

Sustained Weight Loss during 20 Months using a Personalized Interactive Internet Based Dietician Advice Program in a General Practice Setting

Vibeke Brandt
University of Southern Denmark
Odense, Denmark
e-mail: vibra@student.sdu.dk

Cecilia Arendal
Clinical Dietician
Nyborg, Denmark
e-mail: cia-erik@adslhome.dk

Carl J. Brandt
Stenstrup Lægehus
Svendborg, Denmark
e-mail: carl_brandt@get2net.dk

Søren Toubro
Reduce
Roskilde, Denmark
e-mail: st@reduce.dk

Dorte Glintborg
Department of Endocrinology M
Odense University Hospital
Odense, Denmark
e-mail: dorte.glintborg@dadlnet.dk

Kirsten Brandt
Human Nutrition Research Centre, School of Agriculture,
Food and Rural Development
Newcastle University
Newcastle upon Tyne, United Kingdom
e-mail: kirsten.brandt@newcastle.ac.uk

Abstract—Obesity is an increasing drain on the resources of general practitioners, who have few effective options for treatment other than surgery and (often prohibitively expensive) personal dietician advice. This pilot project investigated the weight loss efficacy and the cost of an interactive internet-based weight loss program in a Danish medical center setting. The study comprised an initial weight loss period of approximately 4 months, consisting of frequent online consultations with a dietician and an exercise coach supported by electronic diaries and establishment of an online community, where the patients exchanged experiences with other users of the program. This was followed by a 16-month maintenance treatment providing less intensive counseling. Of 46 obese patients offered participation, 32 patients were enrolled in the study and 21 completed the full course. The mean weight at inclusion was 104 kg with a BMI of 36.4 kg/m². After 4 months of treatment and an average of 17 consultations the participants lost on average 7.0 kg, $p < 0.001$. During the 16-month maintenance period, the average weight did not change and 81% of the participants retained or increased their initial weight loss. The cost of the initial treatment was calculated as 165 DKK (approx. €22) per kg weight lost. These results indicate that e-mail consultations can produce comparable weight loss as conventional weight loss treatments in general practice at a lower cost, particularly for sustaining the weight loss over a longer period of time. The results of this preliminary uncontrolled study with few participants indicate that future randomized clinical trials with more participants comparing the e-consultations with relevant conventional practices are justified, in order to quantify effect and long-term cost-efficiency of e-consultations as an intervention against obesity.

Keywords—obesity; internet community; treatment; preventive medicine

I. INTRODUCTION

Obesity is a growing problem, resulting in an increasing demand for efficient weight loss treatments suitable for use in general practice settings [1]. According to the Framingham study, obesity shortens life by 3 to 8 years for a 40-year-old person [2] demonstrating the urgent need for effective ways to reduce obesity.

Form and content of communication are important in order to modify life style factors [3], which is the general recommendation to obtain a sustainable weight reduction. Several Cochrane reviews infer that advice from general practitioners (GPs) by itself does not have a long-term effect on weight loss compared to placebo [4]. Dietician guidance and the establishment of group meetings have a significant effect in the short term, but only few long-term studies are available [4][5]. Surgical intervention is an effective long-term weight loss option, but in Denmark it is reserved for very obese patients [5]. Consequently no documented effective non-surgical weight loss offers are available to the GPs of the Danish National Health Service for patients with simple overweight [6].

There is now a vast literature on how the internet can be integrated as a consultation tool [5][7][8][9]. For example, several studies suggest that interaction over the internet with experts in an internet based community is the most effective way to lose weight [10][11]. Recent studies suggest that online contacts are an economically attractive contact form for optimizing guidance on diet and exercise and in keeping the patients motivated [12][13][14]. The internet furthermore substantially facilitates the use of motivational tools such as self-monitoring, which has been used successfully in other approaches of internet based weight loss interventions [16].

In Denmark, 86 % of the population has internet access at home [15], which makes it possible to reach out to most of the patients by online intervention.

