Forschende Komplementärmedizin
Wissenschaft • Praxis • Perspektiven

Research Report · Forschungsbericht

Forsch Komplementmed 2013;20:295–297
DOI: 10.1159/000354408

Published online: August 19, 2013

Investigating Homeopathic Verum and Placebo Globules with UV Spectroscopy

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Keywords
Homeopathy · Anthroposophically extended medicine · Homeopathic potencies · Globules · Complementary medicine · UV spectroscopy

Schlüsselwörter
Homöopathie · Anthroposophisch erweiterte Medizin · Homöopathische Potenzen · Globuli · Komplementärmedizin · UV-Spektroskopie

Introduction

Homeopathic medicines are highly diluted preparations, which are used in homeopathy and anthroposophically extended medicine [1]. Randomised clinical trials [2–6] and meta-analyses [7, 8] have shown clinical effects of homeopathic medicine different from placebo.

The presence of molecules of the starting substance is very unlikely in dilutions above 12c (corresponding to 12 times 1:100 dilutions or 10^{-24}). Thus, classical pharmacological actions of homeopathic preparations – defined as interactions between pharmacologically active molecules and targets – cannot be expected [1]. Current theories involve a transfer of information from the original substance to water by changes in water structure [9], such as the formation of cooperative aggregates of nanoscale domains [10]. But, so far, homeopathic medications lack a plausible mode of action and remain controversial despite their clinical effectiveness.

However, several studies described small but statistically significant differences in physicochemical properties of homeopathic preparations and controls, such as differences in ultraviolet (UV) light transmission [11, 12] and increased nuclear magnetic resonance relaxation rates [13, 14] or relaxation times [15]. 1 study that investigated 2 substances and various potency levels found differences in UV spectra [16].

The aim of the present study was to investigate whether statistically significant differences could likewise be demonstrated by UV spectroscopy between homeopathic verum and placebo globules used in previous clinical trials.

Materials and Methods

Homeopathic Globules

Aconitum napellus 30c (ac30c) and corresponding placebo globules (blank) were received from Spagyros AG (Gümligen, Switzerland). 4 coded vials (2 verum, 2 placebo) from a previous clinical trial [17] were used.

Calcium carbonate / quercus e cortice 6x (cq6x) and corresponding placebo globules (sprayed with aqueous sucrose solution) were received from WALA Heilmittel GmbH (Bad Boll, Germany). 6 coded vials (3 verum, 3 placebo) from a previous clinical trial were used.

Globules had been stored under uncontrolled conditions at room temperature in the dark for several years.

From the coding on the vials it could not be concluded which vials contained verum or placebo globules. Coding was unblinded only after the first analysis of the data (see below).

UV Absorbance Measurements

2–4 globules were gently dissolved in distilled water at 10mg/ml, in duplicates, 20–23 h prior to the measurements to allow complete dissolution, and were stored in Fiolax® test tubes in the dark at room temperature.

Absorbance was measured at 190–340 nm at medium speed (as described previously [11]) with a Shimadzu UV-1800 double beam spectrophotometer (Reinach, Switzerland), which had been turned on 3–4 h before the start of the measurements. The samples were measured in a randomised order 4 times on each of the 5 measurement days.

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Data Analysis

Due to the high absorbance of sucrose, the main component of globules, below 200 nm, only absorbance at 200 nm and above was included in the analysis and 1 value for every nm was recorded. To correct for differences between measurement days, average absorbance of all samples measured on 1 day was subtracted from absorbance of the individual samples. For each sample an average corrected absorbance from 200–290 nm and 200–340 nm was calculated.

The Kruskal-Wallis test was used to determine differences between the samples. Once the samples were unblinded, placebo and verum samples each were combined for the analysis, and the Mann-Whitney U test was used. $p \leq 0.05$ was considered statistically significant and $p \leq 0.01$ as highly significant. Statistical analysis was performed with SPSS Statistics 17.0 (IBM, Armonk, NY, USA).

Results

Figures 1a and b show corrected average absorbance of the individual samples as well as of all verum and placebo samples, respectively, for the range of 200–290 nm (range of 200–340 nm is not shown). The Kruskal-Wallis test revealed significant differences in average UV absorbance at 200–290 nm between ac30c samples (2 verum, 2 placebo) as well as cq6x samples (3 verum, 3 placebo). It also revealed a significant difference in average UV absorbance at 200–340 nm between cq6x samples. After unblinding, measurement results of verum and placebo samples each were combined for each measurement day. The Mann-Whitney U test showed highly significant differences between combined verum and combined placebo samples.

The weight of the globules was also compared. A t test showed that the weight of verum and placebo globules differed significantly, i.e. for ac30c (0.0390 ± 0.0016 vs. 0.0409 ± 0.0022 g) and for cq6x (0.0241 ± 0.0018 vs. 0.0232 ± 0.0007 g).

