SZCZĘSNY Górski D.Sc., STANISŁAW WOSIŃSKI Eng.
RENATA HAUSA-NGANGULI M.Sc.

THERMOGRAPHIC EVALUATION OF THE EFFECTS OF THE ADR-4 ENERGY STIMULATOR ON BLOOD SUPPLY IN THE HANDS OF PERSONS WITH GENERALISED BLOOD SUPPLY DISORDERS[1]

(from the Radio-physiology Laboratory of
the Department of General Radiology of the Faculty of Medicine in Poznań;
Head of Laboratory: S. Górski D.Sc.)

Summary

A thermo-graphic evaluation of blood supply at a rest condition and of thermoregulatory vasomotor activity was performed on 17 women and 1 man with moderate and serious symmetrical Raynaud's syndrome in hands and fingers and with moderate and serious symmetrical blood supply disorders at a rest condition in feet and toes, as well as with anamnesis suggesting Raynaud-type vasomotor neurosis. The tests were performed according to our own standard methods. Following initial tests, 7 women and the 1 man applied the ADR-4 energy stimulator, in accordance with the producer's instructions. 8 women applied an inactive dummy ADR-4. Both groups were chosen at random and the patients did not know whether they were using the active or the inactive form of the appliance. Thermo-graphic evaluation was subsequently repeated in both groups at 1, 3, 7, 14 and 21 days from the commencement of the application of the ADR-4 and the placebo. The following parameters were recorded: maximum and minimum temperatures of fingers and hands on both the palm side and on the back of the hand; the amplitude of the difference between the extreme temperatures in the fingers and mean rate at which the minimum temperature was regained in the fingers of both hands within a period of 10 minutes after standard cooling (expressed as a percentage of the initial temperature). The results showed rises in the values of the thermo-graphic indices being assessed in patients applying the active ADR-4, particularly marked after 14 and 21 days of use. The most clear-cut differences occurred in the minimum temperatures of the fingers and in the chill test. Such effects were not recorded in patients applying the inactive dummy. The results incline one to esteem that the ADR-4 stimulator has a beneficial effect on peripheral blood supply in persons with blood supply disorders.

Key words: thermography, blood supply, women, hands and fingers, magnetic fields, Raynaud's syndrome, chill test

The use of thermography in the quantitative evaluation of peripheral blood supply has been an indisputable application of this technique for many years. Our own methods for applying thermography, elaborated over many years of practical use, enable this evaluation to be carried out in a standardised, quantified manner, in rest and thermoregulatory vasomotor conditions [iii]

Among its applications has been the evaluation of peripheral blood supply in vibration syndrome[iii], the evaluation of blood supply in free skin grafts[iv], in neurological disorders [v vi vii], in the evaluation of how blood supply in children from sports classes – swimming and athletics – adapted to intensive physical activity[viii].

The present research evaluated changes in blood supply in the hands and fingers under the application of a magnetic energy stimulator invented by one of the authors. The ADR-4 is an energy stimulator registered with the Polish Patents Office under the number P320179. This stimulator consists of a magnetic ceramic disc placed in a special casing. At the base of the disc is a ceramic element, on top of which are placed magnetic elements of various field intensity and specific dimensions, which provide the requisite spatial configuration of a stable, heterogeneous magnetic field. The task of the ADR-4 is to improve the sanitary properties of both pure water and water contained in various aliments. The action of the ADR-4 leads to modifications in the cluster structure of water. We know that in normal conditions water is not an amorphous substance. It forms pseudo-crystalline structures, the configuration of which is dependent upon the history of the conditions in which it was located, and it is able to maintain altered properties over a certain time, e.g. surface tension, relative permittivity, electric conductivity, and NMR, NQR, UV and IR spectra (relevant research work

[1] [?] This work was presented at the 13th Scientific Conference of Military Health Service Pediatrists, held in September 1999 in Zakopane and published in Lekarz Wojskowy (Army Medical Journal), Supplement II 1999, pp. 146 – 153.

is in progress in the Wydział Fizyki UAM w Poznaniu [2]). These altered properties in water have a clear influence on living organisms, from bacteria to man. Among the effects produced by the ADR-4 are a change in the fermentation rate of yoghurt (work in progress in the Instytut Rozwoju Mleczarstwa Akademii Rolniczo-Technicznej w Olsztynie [3]), and a change in the aluminium and lead content in hair (work carried out by Trace Elements Inc. in Dallas, USA).

The ADR-4 stimulator was awarded the Gold Medal with special distinction at the 47th World Exhibition of Innovation, Invention and New Technology BRUSSELS EUREKA '98.

