Effects of Naturea Heidelberg GmbH KP-0013-20 gel in skin temperature values ant training recovery

(Working paper)

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Introduction

In today's world everybody strive to achieve some sort of success, and it is very applicable in sports. All athletes, both amateur and professional, seek to enhance their results in any way possible. One of the ways is improving their recovery methods and recovery time. However, many athletes and coaches still do not use any recovery methods as a training tool in training periodization. In this study, the main goal was to determine the effectiveness of KP-0013-20 gel in cooling and local muscle recovery. Bompa (2009:104.) defines recovery as: "Recovery or regeneration is a multifactoral process that requires the coach and athlete to understand the physiological makeup of the athlete, the physiological effects of both training and recovery interventions, and the effects of integrating training and recovery strategies. A coach or athlete who understands these concepts can apply recovery interventions or training plan modifications to maximize training outcomes.". In many different sports athletes are supposed to perform at their best, several times in relatively short time notice. Overtraining and overreaching are real threats that stand between athletes and their capability of achieving their best results, or performing at highest levels. One of the main ways to influence on that matter if, among others, quality of their recovery methods. The application of effective recovery methods significantly improves training frequency, which means greater number of training sessions in relation to lack of recovery methods. Without the use of training recovery methods, it is possible to conduct, for example, three training sessions, while the application of appropriate training recovery methods can increase the number of possible training sessions to four in the same microcycles. (Milanović, 2013.).

Cooling in recovery

Application of local cryotherapy could help improve recoveryby reducing the symptoms linked to the appearance of delayed-onset muscle soreness (DOMS), restoring the functional capacity of the muscles used more rapidly, and reducing the risk of injuries linked to muscle microlesions. (Dorel, 2013). An athlete can also promote muscle and tendon recovery by doing contrast showers, using hot and cold water, which is a good way to increase blood flow from the skin to the organs and eliminate waste products from the muscles, as well as reduce inflammation. Cold therapy can provide important physiological benefits for recovery. Treatments are consisted of 5 to 10 minutes ice baths, ice whirlpools, or cold packs for 10 to 15 minutes. Rubbing ice immediately after a muscle strain may reduce swelling. Perhaps the best time to use ice is immediately following an intense training session in which microtearing of the muscle tissue is likely (Bompa, 2015.). Cochrane (2004.) suggests that active form of recovery generally demands increased levels of energy which results in further decrease of energy stores therefore, if passive form of recovery is proven

to increase glycogen resynthesis contrast hydrotherapy (alternation of hot and cold immersions) could be justified as a post training tool. In other studies it was found that most common and most used form of cooling as a recovery method is cold water immersion (Poppendieck, 2013.).

Methods

Participants

N = twenty-two (22) physically active and healthy adults agreed to voluntary participate in this study. Basic descriptive parameters of entities involved in this study are described in table 1. Most of the participants are students at Faculty of Kinesiology at University of Zagreb and therefore ex active athletes. They were informed on purpose and the methods of this study. None of the participants were taking any kind of medications during the study.

	X±SD (max-min)
Age (yrs)	25,05±4,64 (21,00-43,00)
Height (cm)	181,55±6,79 (163,00-190,00)
Weight (kg)	83,96±10,69 (52,00-103,00)

Table 1. Descriptive parameters of participants

Design of study

Description of protocol

Prior to beginning of the test, all participants were not allowed to do any high intensity physical activity. Protocol used in this study consisted of five minutes rest in order to ensure normal skin temperatures before the test. After five minutes first temperature measurements with thermal camera were taken. Immediately after taking the thermal image, participants were asked to apply KP-0013-20 gel. Application of KP-0013-20 gel was determined on two squeezes and rubbing it consistently on right lower leg, precisely muscles soleus and gastrocnemius, for two minutes. After application of KP-0013-20 gel, participants were instructed to rest for five minutes, and then was second time temperature measurements were taken with thermal camera. Again after another five minutes, ten minutes overall after the application of gel, and again after another five minutes or fifteen

minutes overall after first application thermal measurements were taken.All temperature measurements were taken at the distance of four meters from examinees.

