Complementary Treatment of Obesity and Overweight with Salacia Reticulata and Vitamin D

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Original Communication

Complementary Treatment of Obesity and Overweight with *Salacia Reticulata* and Vitamin D

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Abstract: *Background:* The Indian plant root *Salacia reticulata*, which is rich in alpha-glucosidase inhibitors, is used for metabolic disorders in Ayurvedic medicine. Vitamin D_3 is also used in the treatment of some metabolic diseases. Our goal was to determine its potential effect for humans with obesity. *Material:* In a randomized open-label study, we investigated 40 healthy participants aged 30–60 years, physically active, with a body mass index (BMI) of 25–45. The participants were randomly allocated into two groups. Body weight, BMI, and body composition were measured. Both groups (A and B) received a guideline for lifestyle and fitness training for 4 weeks. Group B additionally took one capsule containing 200 mg of *Salacia reticulata* and 1.6 µg (i.e. 64 IU) Vitamin D_3 (SRD) 3 times/day with the meals. *Results:* Significant weight and body-fat reduction within 4 weeks was observed. Group A lost 1.8 kg or 2.1 %, group B lost 5.3 kg or 6.1 % ($p = 0.03$), therefore BMI reduction was achieved. While Group A lost 1.4 % of body fat, group B reduced it by 4.5 % ($p = 0.01$). *Conclusion:* These promising results suggest that the combination of *Salacia reticulata* and Vitamin D_3 might be highly valuable and potent to treat overweight and obesity, especially in addition to a modifying lifestyle program. Further research is needed in addition to this study to clarify pathways and effect mechanisms.

Key words: obesity, vitamin D, Salacia reticulata, overweight, exadipin, lifestyle, training

Introduction

Salacia reticulata is an Indian plant root and has been used for treatment of diabetes, metabolic disorders, and obesity for hundreds of years, especially in Ayurvedic medicine. The known active ingredients of the root are alpha-glucosidase inhibitors, salacinol, kotalanol, thiocylitol, and mangiferin [1, 5]. Multiple effects in the metabolism of glucose have been shown in animal trials. For example, the incidence and the risks of diabetes decreased in these studies, as well as levels of blood glucose, due to the reduction of intestinal glucose absorption and the regulation of reactive insulin secretion [6, 13]. Further positive effects on

lipid metabolism were reported, such as reduction of fat accumulation and metabolic disease prevention [14–17]). The incidence and prevalence of metabolic syndrome were decreased, and a significant reduction in body weight could be shown in animal trials [9, 14–17]). *Salacia reticulata* suppresses the development of fat cells [1]. It was reported that the root might be effective in the treatment of certain metabolic diseases [14, 18]. One human study was published concluding that *Salacia reticulata* was able to significantly reduce glycosylated hemoglobin (HbA1c) and thus might be an option for the treatment of type II diabetes [10]. In this study, patients received verum Ayurvedic treatment with a tea containing an unspecified amount of *Salacia reticulata* for three months, randomly preceded or followed by either three months' placebo treatment (tea without *Salacia reticulata*) [10]. The use of the root seems to be safe in animal trials. No skin reactions, teratogenicity, or hepatopathology have been reported [19–22].

Vitamin D_3 (cholecalciferol) has become of more interest in the last years, resulting in over 20,000 publications available in PubMed (as of September 2013). Among other beneficial influences, it was reported that serum triglyceride concentrations as well as HbA1c levels decreased significantly following vitamin D_3 treatment, compared to placebo [23, 24]. The underlying mechanisms are still not clear; some theorize that the mechanisms are the regulation of beta-cell activity and the production of anti-inflammatory cytokines which protect beta cells from destruction. There is still some controversy as reported by Seshari *et al.* [25].

The present study investigated in an open-label trial the combined effect of *Salacia reticulata* and Vitamin D_3 on body weight and body fat during a 4-week intervention period.

These two substances seem to provide multiple positive effects for the treatment of metabolic disorders, but so far no study has evaluated the combination of *Salacia reticulata* and vitamin D_3 in the treatment of overweight, obesity, and metabolic disorders in humans.

Methods

The combination of *Salacia reticulata* and vitamin D_3 (SRD) is available as Exadipin® (AapoSpa, Austria), which was used for our study. It is licensed as a supplement for special medical treatments, and contains 200 mg *Salacia reticulata* root powder (with 60 mg saponins) as well as 1.6 µg vitamin D_3 (i. e. 64 IU) per capsule. The recommendation is to take it with every meal, at least 3 times a day.