Materials and Methods

The tests were carried out on 16 persons, aged 20-62 years. They were performed with the help of the AGA 680 Medical thermograph interfaced with a PC, using a program created by *Jan Błaszczyński*, from the firm JBL of Krakow. Our own methods were applied [1]. The temperature was thermostatically set at a range of 19-21º C. The series of tests covered initial measurements then repeated measurements at 1, 3, 7, 14 and 21 days from the commencement of the standard application of the ADR-4 stimulator, in accordance with the producer's instructions.

The subjects were each given, at random, either an active ADR-4 or an inactive dummy, with the same comments concerning the aim of the research, i.e. that it sought to establish whether the application of the device produces any effects. In order to avoid any autosuggestion, the subjects were not informed of the existence of two forms of the appliance – an active and an inactive form.

The tests produced values for the following thermo-graphic parameters: the minimum and maximum temperatures in fingers 2-5, in the whole hand (palm and back), in rest conditions and at 10 minutes after 5 minutes of standard cooling in water at a temperature of 15º C. Prior to their immersion in the cooling bath, the hands were immersed for 5 minutes in water at a temperature of 37º C. The temperature of the water was regulated with a tolerance of 0.1º C. The hands were immersed immediately. After bathing the hands were dried delicately and thoroughly with a paper towel.

Discussion

The results showed no substantial difference in the initial values of the evaluated parameters between the group using the active ADR-4 and the group using the inactive placebo.

The temperatures of the fingers prior to cooling showed a rising tendency both in persons using an active ADR-4 and in persons using the placebo, from the first to the third day. The temperatures then decreased for both groups. From the seventh day onwards, the temperatures then rose in the ADR-4 group, but not in the placebo group. These temperatures express blood supply in rest conditions. After cooling, the temperatures behaved in a similar manner in the test group, whereas in the control group the initial rise was absent. These temperatures reflect the intensity of the thermoregulatory vasomotor reaction. This may indicate the existence of a two-phase thermoregulatory reaction under the stimulus of the ADR-4. The first phase can be linked to the placebo effect, since it also occurred in the persons using the dummy. Similar rises, albeit considerably less marked, were observed over the area of the whole hand.

Conclusions

The tests carried out allow the following inferences to be drawn.

1. The entire range of temperatures in the fingers and hands, as well as the rate at which the minimum temperature in the fingers was regained after cooling, in persons with moderate and serious, symmetrical, generalised blood supply disorders, with many years of anamnesis, showed a favourable change from the seventh day of the use of the ADR-4 stimulator.

2. Analogous changes were not observed in those persons with similar blood supply disorders who used the inactive dummy.

---

[2] Department of Physics of Adam Mickiewicz University in Poznań

[3ii] Institute for the Development of Dairying of the Faculty of Farming Technology in Olsztyn

3. The rises in the thermo-graphic indices were most marked in fingers and the least significant over the whole hand.

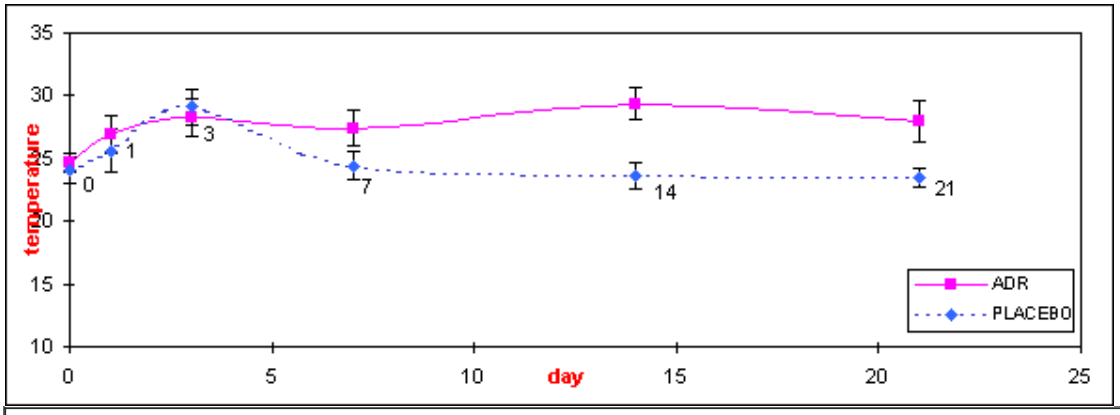
4. The rises in the indices were more substantial in the test after cooling than in the test without cooling.

5. The results incline one to acknowledge the presence of a beneficial effect from the use of the ADR-4 stimulator on peripheral blood supply.