Apparatus and data processing methods

For the purpose of taking thermal images of examinees, a thermal camera model FLIR E60 was used. FLIR tools software was used for the analysis of the thermal images. KP-0013-20 gel is made of active substances such as: mentapiperita oil 1,92%; Eucalyptus oil 0,92 %; MethyLacetate 0,50%; MenthaHaplokalix extract 0,50%; Lavandula oil 0,48%; Citrus aurantiumbergamia oil 0,05%; Pinus cembra oil 0,02%; Abissibirica needle oil 0,014%. All data was processed in Statistica 12. Means (X) and standard deviations (SD) were used to describe quantitative variables. Analysis of variance (ANOVA) was used to determine significant differences between selected samples. Student's t-test was used to determine significant differences between selected samples. Data in the text and figures are expressed as X±SD (min-max). Statistical significance was set at $p<0.05$.

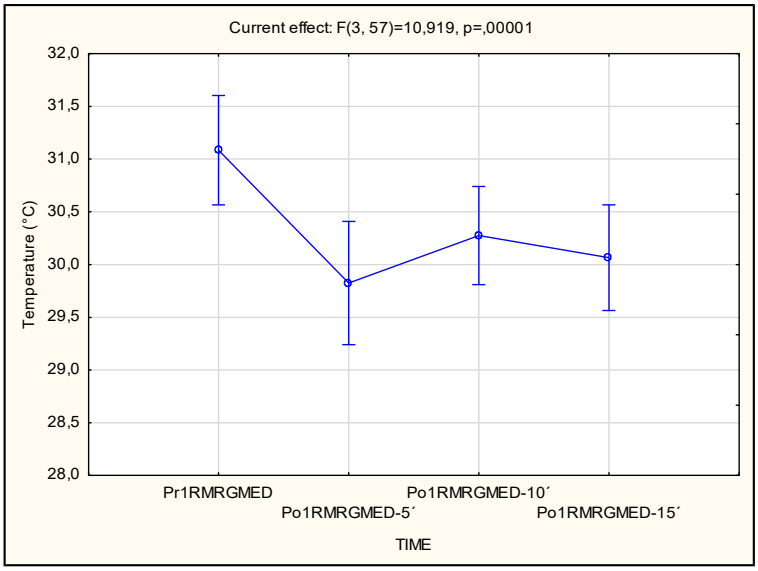
Results and discussion

Skin temperature values were taken on three spots on lower leg: M. gastrocnemius medialis (RM_LG_{MED}, RM_RG_{MED}), M. gastrocnemius lateralis (RM_LG_{LAT}, RM_RG_{LAT}) and M. soleus (RM_LS, RM_RS). Measurment spots code names are as described, with additon of prefix “pr“ for thermal measurements taken prior to application of KP-0013-20 gel, prefix “po” for thermal measurements takenafter the application of KP-0013-20 gel. Measurement spots code names with suffix “-5,-10,-15” are describing the time of thermal measuring.

	Code name	Prior to KP-0013-20 gel X±SD (min-max)	Post KP-0013-20 gel – 5' X±SD (min-max)	Post KP-0013-20 gel – 10' X±SD (min-max)	Post KP-0013-20 gel – 15' X±SD (min-max)
1.	RM_LG_{MED}	31,15±1,18 (28,30-32,90)	30,94±1,18 (28,00-32,60)	30,84±0,91 (29,10-32,30)	30,67±0,97 (28,60-32,20)
2.	RM_RG_{MED}	31,24±1,18 (28,10-33,50)	29,86±1,21 (27,60-31,60)	30,31±0,96 (28,50-31,70)	30,07±1,08 (28,30-31,80)
3.	RM_LG_{LAT}	30,47±1,16 (27,60-32,30)	30,26±1,04 (27,30-31,60)	30,20±0,92 (28,30-31,50)	29,98±0,85 (28,30-31,20)
4.	RM_RG_{LAT}	30,26±1,41 (26,30-32,90)	29,25±1,24 (26,80-30,80)	29,63±1,03 (27,10-31,40)	29,46±1,17 (27,50-31,30)
5.	RM_LS	30,30±1,15 (27,00-31,60)	30,14±1,01 (27,20-31,50)	29,99±0,84 (27,90-31,00)	29,90±0,84 (27,80-31,00)
6.	RM_RS	30,26±1,28 (26,60-31,70)	28,99±1,20 (26,70-30,60)	29,38±1,04 (26,90-31,00)	29,42±0,97 (27,20-30,70)

Table 2. Descriptive parameters of measured variables

Results of this study are presented as ANOVA and Student's t-test for dependent samples data for every one of three measurement spots.