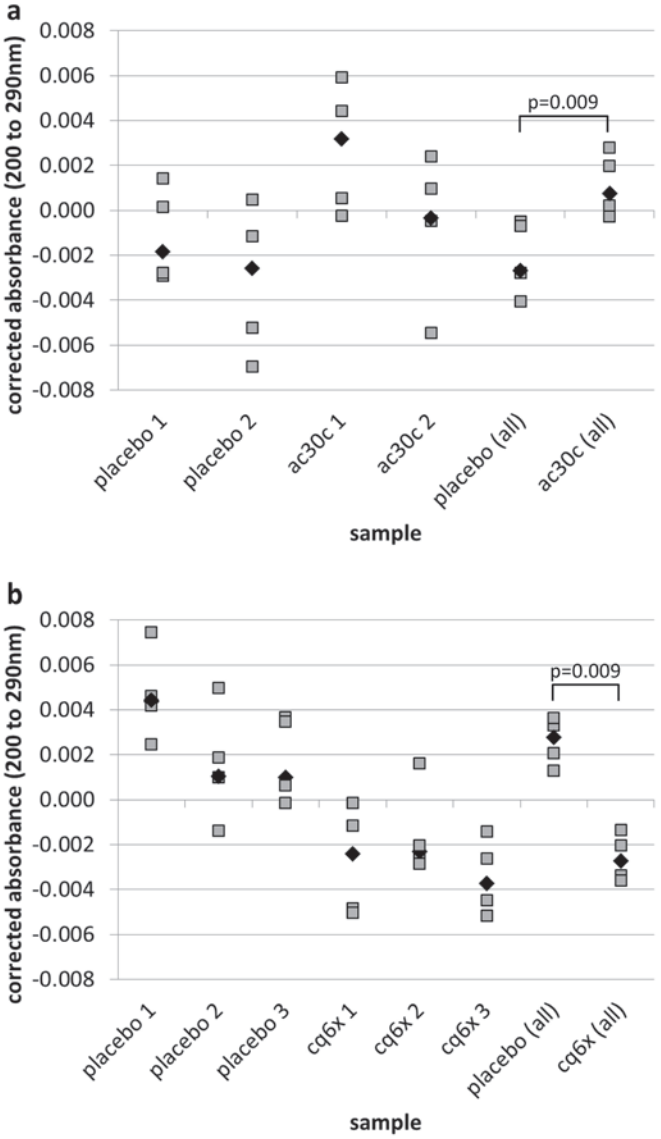

Fig. 1. Corrected average absorbance of verum and placebo globules of a) aconitum napellus 30c (ac30c) and b) calcium carbonate / quercus e cortice 6x (cq6x). The Mann-Whitney U test was used to determine differences between the combined placebo and combined verum globules. The grey squares indicate average of 1 measurement day; the black diamonds indicate median of 5 measurement days.

Discussion

In this study we investigated 2 sets of homeopathic globules, each set consisting of verum and placebo globules that were previously used in clinical trials. In 1 trial, reactions of healthy volunteers towards ac30c globules were assessed in a randomised, double-blind, controlled crossover study, and were significantly different from reactions after placebo intake [17]. In the other trial, the effectiveness of cq6x in patients with restless leg syndrome was examined (L. Rist, personal communication).

We found significant differences in UV absorbance and in weight between verum and placebo globules. The question is from where these differences originate, from specific characteristics of the starting materials (aconitum napellus and calcium carbonate / quercus e cortice), from differences in the production of verum and placebo globules, other yet unknown interference factors or a combination of these. We considered analyzing the globules further with mass spectrometry. However, due to varying structural properties, fractionation of the assumed ingredients prior to analysis would have been necessary. The high dilutions of the starting materials as well as their nature (no single compounds but plant extracts) would have made the analysis too complex and moreover not promising.

We found that absorbance of ac30c verum globules was higher than that of placebo globules and absorbance of cq6x verum globules was lower than that of placebo globules. These findings are not contradictory, since previous experiments with aqueous homeopathic preparations showed wavelike patterns of higher and lower absorbance among different steps of dilution, i.e. certain potency levels showed higher and others lower absorbance than the controls [11, 12].

Based on these results, a more expanded UV spectroscopy study with special focus on controlled production of the globules, various starting materials, and several clinically used low and high potency levels is currently under way in our laboratory. To elevate potency research to a next level and to further explore in particular observations such as wavelike patterns or potency level dependent properties, interdisciplinary and multi-modal studies comprising physicochemical measurements, plant models, and clinical applications would be desirable.

Acknowledgment

We are very grateful to Dr. Lukas Rist, Research Department, Paracelsus-Hospital Richterswil, for providing the globules, and to Monika Stutz, Department of Clinical Research, University of Bern, for providing laboratory space and equipment.

Disclosure Statement

The authors declare that they have no conflict of interest.

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