Table/Graph I

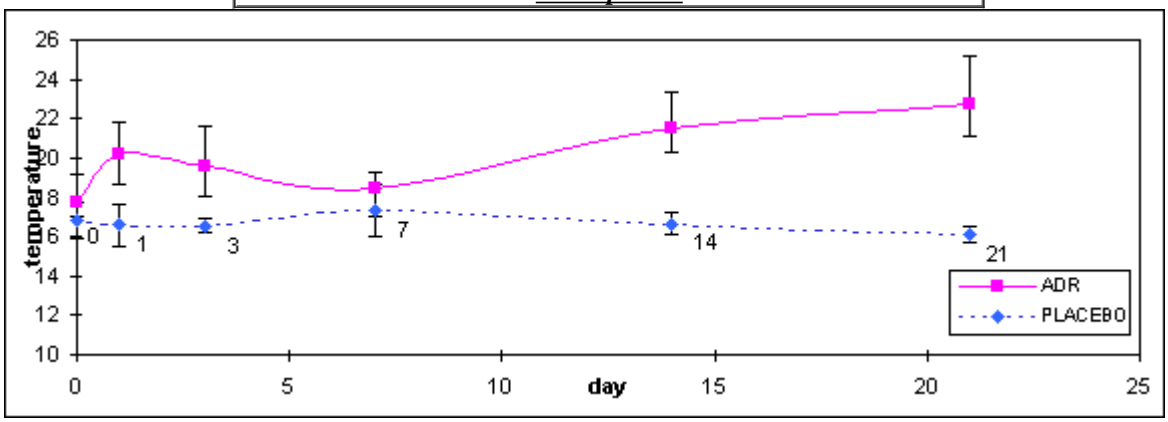
Average T min. fingers left and right before cooling - ADR4						
Average	24,6625	26,91875	28,2875	27,4125	29,375	27,94375
Std Deviation	1,528779	3,152823	3,06548	2,969371	2,578759392	3,311388
for p=0.05	0,749087	1,544853	1,502055	1,454963	1,263567012	1,622548
Average T min. fingers left and right before cooling - placebo						
Average	24,025	25,59375	29,125	24,43125	23,6625	23,425
Std Deviation	2,119906	3,529961	2,941088	2,227022	2,140988868	1,543805
for p=0.05	1,038733	1,729647	1,441105	1,091219	1,049063715	0,756449
Test T	0,337812	0,271793	0,436561	***0,003313***	***1,73333E-07***	***6,6E-05***
Following days	0	1	3	7	14	21

Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***



Average T min. fingers left and right after cooling - ADR4						
Average	17,73125	20,2	19,5625	18,4375	21,5375	22,71875
Std Deviation	2,860704	3,228209	4,285149	1,778342	3,751955046	5,065467
for p=0.05	1,401717	1,581791	2,099681	0,87137	1,838421468	2,48203
Average T min. fingers left and right after cooling - placebo						
Average	16,875	16,58125	16,5625	17,33125	16,6625	16,09375
Std Deviation	1,875278	2,108465	0,75	2,673754	1,147678817	0,860596
for p=0.05	0,918868	1,033127	0,367493	1,310113	0,562351454	0,421684
Test T	0,325954	***0,00089***	***0,014039***	0,1799	***0,00010257***	***9,79E-05***
Following days	0	1	3	7	14	21

Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***

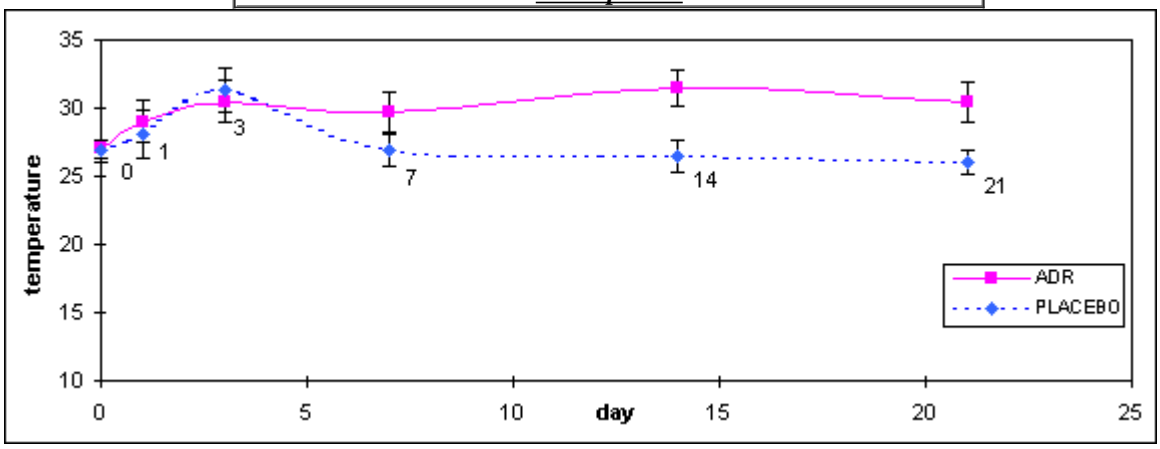


Table/Graph III

Average T max. fingers left and right before cooling - ADR4						
Average	27	29	30,5	29,75	31,5	30,4375
Std Deviation	1,36626	3,119829	3,03315	2,955221	2,732520204	3,076118
for p=0.05	0,669454	1,528686	1,486214	1,44803	1,338908314	1,507268