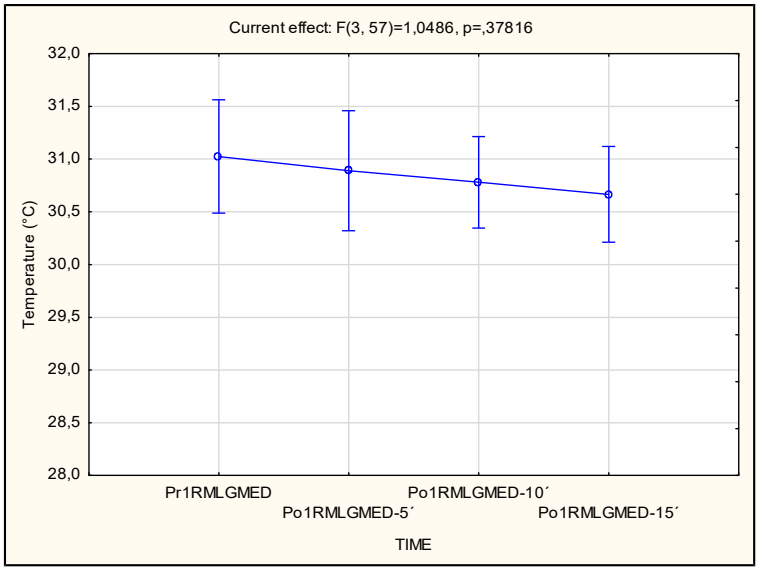


Fig. 1. Differences in skin temperatures in M. gastrocnemius medialis – left leg and right leg

Variable	T-test for Dependent Samples (Termograf - KP-0013-20 gel2017-02) Marked differences are significant at p < ,05000									
	Mean	Std.Dv.	N	Diff.	Std.Dv.	t	df	p	Conf.	Conf.
Po1RMLGMED-5´	30,94	1,18								
Po1RMRGMED-5´	29,86	1,21	22,00	1,08	0,68	7,47	21,00	0,00	0,78	1,38
Po1RMLGMED-10´	30,84	0,91								
Po1RMRGMED-10´	30,31	0,96	22,00	0,53	0,34	7,43	21,00	0,00	0,38	0,68
Po1RMLGMED-15´	30,67	0,97								
Po1RMRGMED-15´	30,07	1,07	20,00	0,60	0,72	3,75	19,00	0,00	0,27	0,93

Table 3. T-test for dependent samples, measurement of Po1RMLGMED vs. Po1RMRGMED.

It is evident that values in skin temperatures after the application of KP-0013-20 gel are significantly lower than prior to application of gel. That indicates reduction of skin temperature of 1°C. In testing of final measurements taken, it was found that there is a statistically significant difference between specific points of application in skin temperature (Fig. 2.).