Conventional dietician advice is costly, therefore it is important to ensure that resources are being used in the best way possible. In Denmark it is now possible to employ dieticians in general practice and health care centers. However many practices experience difficulties to organize the activities in a way that makes it economically feasible to offer diet treatment to patients within the rates provided by the Danish National Health Service.

The present paper reports on the methods used and results achieved in a preliminary uncontrolled prospective survey of weight loss and weight maintenance among obese patients, who received advice and support about diet and exercise using a personalized interactive internet-based dietician advice program in a clinical practice setting.

II. METHOD AND SUBJECTS

A. Patients

One medical center with primary care participated in the study. In May 2008, new patients and patients who were already enrolled in weight stabilization courses were offered the opportunity to participate. Initially 46 patients attended a consultation with a dietician, of which 32 patients agreed to participate in the full study and signed the informed consent form. Patients then received information on how they could log on to the program. Before attending the dietician, the patients filled out name, address and e-mail address. The study was approved by the South Danish regional committee on biomedical ethics.

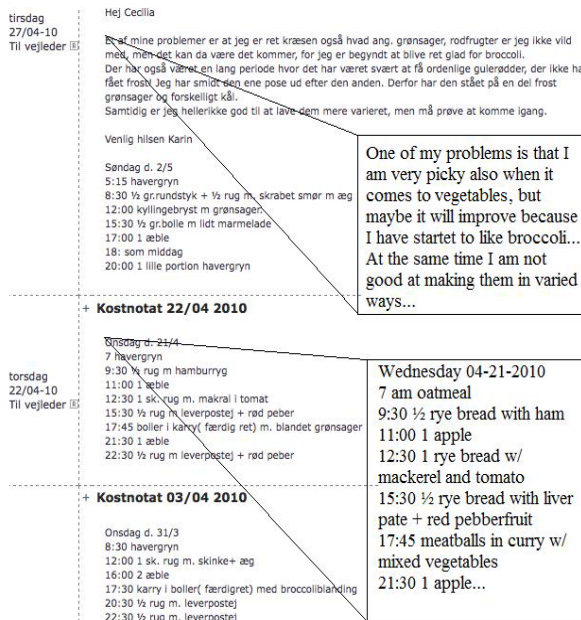


Figure 1. Screenshot of dietary notations on a daily basis from one of the participants using the website.

B. Study design

The pilot study was designed as an uncontrolled prospective survey of the efficacy of using an existing commercial weight loss program [17] for obese patients in a general practice setting. At the first login, patients filled out a comprehensive 16-page medical history with information regarding their health, education and medicine intake. Completing the forms gave e-access to consultations with a dietician and an exercise coach. E-access also allowed e-mail chats with the other patients participating in the study.

During the first week the patients recorded a diet and exercise history on a day-to-day basis (see Figure 1). Based on these records, the patients received a diet plan, weekly advice from a dietitian (see figure 2) as well as an exercise plan and advice from an exercise coach once a month. Treatment principles in both online and physical consultations were based on the Danish Board of Health's recommendations from "The 8 dietary guidelines" [6].

The aim was to enhance the daily intake of vegetables and fruits, choose whole-grain options for bread and other cereal products, replace products rich in fat with lean alternatives and distribute food intake into several smaller meals throughout the day.

The treatment consisted of providing simple and manageable guidelines and tools that gave the patients substantial freedom in planning their meals while the dietitian could supervise and advise each patient individually on where improvements could be achieved. Patients who according to the dietician's professional assessment needed face-to-face consultation with the dietician during the study period, were seen by a dietician in the medical center 2 to 3 months into the study period. Only one dietitian was connected to the project, which means that the patients were met by the same dietician at the medical center as online.