The participants were invited and actively asked to participate in the study in fitness centers in the federal state of Styria, Austria. All participants were informed about the study when they joined the fitness training club with the intention to lose weight. The participants received the necessary information for the study in a comprehensible written form. All the participants confirmed that they agreed with the procedure (informed consent) before examination and treatment. The study was approved by the local ethics committee (IRB).

Inclusion Criteria

- Healthy participants without ongoing drug treatment
- Overweight or obesity [body mass index (BMI) 25–45]
- Ability to do sports
- Age: 30–60
- Body composition: obese, not muscular

Exclusion Criteria

- Diabetic subjects or subjects suffering from cardiovascular diseases
- Taking any medication or additional dietary supplements

In total 40 participants (8 men, 32 women) of Caucasian ethnicity were included in 2 groups (20 participants each). The ratio of male and female participants did not differ in the two groups.

Assessment

After inclusion in the study, the participants were randomized into 2 groups via an online tool (www.randomizer.org). Each participant was examined by a professional sports scientist. The following parameters were obtained and measured at the start of the trial (in the fasting state in the morning by the same investigator):

- age and sex
- body weight (with a calibrated scale (Soehnle 7730, Leifheit AG, Nassau, Germany)
- height (biometric)
- BMI (calculated)
- body composition [impedance measurement with Soehnle 7850 (Leifheit AG, Nassau, Germany)]

Both groups (A and B) received a guideline for lifestyle, which includes the following basic recommendations (and additional explanations):
- Take care WHAT you buy in supermarkets
- Use your knowledge about nutrition and lifestyle – be SMART
- Don't drink ALCOHOL and sugary soft-drinks
- Don't life ascetically, but SIN rarely
- REDUCE carbohydrates and fat
- Eat food only in highest QUALITY
- Don't LIE to yourself
- Do sports and do it with FUN
- Control your body-WEIGHT continuously

Additionally, participants received a standardized fitness training plan consisting of twice-weekly muscle-strengthening and aerobic cardio training programs (each session 45 minutes), which were supervised by a professional trainer. Group B additionally took one capsule of SRD 3 times a day with meals.

The participants performed the exercise with the guidance of professional fitness trainers and nutrition specialists. After a period of 4 weeks all parameters mentioned above were measured again.

Additionally each participant completed a questionnaire addressing how strictly the guidelines (incl. SRD intake) had been adhered to by answering one question on a spectrum from 0 (= nothing adhered to) to 10 (= everything adhered to).

Statistical Methods and Analysis

Microsoft Excel 2007 was used for data collection and SPSS 16 was used for data analysis.

First, the Kolmogorov-Smirnov Test was used for evaluation if the data set was normally distributed. The two-sided unpaired *t*-test was used for unpaired groups, and the paired *t*-test for paired groups. The level of significance was set at $p \leq 0.05$. Analysis was performed assuming treat intention to treat.

Results

The mean and standard deviation (SD) of different variables were calculated for the 40 participants (Table I). The age range of the participants in both groups A and B was 30–60 years; height ranged from 154 to 182 cm in both groups A and B, as well. At the time of inclusion, the weight range of group A was 64.3–123.7 kg, and 63.4–134.4 kg in group B. The BMI of group A ranged from 25.0–43.8 kg/m², and from 25.2–43.9 kg/m² in group B. The body fat mass showed a range of 17.0–54.1 % in group A, and 30.3–46.5 % in group B.

After 4 weeks of intervention, the parameters had changed as follows. The mean body weight was 83.7 kg (63.3–122.9 kg) in group A, representing a decrease of 1.8 kg or 2.1 %. The mean body weight of group B was 81.7 kg (60.9–124.6 kg), which corresponds to a reduction of 5.3 kg or 6.1 %. The difference of means was 3.5 kg, which was significantly higher ($p = 0.03$) compared to control group (Figure 1).

The mean BMI in group A was 29.4 kg/m² (22.4–43.5 kg/m²), signifying a decrease of 0.6 kg/m² and a relative loss of 2.0 %. The mean BMI was 29.3 kg/m² (22.8–40.7 kg/m²) in group B, corresponding to a decrease of 1.9 kg/m² and a relative loss of 6.1 %.