Average T max. fingers left and right before cooling - placebo						
Average	26,84375	28,125	31,3125	26,9375	26,475	26,0125
Std Deviation	1,748511	3,644631	3,177394	2,372586	2,367417721	1,795504
for p=0.05	0,856754	1,785834	1,556892	1,162544	1,16001165	0,879779
Test T	0,780252	0,471466	0,465146	***0,005989***	***5,12759E-06***	***4,41E-05***
Following days	0	1	3	7	14	21

Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***

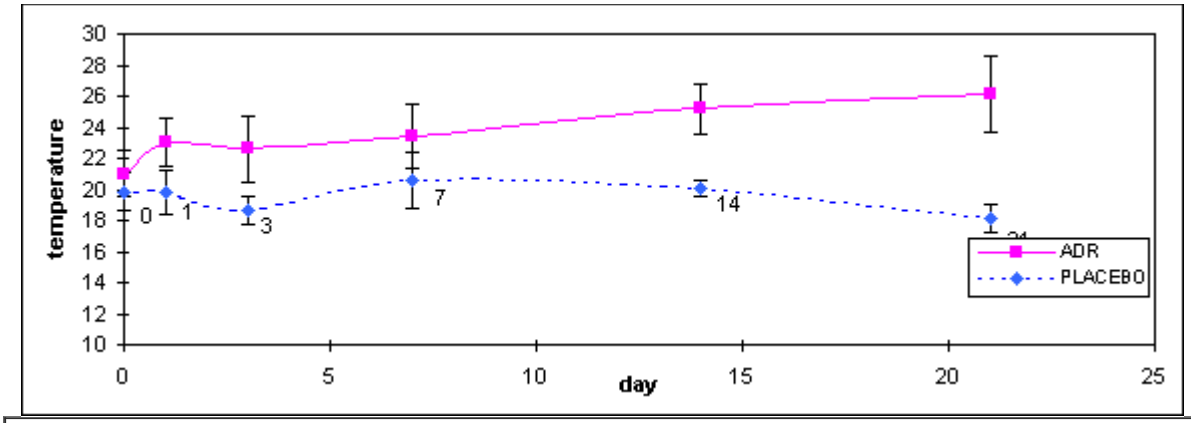


Table/Graph IV

Average T max. fingers left and right after cooling - ADR4						
Average	21,01875	23,05625	22,625	23,3875	25,1625	26,125
Std Deviation	3,042854	3,235422	4,346263	4,205215	3,22446378	4,927812226
for p=0.05	1,490969	1,585326	2,129626	2,060514	1,57995588	2,414580046
Average T max. fingers left and right after cooling - placebo						
Average	19,8625	19,76875	18,6125	20,56875	20,09375	18,1375
Std Deviation	2,577305	2,855805	1,899781	3,580078	0,993625516	1,731232701
for p=0.05	1,262854	1,399317	0,930874	1,754203	0486866836	0,84828718
Test T	0,255512	***0,004831***	***0,00287***	**0,050305**	***1,15341E-05***	***7,60633E-06***
Following days						

Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***

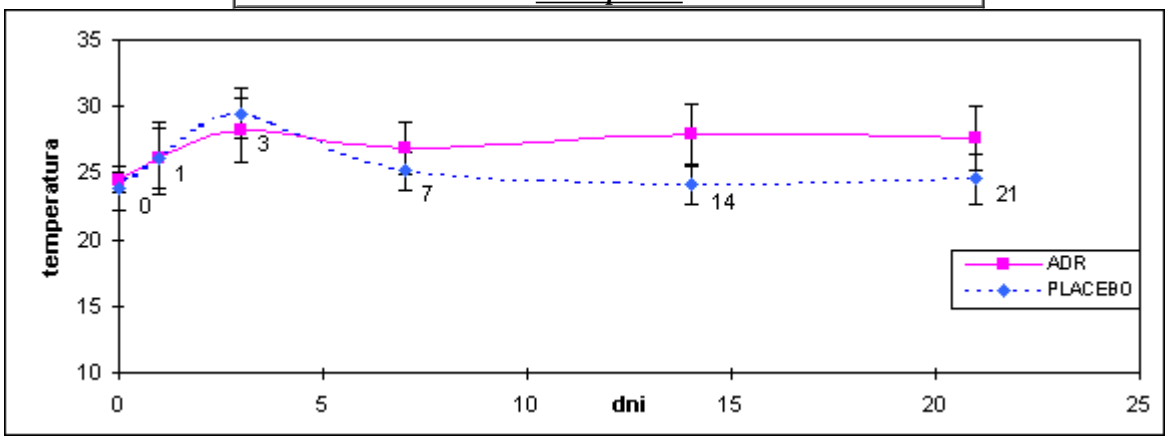
Table/Graph V



Average T min. hands left and right before cooling - ADR4						
Average	24,475	26,1375	28,225	26,9125	27,875	27,6626
Std Deviation	1,400765	3,224432	3,406611	2,864281	3,356762896	3,504665258
for p=0.05	0,970661	2,234373	2,360614	1,984806	2,326071823	2,428560896

Average T min. hands left and right before cooling - placebo						
Average	23,8875	26,1	29,5	25,1375	24,1626	24,5375
Std Deviation	2,435709	3,965206	2,77746	1,963188	2,222570905	2,815232799
for p=0.05	1,687827	2,747693	1,924644	1,360393	1,540132478	1,950818063
Test T	0,566024	0,983747	0,42625	0,173061	**0,022681435**	0,070375145
Following days	0	1	3	7	14	21

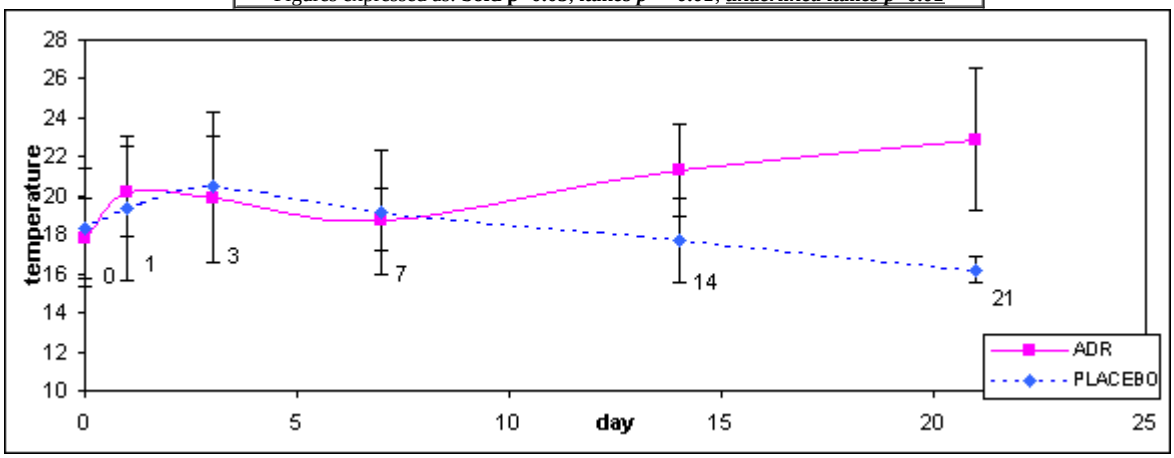
Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***



Table/Graph VI

Average T min. hands left and right after cooling - ADR4						
Average	17,8	20,2	19,85	18,75	21,2875	22,87142857
Std Deviation	2,956832	3,341514	4,648502	2,299068	3,395979766	5,283847804
for p=0.05	2,04894	2,315505	3,221184	1,593141	2,353247188	3,661447018
Average T min. hands left and right after cooling - placebo						
Average	18,375	19,375	20,475	19,1875	17,725	16,1875
Std Deviation	4,332188	5,390136	5,582306	4,613161	3,169835507	0,961304917
for p=0.05	3,001994	3,7351	3,868264	3,196694	2,196540323	,0666137094
Test T	0,761673	0,719492	0,811379	0,814992	**0,04787652**	**0,015123796**
Following days	0	1	3	7	14	21

Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***

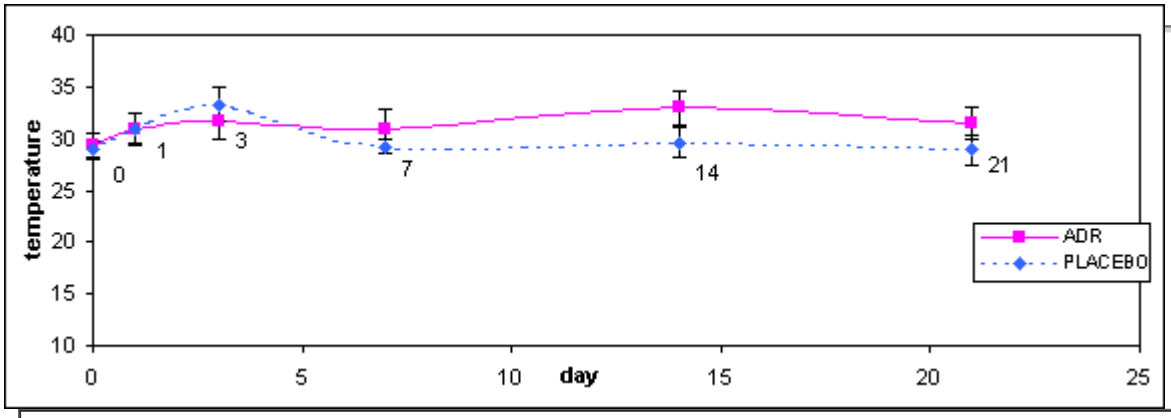


Table/Graph VII

Average T max. hands left and right before cooling - ADR4						
Average	29,375	30,875	31,625	31	33	31,5
Std Deviation	1,685018	2,295181	2,326094	2,56348	2,329929	2,13809
for p=0.05	1,167635	1,590448	1,611869	1,776366	1,614527	1,481591
Average T max. hands left and right before cooling - placebo						
Average	28,875	31	33,25	29,25	29,625	28,875

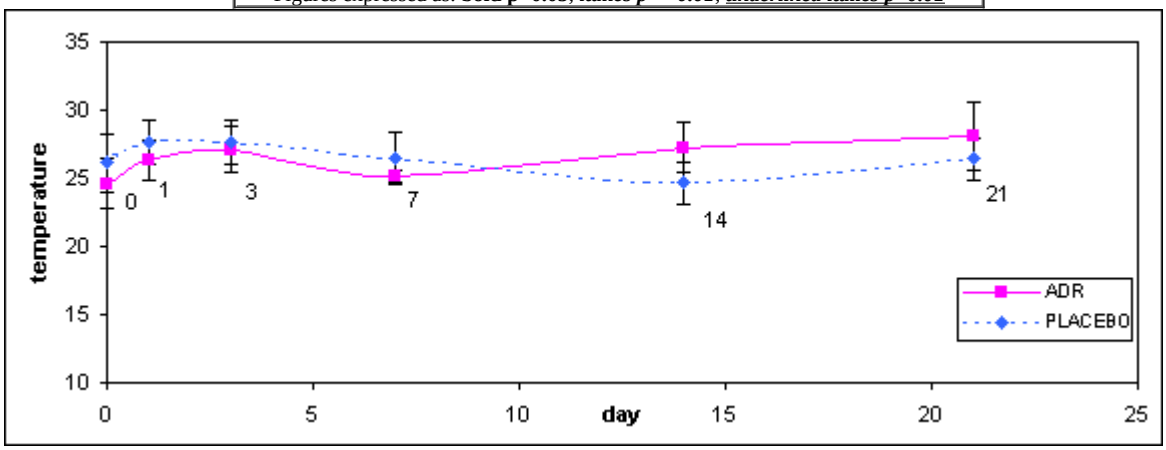
Std Deviation	1,125992	2,203893	2,37547	1,035098	2,13391	2,167124
for p=0.05	0,780257	1,527189	1,646084	0,717272	1,478695	1,501711
Test T	0,49836	0,913108	0,188502	0,10619	***0,009221***	**0,028655**
Following days	0	1	3	7	14	21

Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***



Average T max. hands left and right after cooling - ADR4						
Average	24,6	26,375	27,125	25,1	27,25	28,125
Std Deviation	2,650067	2,13391	2,416461	0,69282	2,659216	3,563205
for p=0.05	1,836367	1,478695	1,674489	0,48009	1,842706	2,469126
Average T max. hands left and right after cooling - placebo						
Average	26,125	27,6	27,625	26,5	24,6625	26,4125
Std Deviation	3,008915	2,371256	3,326094	2,659216	2,180392	2,227386
for p=0.05	2,085031	1,643164	1,611869	1,842706	1,510904	1,543469
Test T	0,300504	0,295966	0,679702	0,187809	**0,052291**	0,271961
Following days	0	1	3	7	14	21