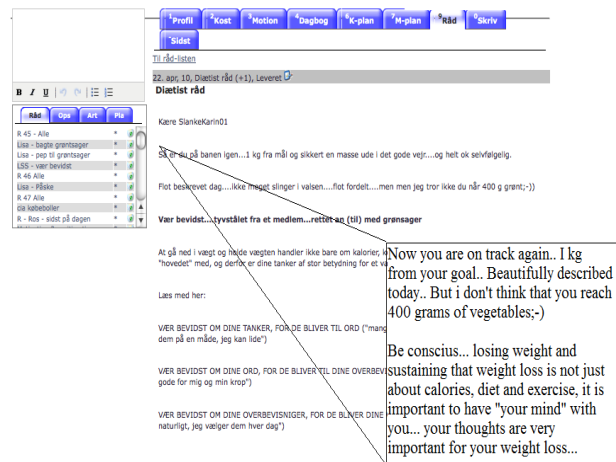


Figure 2. Screenshot of personal advice from the dietician as a response to the information in Figure 1.

The internet tools in the program encouraged the patients to record their exact dietary intake on a day-to-day basis, enabling the dieticians at the face-to-face consultation to focus more on serving the patient's needs and spend less time to simply clarify recent food intake. The patients could also write about any complication or worry that they might have during a day, as illustrated in the example in Figure 1. Dietary notes and commentaries from the patients were used by the dietician, the exercise coach as well as peers (other users of the program) to intervene and relate to problems when they appeared.

The patients were supported by their peers on the website by using an internet community (presented as 'forums for debate'), consisting of all users of the internet based program, both the patients enrolled in the study and other users who pay for the service privately to lose weight in a non-clinical setting. The members of this internet community were encouraged to contact each other for support, as seen in the example in Figure 3.

The internet community was very intimate as only patients with a weight problem had access. The patients could communicate via discussion forums and internet chat forums. Communication was also available in specially designed inboxes on the website, as comments to food and exercise records or via personal pictures.

To illustrate this we have chosen some typical comments from the patients: "I know I don't use as many fiber rich vegetables in my salad as I would like, but there is no room when I eat my regular salad that I love..." "...the weather makes it difficult for me to exercise because of my gout. What can I do?" or "my dog died. I'm so sad...". The dietician would get to know every participant individually, and be able to guide them in a way that suited their lifestyle, as seen in Figure 2.

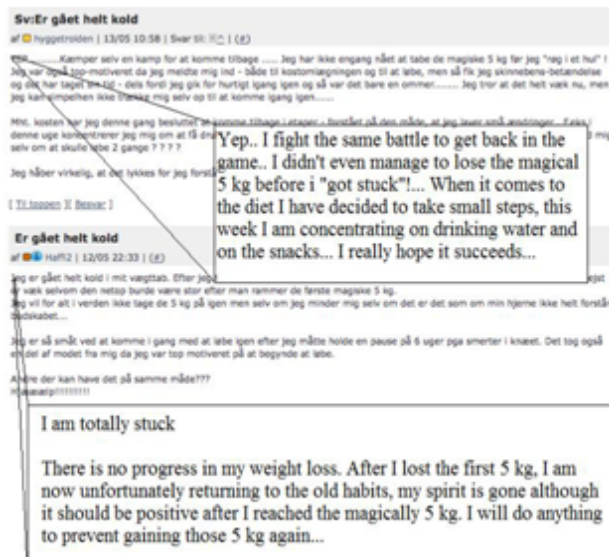


Figure 3. Screenshot of participants using the debate forums from the internet community.

Waist and hip measurement, weight and clinical analysis values were obtained at baseline and after 4 month initial treatment. These assessments were performed by the study team at physical consultations, see table 1. The following approx. 16 months (maintenance period) most of the patients continued to use the program, but only received internet consultations when requested by the patient or by the dietician, and weight measurements were recorded whenever the patients attended the health centers for other reasons.

Results were analyzed as a one-sample t-test for the hypothesis that the weight loss or other change from one time point to the next was different from 0.

III. RESULTS

The datasets from 22 of the 32 enrolled patients were sufficiently complete to be included in the outcome calculations. Of the remaining 10 patients, 2 only registered starting weight and the remaining 8 never logged on. All 22 completed the initial treatment period and 21 the maintenance treatment. One patient only completed a 12-month period due to pregnancy; we used the last observation carried forward. Baseline data and details of treatment for the 22 patients who participated in the are given in Table 1.