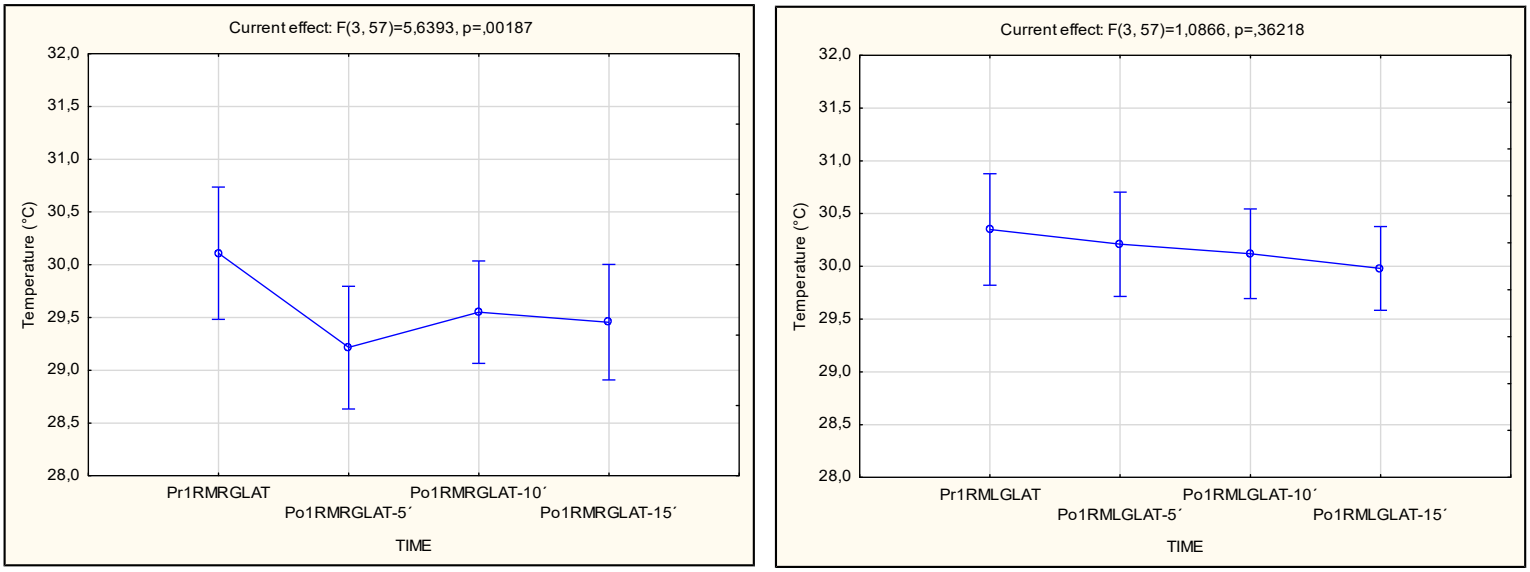


Fig. 2. Differences in skin temperatures in M. gastrocnemius Lateralis – left leg and right leg

Variable	T-test for Dependent Samples (Termograf - KP-0013-20 gel2017-02) Marked differences are significant at p < ,05000									
	Mean	Std.Dv.	N	Diff.	Std.Dv.	t	df	p	Conf.	Conf.
Po1RMLGLAT -5´	30,26	1,04								
Po1RMRGLAT-5´	29,25	1,24	22,00	1,01	0,80	5,92	21,00	0,00	0,66	1,37
Po1RMLGLAT -10´	30,20	0,92								
Po1RMRGLAT-10´	29,63	1,03	22,00	0,57	0,57	4,74	21,00	0,00	0,32	0,82
Po1RMLGLAT -15´	29,98	0,85								
Po1RMRGLAT-15´	29,46	1,17	20,00	0,53	0,76	3,09	19,00	0,01	0,17	0,88

Table 4. T-test for dependent samples, measurement of Po1RMLGLAT vs. Po1RMRGLAT.

From table 3. it is evident that values in skin temperatures after the application of KP-0013-20 gel are significantly lower than prior to application of gel. That indicates reduction of skin

temperature of 0,5°C. Most significant difference was found after the first thermal camera measuring, or five minutes after the application when de difference vas over 1.0°C. In testing of final measurements taken, it was found that there is a statistically significant difference between specific points of gel application in skin temperature (Fig. 2.).