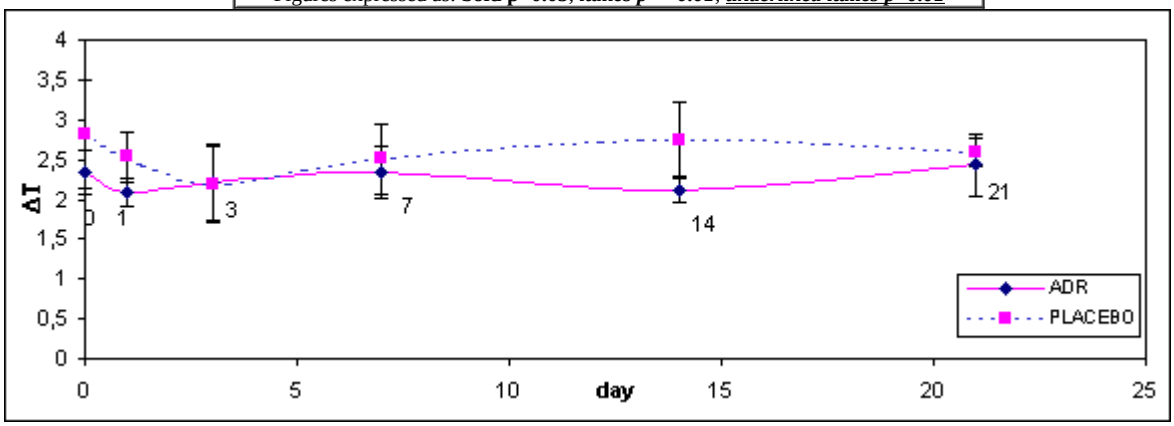
Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***



Table/Graph IX

Average delta T. fingers left and right before cooling - ADR4						
Average	2,3375	2,08125	2,2125	2,3375	2,125	2,43125
Std Deviation	0,580661	0,356312	0,978349	0,651025	0,341565	0,789699
for p=0.05	0,284518	0,174589	0,479381	0,318996	0,167364	0,386945
Average delta T. fingers left and right before cooling - placebo						
Average	2,81875	2,53125	2,1875	2,50625	2,75	2,5875
Std Deviation	1,391507	0,64984	0,981071	0,908089	0,981835	0,353789
for p=0.05	0,681825	0,318415	0,480715	0,444955	0,48109	0,173353
Test T	0,216285	**0,023272**	0,942942	0,550776	**0,026787**	0,478176
Following days	0	1	3	7	14	21

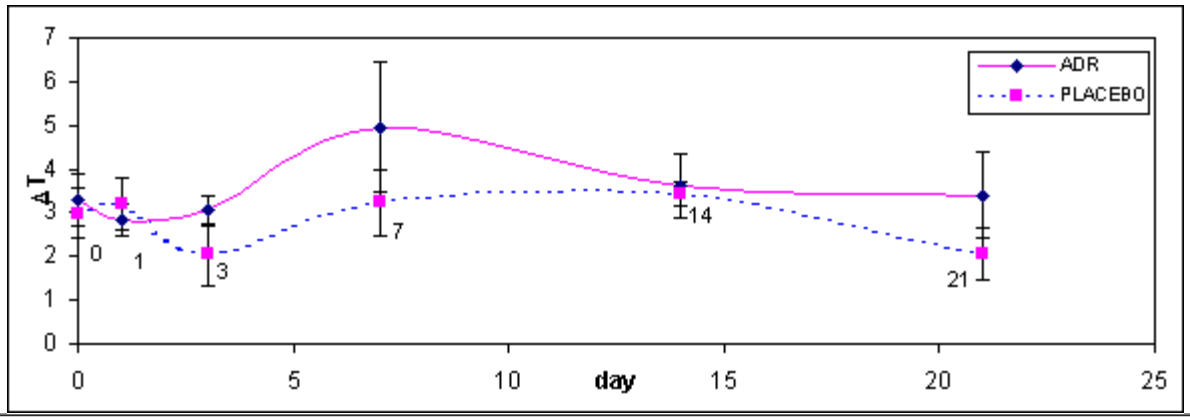
Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***