The average weight loss after the initial intensive treatment period of 115 days (95% CI: 101; 121), was 7.0 kg, with a standard error of the mean of 1.1 (95% CI: 4.6, 9.3), $P < 0.001$. Nine participants achieved a weight loss of 5-10 kg and 4 participants lost more than 10 kg. There were no significant correlations between weight loss and duration of treatment period or between weight loss and number of consultations. Clinical and anthropomorphic data of patients enrolled are listed in Table 1. The mean age at inclusion was 43 years and the mean weight 104 kg with a BMI of 36.4 kg/m².

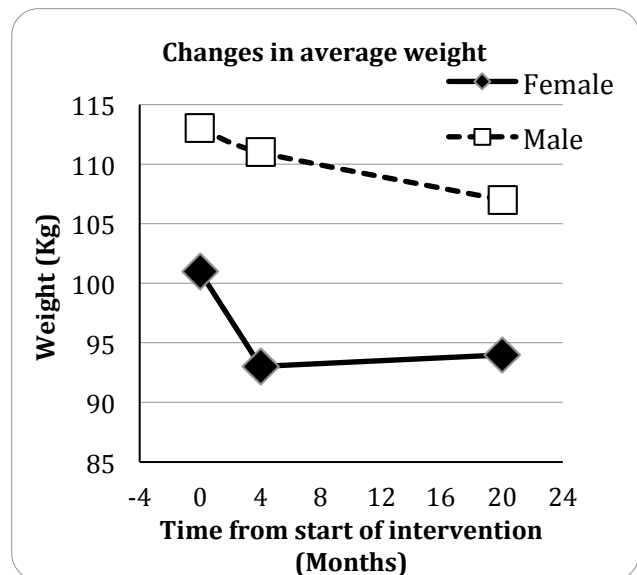


Figure 4. Average weight of the participants at baseline, after 4 months and after 20 months follow up.

The mean weight loss from baseline after the maintenance period, a total of approx. 20 months, 595 days (95% CI: 519; 671), was still 7.0 kg. 15 out of 21 achieved a weight loss between 5 and 29 kg. 4 lost between 0.3 and 2.2 kg, and the last 3 patients gained between 0.1 and 4.7 kg. One patient became pregnant and 1 patient was absent for the approx. 20 month assessment, they were excluded and we used the last observation carried forward. Seventeen out of the 21 i.e. 81% of the participants managed to sustain a weight loss of more than 1 kg after 20 months.

The dietician and some of the patients were interviewed about their experience with the program. Both parties agreed that one of the most important parts of the program was the continuity. The dietician was always available over the internet, which created an ongoing motivation for lifestyle changes instead of a short-term diet change. The patients also found that continuous emotional support and practical advice from peers had been very important during the study.

Some patients found the internet community equally important as the dietician, as illustrated by a comment: "I spend most of my time on the internet community, I like to see how the others are doing and whether they have the same problems as me."

Feedback from the doctors and staff in the medical center indicated that they were satisfied with the cooperation with the dietician. It was seen as a benefit to offer dietician advice close to the patients without requiring frequent visits to the medical center. The main challenge mentioned by this group was the technical integration with the existing e-journal system of the Danish National Health Service.

The total cost of the initial weight loss treatment, including the personal (face-to-face) consultations and clinical assessments, was estimated to a total of approximately 35,000DKK. Without the cost of the study assessments the cost would have been approximately 25,700 DKK. This estimate corresponds to 165 DKK (€22) per kg weight lost for the treatment provided.

TABLE 1. Clinical and anthropomorphic data for the patients. Full set of data at baseline and after the initial treatment period, only weight measurements after the approx. 20 months maintenance period.