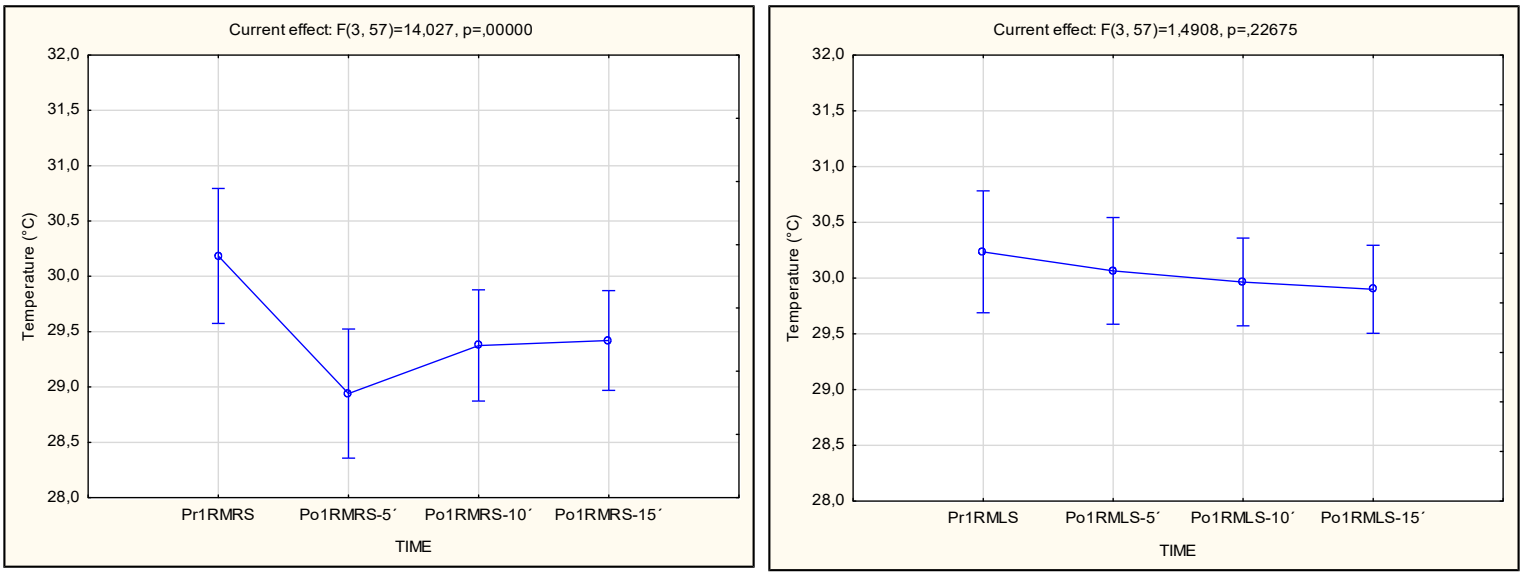


Fig. 3. Differences in skin temperatures in M. soleus – left leg and right leg

Variable	T-test for Dependent Samples (Termograf - KP-0013-20 gel2017-02) Marked differences are significant at p < ,05000									
	Mean	Std.Dv.	N	Diff.	Std.Dv.	t	df	p	Conf.	Conf.
Po1RMLS-5´	30,14	1,01								
Po1RMRS-5´	28,99	1,20	22,00	1,15	0,80	6,73	21,00	0,00	0,79	1,51
Po1RMLS-10´	29,99	0,84								
Po1RMRS-10´	29,38	1,04	22,00	0,60	0,50	5,65	21,00	0,00	0,38	0,83
Po1RMLS-15´	29,90	0,84								
Po1RMRS-15´	29,42	0,97	20,00	0,48	0,49	4,34	19,00	0,00	0,25	0,71

Table 5. T-test for dependent samples, measurement of Po1RMLS vs. Po1RMRS.

As previous data suggests, the same thing was found in the third measurement (Fig. 5. and Table 5.). Skin temperature on M. soleus was significantly lower on the applied leg than on the non-applied leg. Difference in temperature is most evident after five minutes, when it is

over 1,0°C. Temperature then slowly rises and final difference is 0,5°C. This is the case with all data collected form this study, which indicates that best cooling effects are in period of five to ten minutes after the application of KP-0013-20 gel.

Preliminary results of a study preformed at clinical physiology and sport physiology laboratory at Faculty of medicine in Osijek under the guidance of prof.dr.sc Ines Drenjačević, dr. med. showed significant vasodilatation after the application of KP-0013-20 gel. 10 young healthy individuas of both sexes participated in this study (5 women and 5 men, age range 21-33). Upper arm skin microvascular blood flow was measured using a noninvasive laser Doppler flowmetry (LDF) before and after KP-0013-20 external (skin surface) application. As a control measurement, in the same subjects regular ultrasound gel (placebo) was applicated on other hand and LDF measurement was done using the same protocol. Microcirculatory blood flow in a given time was expressed in arbitrary perfusion units (PU) and determined by software calculating the area under the curve (AUC) during the set time. Time-to-Dilation (TtD) and Time-to-Maximum Dilation (TtM) were measured from the time of KP-0013-20 application until the dilation and maximum dilation occured (Fig. 4.). Body mass index (BMI), waist-to-hip ratio (WHR), blood pressure (BP) and heart rate (HR) were measured before functional vascular measurement.As expected, men participants had higher BP and lower HR than women. In all participants KP-0013-20 application induced significant vasodilation in upper arm skin microcirculation. Skin microvascular blood flow incresead on average for 14 times. Average TtD was 11 minutes and TtM was 25 minutes. Regular ultrasound gel (placebo) did not induce any significant change in skin microvascular blood flow in all subjects.

