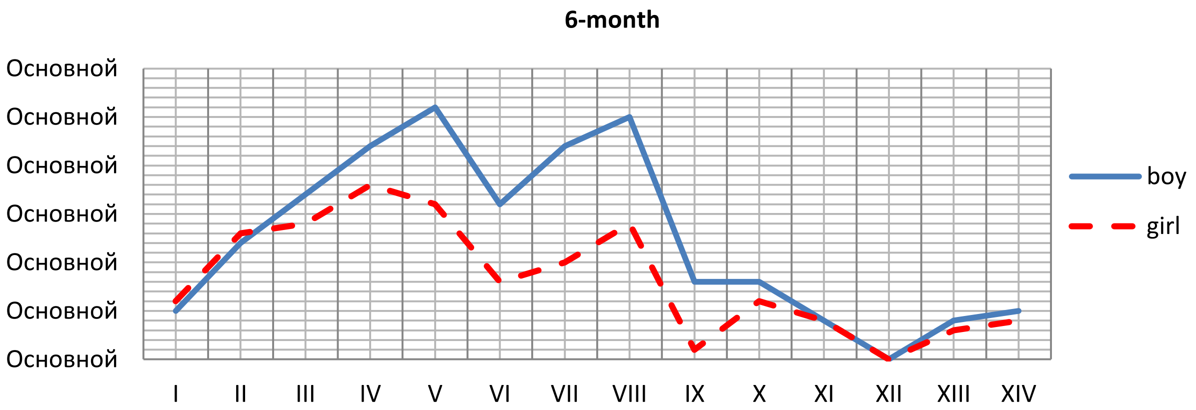

Fig. 7 b. Longitudinal temperature gradients in children in the dynamics of the first year of life (6 months).

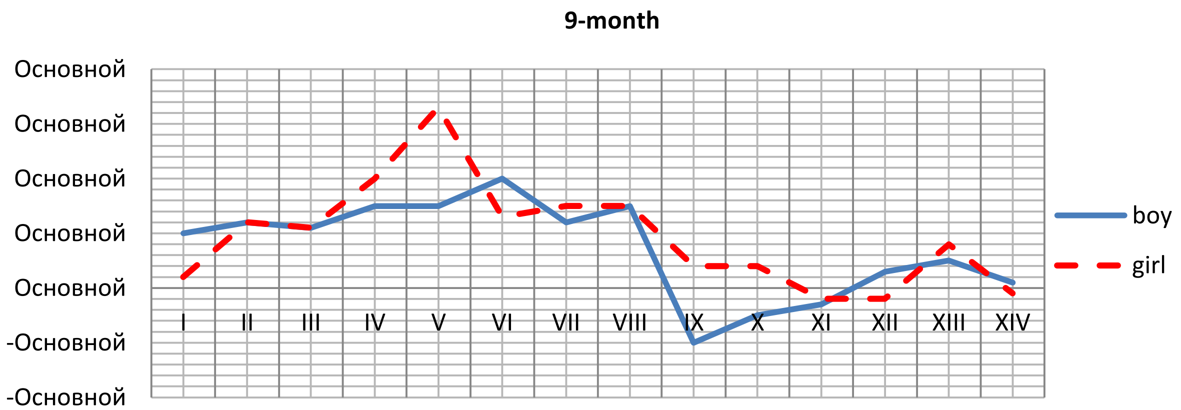

Fig. 7 in. Longitudinal temperature gradients in children in the dynamics of the first year of life (9 months) .

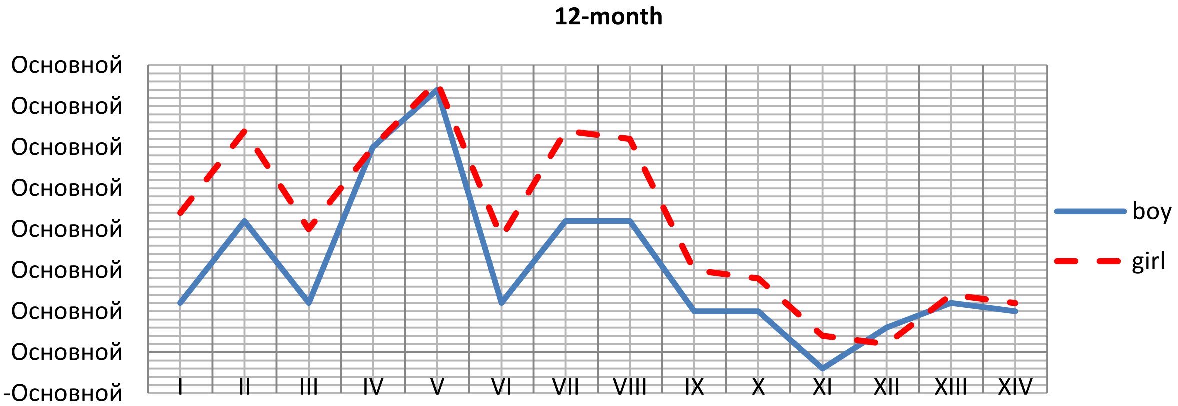

Fig. 7. Longitudinal temperature gradients in children in the dynamics of the first year of life (12 months)

We have shown that when the growth of limbs in length slows down, their relative temperature increases, and when the growth in length increases, it decreases. As shown in Fig. 7a-d, the longitudinal gradients of skin temperature (Gradient t °C) in the extremities are multidirectional over time and depending on the sex of the examined children. So, if in boys the gradients t°C shoulder-forearm, shoulder-brush increased in the periods of 6 and 12 months ($p<0.05$-0.01), and the gradients t°C forearm-brush remained unchanged ($p>0.05$), then in girls at the age of 6 months the gradients t°C shoulder-the hand and forearm-hand increased ($p<0.01$) with a reduced t°C gradient in the shoulder-forearm region ($p<0.05$). Further dynamics were completely different from those of boys, i.e. at the age of 9 months, the gradients t°C shoulder-brush, forearm-brush decreased ($p<0.05$) with an increase in the gradient t°C shoulder-forearm ($p<0.01$), and by 12 months the gradients t°C shoulder-brush increased again ($p<0.05$), with a decrease in the gradient t°C forearm-brush ($p<0.01$).

Conclusions:

1. Temperature gradients in children of the first year of life depend on the heterochrony of limb growth depending on gender.
2. With an increase in the temperature gradient of the upper extremities, there is clearly a multidirectional and sexual dimorphism.

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