	Females (n=17)			Males (n=5)		
	Start	4 months	20 months	Start	4 months	20 months
Age(years)	42 (39-46)			43 (37-50)		
E-mail cons.	0	17 (14-20)	57 (45-70)	0	17 (12-21)	29(18-39)
Period (days)		111 (97-126)	568 (485-650)		130 (119-140)	683 (649-717)
Weight (kg)	101 (94-108)	93 (85-100)**	94*** (85-102)**	113 (108-117)	111 (105 -116)*	107 (101-113)*
BMI (kg/m ²)	35.6 (32.9-38.2)	32.6 (29.9-35.3)**	32.9 (29.9-36.0)**	39.1 (38.0-40.2)	38.4 (37.1-39.8)	37.3 (33.0-41.6)
Waist (cm)	103.2 (97.3-109.2)	95.4 (90.2-100.)*		122.7 (119.9-125.5)	120.3 (116.6-124.1)	
Hip (cm)	119 (112.1-125.8)	109.4 (104.2-114.6)*		113.5 (112.5-114.5)	113.5 (112.5-114.5)	
WHR	0.86 (0.82-0.93)	0.86 (0.82-0.93)		1.10 (1.07-1.13)	1.09 (1.04-1.13)	
Total cholesterol	5.2 (4.6-5.7)	4.9 (4.4-5.3)		5.8 (5.6-6.0)	5.0 (4.5-5.5)	
LDL (mmol/l)	3.1 (2.5-3.6)	3.0 (2.5-3.4)		3.3 (3.0-3.5)	3.5 (3.3-3.7)	
HDL (mmol/l)	1.7 (1.1-1.4)	1.7 (1.1-1.4)		1.0 (0.8-1.1)	1.1 (1.0-1.1)	
TG (mmol/l)	1.7 (1.3-2.1)	1.3 (1.0-1.6)		4.2 (3.3-5.1)	2.2 (1.6-2.7)	
HbA1c (%)	5.0 (5.3-6.8)	5.2 (5.2-6.3)		8.0 (6.6-8.7)	7.0 (6.0-7.8)	

Data presented as mean value (95% confidence interval)

* p<0.05 vs. before related to same sex

** p<0.001 vs. before related to same sex

*** Two patients were excluded due to pregnancy and absence; we used last observation carried forward (one after 4 months and one after 10 months)

The cost to the Danish National Health Service of an e-mail consultation was 49.68DKK, compared with 211.14DKK for a consultation in the medical center with the aim of assisting the patient to change lifestyle. The average price per patient for the 4-month weight loss process in this implementation study was 1165 DKK. Data on costs are not available for the subsequent maintenance period, but they were substantially lower than during the initial treatment period.

IV. DISCUSSION

In the present study we used a combination of the expertise available to a Danish health center with an interactive e-consultation delivery tool and an internet community to accomplish a sustainable weight loss amongst obese Danes. Using this method we achieved an average weight loss of 7.0 kg during the first 4 months, which is comparable to other conventional treatments [10]. A maintained average weight loss of 7.0 kg after 20 months follow up is a strong indicator that this might be a way to efficiently and cost-effectively reduce weight for a large population. However a randomized controlled trial would be necessary to determine whether the results are reproducible.

Bennett *et al* recently reported on a randomized clinical trial of another web-based weight loss program in primary care in the USA, with a similar study population (baseline BMI 34.6 and age 54.4). This study showed a comparable efficacy with a 3.05 kg greater weight loss amongst cases compared with usual care. The trial period was 12 weeks and one of their conclusions was that trials of longer duration are necessary [16].

This study however displayed several differences from ours, i.e. they tried to create adherence to the program by offering the possibility of winning money and their internet program did not include facilitated peer support (online community). Since many of the patients used the community frequently during our study and found it very beneficial this may be an important difference. Also the patients in our study corresponded with the same dietician over the internet and during the counseling in general practice, in contrast to the study of Bennett *et al* [16], where the program was not designed to provide individual counseling. Using the patient's interaction with the community and e-mails from the patient, the dietician could follow the patients' progress and provide more accurate and effective advice, since she had the opportunity to build a greater understanding of every individual. Together with the longer weight loss period this might be a reason why our study appeared to show a larger weight loss, while their results are more significant due to a higher number of participants and more relevant due to the comparison with a control group. However in combination these two studies strongly indicate that as a concept internet based weight loss programs can be successful in the short term, may be useful in longer term maintenance of weight loss and can be effectively introduced in health care.