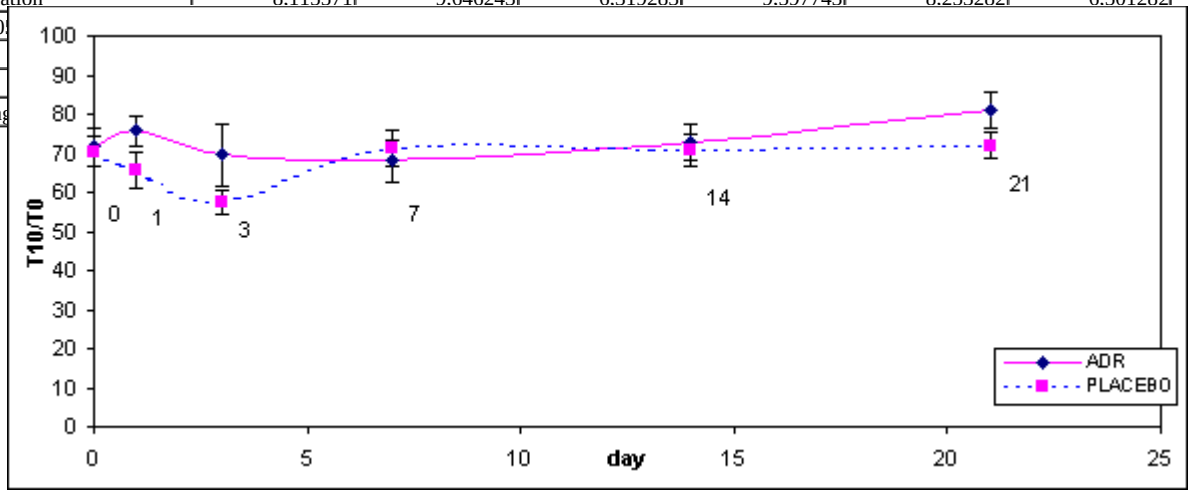
Table/Graph X

Average delta T. fingers left and right after cooling - ADR4						
Average	3,2875	2,85625	3,0625	4,95	3,625	3,40625
Std Deviation	1,196592	0,743836	0,694622	3,047622	1,512393	2,006811
for p=0.05	0,586319	0,364472	0,340358	1,493305	0,741058	0,983318
Average delta T. fingers left and right after cooling - placebo						
Average	2,9875	3,1875	2,05	3,2375	3,43125	2,04375
Std Deviation	1,175798	1,222497	1,437591	1,540941	0,57471	1,226903
for p=0.05	0,576129	0,599012	0,704405	0,755046	0,281602	0,601171
Test T	0,47995	0,363423	***0,018935***	**0,057212**	0,637327	**0,02904**
Following days	0	1	3	7	14	21

Figures expressed as: **bold p<0.05**; ***italics p=~ 0.01***; ***underlined italics p<0.01***



Average T10/T10. fingers left and right after cooling - ADR4						
Average	71,625	75,6875	69,5625	68,125	73	81
Std Deviation	10,28834	8,268162	16,52057	10,97193	9,423375	9,838699
for p=0.05	5,041188	4,051319	8,094918	5,376141	4,617362	4,820867
Average T10/T10. fingers left and right after cooling - placebo						
Average	70,4375	65,625	57,25	71,125	70,875	72
Std Deviation	8.115571	9.646243	6.319283	9.597743	8.253282	6.501282
for p=0.0						
Test T						
Following						



Comment

The TEST T values in **bold** correspond to p<0.05; ***italics*** *to p=0.01;* **underlined** to p<0.01.

---

[i]References

[?] Sz.Górski, W. Fibiger: Termograficzna próba czynnościowa w diagnostyce zmian naczyniowych w zespole wibracyjnym [Thermographic Functional Test in the Diagnosis of Vascular Disorders in Vibration Syndrome]. Medycyna Pracy 1979, XXX, 3, pp.213-220.

[ii] Sz.Górski, J. Błaszczyński, B. Więcek: Zintegrowany system termograficzny i wizyjny do diagnostyki ukrwienia obwodowego i zmian zapalnych, ze wspomaganiem komputerowym [Integrated Thermographic and Visual System for the Computer Assisted Diagnosis of Peripheral Blood Supply Disorders and Inflammatory Processes]. KBN 8T11E 040 10.

[iii] Sz.Górski: Aspects thermographiques des micro et macro -traumatismes de la main. II Congres Europeen de la Thermographie, Barcelona, 11-15.09.1978. Abstract Book, Heralds de Aragon, Zaragoza, 1978, p.154.

[iv] H.Paszkowska, Sz.Górski: Ocena wgajania się autogennych wolnych przeszczepów skóry pełnej grubości na podstawie badań termograficznych i histochemicznych [Evaluation of the Healing of Autogenic Free Full Skin Grafts. Thermo-graphic and Histochemic

[v] J.Koczocik-Przedpelska, Sz.Górski, E.Powierza: Relationship between sensory nerve conduction and temperature of the hand. Act Physiol.Pol. 1983, Vol. 43, fasc.1, pp.21-28.

[vi] J.Koczocik-Przedpelska, Sz.Górski: Double Pattern of Relationship between Skin Temperature, Thermoregulation and Sensory Nerve Conduction. Electromyography and Clinical Neurophysiology, 1990, 30, pp. 435-442.

[vii] J.Koczocik-Przedpelska, Sz.Górski: Double Pattern of Relationship between Skin Temperature, Thermoregulation and Sensory Nerve Conduction. Electromyography and Clinical Neurophysiology, 1990, 30, pp. 435-442.

[viii] Sz.Górski, E.Rostkowska: Przydatność termowizji do badań naukowych w sporcie [The Benefits of the Application of Thermo-vision in Sports Science Research]. Series: Monografie Nr 288, 1991 Wydawnictwo AWF w Poznaniu 1991, pp. 19-23.