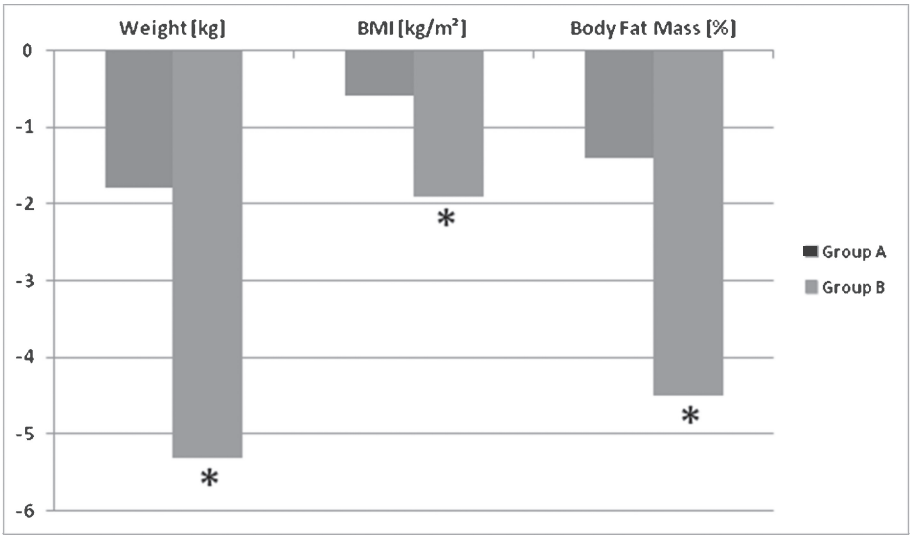

Figure 1: Weight-, BMI-, and fat loss of both groups. This chart shows the lost weight [kg], BMI [kg/m²], and body fat mass [%] of both groups within 4 weeks. Group A received lifestyle intervention, group B received in addition one capsule of a combination of Salacia reticulata and low-dose Vitamin D with every meal. * $p < 0.05$.

Table I: Mean and standard deviation of measured parameters of both groups. Group A received lifestyle intervention for 4 weeks, group B received additionally one capsule of a combination of *Salacia reticulata* (200 mg) and low-dose vitamin D (1.6 μg, i.e. 64 IU) with every meal. Date 1 was at inclusion, date 2 was 4 weeks later.

Variable	Group A		Group B	
Examination Date 1	mean	SD	mean	SD
Age [years]	46.8	9.4	48.1	9.6
Height [cm]	169.2	7.7	167.9	6.3
Weight [kg]	85.5	8.6	87.0	8.8
BMI [kg/m^2]	30.0	5.3	31.2	4.7
Body Fat mass [%]	34.8	9.7	36.1	5.6
Examination Date 2				
Weight [kg]	83.7	8.9	81.7	8.5
BMI [kg/m^2]	29.4	9.7	29.3	4.5
Body Fat mass [%]	33.4	5.4	31.6	5.2

Mean difference between both groups was 1.3 kg/m^2 ($p = 0.02$), in favor of group B.

The mean percentage of body fat mass was 33.4 % (15.6–52.9) in group A, which signified a reduction of 1.4 % and a relative loss of 4.0 %. The mean body fat mass in group B was 31.6 % (20.4–41.0 %), representing a decrease of 4.5 % and a relative loss of 12.5 %. A mean difference between both groups of 3.1 % ($p = 0.01$) was calculated.

The questionnaire (how strictly the guideline was adhered to) showed a mean value of 7.05 (range 4–8) in group A, compared to 7.15 (4–9; $p = 0.76$) in group B.

Discussion

The scientific interest in Vitamin D_3 has grown in recent years. Cholecalciferol is a natural substance produced in the human body from 7-dehydrocholesterol by interaction with ultraviolet (UV), especially UVB, light in the skin. Vitamin D_3 can also be taken orally with nutrition or as nutrition supplements. Adults (over 70 years of age) are given the recommendation (DGE) to take 20 μg/day, which corresponds to 800 IU (International Units). No side effects were reported up to a daily intake of about 4000 IU [26]. A deficiency or under-supply of Vitamin D_3 can be a risk factor for several diseases: autoimmune diseases like multiple sclerosis [27], Crohn's disease [28], diabetes mellitus [29], infections like tuberculosis (TB) or infections of the respiratory system [30–32], hypertension [33], different kinds of cancer [34–36], osteopenia and osteoporosis, cardiovascular diseases [29, 37, 38], metabolic syndrome [29], muscle disorders [39], reduced brain function, and rachitis (rickets) [40]. This deficiency is suggested to occur because of UVB deficiency and/or unbalanced nutrition containing too small a Vitamin D_3 concentration. The endogenous production of Vitamin D_3 in the body also depends on skin pigmentation: the more pigmented the skin, the less efficient the transformation of the pre-vitamin to Vitamin D_3. Vitamin D_3 supplementation is often recommended in the winter months, as well as for dark-skinned people. In some studies the prevalence of Vitamin D deficiency was over 78.2 % [41, 42].