Several studies suggest that keeping the patients in the program is as effective as frequent follow-up but cheaper [5].

In the present study, the low number of dropouts among those who progressed beyond the first week was remarkable; according to the patients this was mainly due to the community, where they established relationships with other patients. The low dropout rate could also be affected by the fact that the patients all received advice from the same dietician, and she could possibly be very good at keeping the patients motivated. It would be interesting to further investigate specifically the efficacy of the internet community, since the Bennet *et al.* study showed that the more patients were using the internet program, the greater their weight loss [16], even though no such correlation was found with the small number of participants in the present study. Future developments of the program could focus on the community and make it more attractive. We may achieve greater and in particular more sustained weight loss results if we could get the patients more involved in the program through the internet community.

The use of self-monitoring provided by the online program had both advantages and disadvantages. The patients were able to follow their own progress using the website, which can help keep motivation, and the data that the patients provided were essential as tools for the dietitian to achieve the very cost-effective provision of advice. In contrast, the self-reported data could not be used for, evaluation of the intervention outcome, due to potential bias such as under- or over-estimations or recall bias. Therefore only data from measurements that were carried out at the medical center by the dietician or a nurse are presented in the present paper.

Web-based interventions have the disadvantage that the participants must be fairly proficient at using the internet and have the required writing and reading skills for using the program, in addition to the obvious requirement for convenient internet access. In our study, 14 patients who were offered participation failed to go through the enrollment progress, and some of these could be due to lack of computer or writing skills.

Feedback from doctors and secretaries involved in the study was very positive. It was agreed that the program could potentially help to better utilize the scarce dietician resources by decreasing the need for consulting face to face. In relation to the implementation in the medical centers, it was important that there should be a technical integration that makes the internet portal an integrated part of the electronic journal system used by the Danish National Health Service. Communication between the medical center and dieticians could become an integrated part of the doctors daily work tool. It is especially necessary to establish a technical integration with billing and information exchange, to minimize the need for intervention by the other staff at the medical center.

With a total of 500 licensed dieticians in Denmark and approximately 50 newly educated every year, faced with the needs of 4000 medical centers to provide relevant treatment offers to ever increasing numbers of obese patients, the

present pilot trial indicates the potential usefulness of this type of effective and economically attractive individual internet treatment for the large part of the population in need of dietary advice.

V. CONCLUSION AND FUTURE WORK

The study showed that the internet based interactive weight management program may be a cost-effective way to produce a significant and sustained weight loss among patients with obesity in general practice. The internet can be used as a communication tool for lifestyle changes and provide a community for the patients to support them to maintain weight loss and healthier life style. We have developed a protocol for a randomized controlled trial to further investigate the efficacy of this weight-loss program in a more controlled setting, comparing the intervention with usual care [18]. Furthermore, we are working on a refinement of the internet platform to record how much each of the participants use the internet community, as a tool to assess the importance of this feature.

ACKNOWLEDGMENT

Thanks to medical student Mathilde Pedersen, University of Southern Denmark and to political science student Sara Katrine Brandt for editorial contributions to this paper. Thanks to the staff at Stenstrup Lægehus, Nyenstadvægerne and Marstal Lægehus for making this study possible. Thanks to Region Syddanmark and the KEU fund for input and financial support.