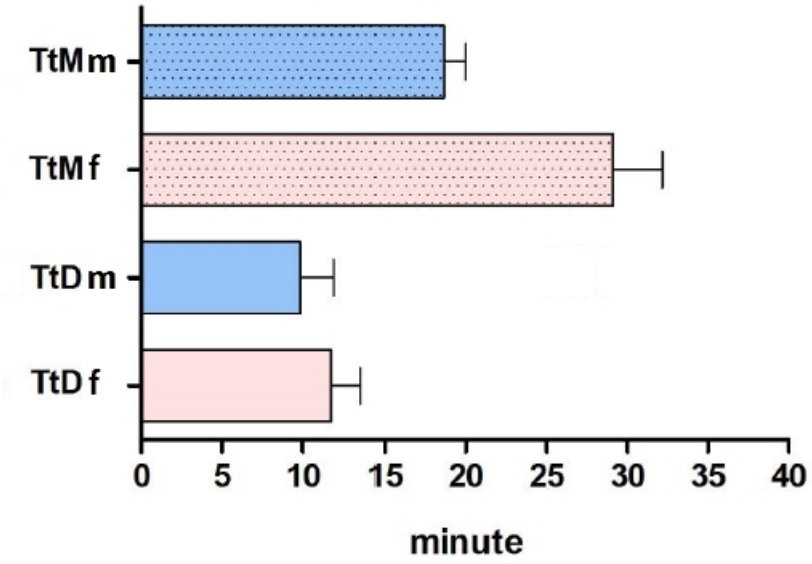


Fig. 4. Time to beginning of vasodilatation (TtD) and time to maximal vasodilatation (TtM).

The trend of increased vasodilatation could be explained with increasement of skin temperatures values. It was found that skin temperatures were increasing after reaching maximal values after five minutes of gel application. The vasodilatation found in preliminary results could be the key to this find, because it is familiar that vasodilatation means higher blood flow, which means more “warmer” blood, from upper parts of body, will affect locally affected muscle tissue in lower leg, specifically m. gastrocnemius and m. soleus.

Additionally, vasodilatation, or vaso-pumping, also increases supply of oxygen, antibodies and the ability to clear metabolites (Cochrane, 2004.). Cochrane suggests that the use of passive (no exercise, massage, contrast hydrotherapy) or active recovery (light exercise) for replenishing fuel stores and removal of metabolic wastes has implications for accelerating post exercise recovery rates. Local application of cooling methods can induce significant physiological feedback through action on the (deep) intramuscular temperature in the zone treated (Hausswirth, 2013).

Conclusion

The results gathered in this study suggest that application of KP-0013-20 gel will result with lower skin temperatures. Gel was applied on one lower leg, while the other one was treated as control sample. Three different spots were taken to collect data from, M. gastrocnemius (medial and lateral side) and M. soleus, as we found that as the most objective way to determine exact skin temperatures on affected and non-affected leg. Most significant difference in skin temperatures was found in first measuring, or five minutes after the application. In second and third measurements, a decrease in skin temperature was found. Similar conclusions were found in preliminary results, where blood flow of upper arm was monitored after the application of KP 0013-20 gel. Significant increase was found in blood flow and vasodilatation of blood vessels of upper arm. These findings suggest that the application of gel can provoke recovery effects if applied properly. Best results are supposed to appear after fifteen to twenty minutes after the correct application, and that is followed with increased blod flow (vasodilatation) which indicates that That indicates recovery effects of applied gel, and justifies it's use as a recovery method for local treatment.

Usage of such gel correctly, can significantly improve recovery time and increase possibility of greater number of training session while planning and programming. It is also applicable in every day athletes or non-athletes in treating muscle soreness, or some professional impairments considering locomotor system such as long-standing activities etc. It is important to notice that this gel works as a locally applied medium, which allows its usage on specific areas that require treatment. Its simplicity of use certainly improves everyday use and encourages consumers to choose it as a significant, and scientifically proven addition in their recovery methods repository

References

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