Improvement of vitamin D_3 status resulted in the reduction of inflammatory markers, such as serum highly-sensitive C-reactive protein (hsCRP), serum amyloid A (SAA), interleukin (IL)-2, IL-6, IL-10, and tumor necrosis factor (TNF)-α, and diabetic complications in type 2 diabetes patients [43]. Some data suggest a potential role for Vitamin D_3 in the treatment of diabetes-associated hepatic complications [44]. Nazarian *et al.* indicated that orally administered high-dose Vitamin D_3 supplementation improves insulin sensitivity in subjects with impaired fasting glucose and suggested that high-dose Vitamin D_3 supplementation might provide an inexpensive public health measure in preventing, or at least delaying, the progression from impaired fasting glucose to diabetes [45]. Other studies found that serum triglyceride concentrations as well as HbA1c decreased significantly under Vitamin D_3 treatment compared to placebo [23, 24].

Finally, McGill showed clearly that serum Vitamin D_3 is inversely related to weight, BMI, and markers of type II diabetes mellitus (TIIDM) (large waist,

raised HbA1c) [46]. However, a study dealing with genetic association concluded that lower 25-hydroxyvitamin D is likely to increase BMI only to a small extent [46]. Other studies support the assumption that Vitamin D supplements do not influence body weight, at least in adult obese individuals [47, 48].

During the study participants took no permanent drugs or medications. Age, height, and weight were similar in both groups, which led to homogenous and comparable initial conditions. An average weight loss of more than 5 kilograms in 4 weeks was a big success for the participating members taking SRD. The difference of weight loss in groups A and B was significant, suggesting that SRD might be a potent agent of treating overweight and obesity.

Even more interesting for us was the fact that significantly more body fat (in total more than 4.5 %) was lost in the group supplemented with SRD compared to the control group. We assume that a combination of exercise and nutrition is still the best formula for losing fat, and that this might be improved by an oral intake of SRD.

No significant difference could be observed in the means of the questionnaire scale. Probably both groups took similar nutrition and did comparable exercise.

Akase *et al.* and Shimada *et al.* found that *Salacia reticulata* seems to be a potent substance for treating metabolic diseases, especially overweight and obesity, but its combination with Vitamin D_3 leads to better results [14, 17]. In literature, the reasons for these effects are multifactorial. The ingredients (alpha-glucosidase inhibitors, salacinol, kotalanol, thiocyclitol, and mangiferin + Vitamin D_3) are thought to interact with different enzymes and to block uptake mechanisms of glucose and fat at the small intestine as well as into cells [6, 14, 15, 17]. These interesting findings might be relevant for future metabolic guidelines if further studies were to support the data. Overall, this might be a very potent combination for future metabolic treatments.

The limitations of the study should be mentioned briefly as follows. A placebo supplement would have been an option instead of just training (control group). In addition, no blood laboratory parameters (glucose, lipids, vitamin D, etc.) were measured. These might provide more support for a clear conclusion. However, our goal was to get an impression as to whether the supplement might have effects on overweight and obesity in humans, and not just in animal models, as reported previously by other authors.

As a follow-up study, a randomized double-blind, placebo-controlled clinical trial is planned in order to obtain clear data on metabolic pathways, effects on blood sugar and fat profiles, anti-oxidation and anti-inflammation indicators, and Vitamin D serum levels. Of course, a larger sample size, a prolonged duration of intervention, and an increase of the Vitamin D dose could also be taken into account in further studies.

Conclusion

Salacia reticulata and Vitamin D_3 have been well studied individually for the treatment of metabolic diseases. Especially for Vitamin D_3, there are enough data to recommend the supplementation of this agent to treat common metabolic diseases of human beings. *Salacia reticulata* is an Indian plant root, which has been used for hundreds of years in Ayurvedic medicine for treating of those diseases as well, but up until now research has been focused mainly on animal trials.

Our data suggest that the combination of *Salacia reticulata* and Vitamin D_3 might be highly valuable and potent for the treatment of overweight and obesity, especially in addition to a lifestyle modification program focused on nutrition and exercise. The findings encourage further research to clarify the pathway and effectiveness of *Salacia reticulata* in the treatment of obesity, diabetes, and other metabolic diseases.

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Conflicts of Interest

No potential conflict of interest relevant to this article is reported. The authors declare no competing financial interests. The authors assume responsibility for the overall content and integrity of this article.

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