Therapeutic effectiveness of coldness in relieving pain and reducing inflammation has been known for many years now. Over that time, various coldness therapies have gained in popularity, including winter swimming, snow baths or physiotherapeutic treatments like local and whole body cryotherapy. (WBC) . Recent researches have shown positive effects of WBC in reducing the negative consequences of obesity, for example by improving lipid profile. WBC could be, thus, intended as an adjuvant method in the treatment of overweight or obesity. WBC is a cheap easily accessible practice, with a few well-defined contraindications and limited non severe possible adverse events, if performed in specialized centers. At the same time, in sport science appears data, which indicated on inhibition of favorable changes induced by regular training. Available data mostly involve athletes and professional training supported by coldness therapy not pro-healthy programmes of exercise and not whole body cryostimulation. Thus the aim of study is to define, the relative effectiveness of WBC, high-intensity intermittent training (HIIT), or their combination (WBC and HIIT) in improving the metabolic status of overweight and obese subjects, reduce the risk of accompanying diseases like diabetes or osteoporosis.

Secondary aims are:

1. To establish, which procedure is most effective: training or training supported with WBC treatment, which factors modify this response (body composition or physical capacity of subjects)
2. To establish if training supported with WBC treatment impairs favorable changes of trained subjects.
3. To assess how long these changes are maintained.

Overweight subjects will be recruited to the experiment. Basing on preliminary data, participant will be assign to four groups: control, whole body cryostimulation, high intensity interval training (HIIT) and WBC+HIIT. Blood collection will take place at baseline, after 10th , 20th sessions of WBC and after for and 12 weeks after experiment. Bone markers, proteins released by muscle, fat tissue will be assessed. Moreover before and after applied procedures muscle strength and physical capacity will be determined. Additionally investigation will involve analysis performed in vitro conditions. Cells cultures of bone and pancreas tissue will be treated by subject`s serum, taken after each of treatment.

This proposal is aimed at investigating, in overweight subjects with impaired glucose tolerance, the endocrine modifications induced by consecutive exposures to cold either in association or not with a specific high intensity training protocol. The final results answer for the question, which procedure is the most effective in improvement of insulin sensitivity for maintaining energy homeostasis and enhance bone metabolism. Additionally obtained data reveal, which effect have short or long-lasting influence.