REFERENCES

- [1] C. J. Brandt, C. Arendal, D. Glintborg, S. Toubro, "e-Dietician in General Practice," *etelemed*, pp.29-32, 2010 Second International Conference on eHealth, Telemedicine, and Social Medicine, 2010
- [2] A. Peeters, J. J. Barendregt, F. Willekens, J. P. Mackenbach, M. A. Al, and L. Bonneux. Obesity in adulthood and its consequences for life expectancy: a life-table analysis. *Ann Intern Med* 2003 Jan 7;138(1):24-32.
- [3] C. J. Brandt, H. Ellegaard, M. Joensen, F. V. Kallan, A. D. Sorknaes, and L. Tougaard. Effect of diagnosis of "smoker's lung". *RYLUNG Group. Lancet* 1997 Jan 25;349(9047):253.
- [4] R. L. Thompson, C. D. Summerbell, L. Hooper, J. P. Higgins, P. S. Little, D. Talbot et al. Dietary advice given by a dietitian versus other health professional or self-help resources to reduce blood cholesterol. *Cochrane Database Syst Rev* 2003;(3):CD001366.
- [5] M. Neve, P. J. Morgan, P. R. Jones, and C. E. Collins. Effectiveness of web-based interventions in achieving weight loss and weight loss maintenance in overweight and obese adults: a systematic review with meta-analysis. *Obes Rev* 2010 Apr;11(4):306-21.
- [6] B. Richelsen, A. Astrup, G. L. Hansen, H. S. Hansen, B. Heitmann, L. Holm, et al. A report from the board of Nutrition. The Danish epidemic of obesity – Proposal for a prevention effort . 2003.
- [7] T. J. Moore, N. Alsabeeh, C. M. Apovian, M. C. Murphy, G. A. Coffman, D. Cullum-Dugan, et al. Weight, blood pressure, and dietary benefits after 12 months of a Web-based Nutrition Education Program (DASH for health): longitudinal observational study. *J Med Internet Res* 2008;10(4):e52.
- [8] D. J. Wantland, C. J. Portillo, W. L. Holzemer, R. Slaughter, and E. M. McGhee. The effectiveness of Web-based vs. non-Web-based interventions: a meta-analysis of behavioral change outcomes. *J Med Internet Res* 2004 Nov 10;6(4):e40.
- [9] R. A. Winett, D. F. Tate, E. S. Anderson, J. R. Wojcik, and S. G. Winett. Long-term weight gain prevention: a theoretically based Internet approach. *Prev Med* 2005 Aug;41(2):629-41.
- [10] B. C. Gold, S. Burke, S. Pintauro, P. Buzzell, and J. Harvey-Berino. Weight loss on the web: A pilot study comparing a structured behavioral intervention to a commercial program. *Obesity (Silver Spring)* 2007 Jan;15(1):155-64.
- [11] D. F. Tate, R. R. Wing, and R. A. Winett. Using Internet technology to deliver a behavioral weight loss program. *JAMA* 2001 Mar 7;285(9):1172-7.
- [12] J. Harvey-Berino, S. Pintauro, P. Buzzell, and E. C. Gold. Effect of internet support on the long-term maintenance of weight loss. *Obes Res* 2004 Feb;12(2):320-9.
- [13] H. A. Haugen, Z. V. Tran, H. R. Wyatt, M. J. Barry, and J. O. Hill. Using telehealth to increase participation in weight maintenance programs. *Obesity (Silver Spring)* 2007 Dec;15(12):3067-77.
- [14] L. P. Svetkey, V. J. Stevens, P. J. Brantley, L. J. Appel, J. F. Hollis, C. M. Loria, et al. Comparison of strategies for sustaining weight loss: the weight loss maintenance randomized controlled trial. *JAMA* 2008 Mar 12;299(10):1139-48.
- [15] Statistics Denmark. Internet access in the home - devices with access to internet. <http://www.statistikbanken.dk/BEBRIT01> (accessed January 2nd, 2010).
- [16] G. G. Bennett, S. J. Herring, E. Puleo, E. K. Stein, K. M. Emmons, and M. W. Gillman. Web-based weight loss in primary care: a randomized controlled trial. *Obesity (Silver Spring)* 2010 Feb;18(2):308-13.
- [17] SlankeDoktor. www.slankedoktor.dk. (accessed January 2nd, 2011)
- [18] V. Brandt, M. Pedersen, C. J. Brandt, C. Arendal, D. Glintborg, S. Toubro, K. Brandt "Design and aims of study to measure long-term efficacy of interactive online dietician weight loss advice in general practice," *etelemed*, 2011 Third International Conference on eHealth, Telemedicine, and Social Medicine, 2011