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Impact assessment of a decision support system on weight management and physical fitness

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ABSTRACT

The study was undertaken to assess the impact of a Decision Support System (DSS) on weight management and physical fitness. DSS was developed using Microsoft visual studio 2005. In order to assess the impact of DSS, 22 obese subjects were selected purposively and further divided in two groups for experimental (12) and control (10). The experimental group was asked strictly to follow the given DSS for one month. DSS study revealed the significant reduction in the intake of energy, fat and carbohydrates whereas significant improvement was observed in the intake of fruits, green leafy vegetables. It was also found to be effective in reducing the body weight, body fat per cent and body fat mass whereas total body water and physical fitness scores were improved significantly. There were no significant alterations observed in any parameter in the control group.

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Key words : Impact assessment, Decision support system, Physical fitness

"Those who do not have time for bodily exercise will sooner or later have to find time for illness." Edward Stanley.

Exercise is a key part of any effective weight management plan. Healthy weight is an important part of wellness. Maintaining a healthy body weight requires a lifelong commitment to regular exercise, a healthy and balanced diet and effective stress management (Mahan and Escott-stump, 2000). Obesity has reached epidemic proportion globally with approximately 106 billion adults and at least 20 million children under the age of five being overweight (Flegal *et al.,* 2004).

In discussing the treatment of obesity, it is necessary to emphasize that one is dealing with the syndrome than a disease. The treatment of obesity is the simple and yet the most complex of all the treatments. Simplest in the sense that all that required energy restriction and complex in the sense that cellular metabolic, socio- economic, cultural, psychological factors all militate against the maintenance of reduced state. Unfortunately, in our society only the weight reduction period is emphasized and the obese subject is exposed to endless variety of weight reduction programmes which include diet, drugs, hormones, psychotherapy and social treatments.

No doubt, the increased health risks with obesity has created an awareness among the public but the results are not always satisfactory. The wide range of solutions offered by the commercial weight loss industry ranging from "miraculous fat burning pills" to nutritional pre determined diets like "crash diet and fat diets" ignore the basic concept for weight loss and the need for changing life long habits. Pre-packaged food regimens strenuous physical activity and training are also in vogue.

Instead of indulging in such short term treatments, the goal of weight reduction should be set towards achieving a permanent weight control. The first step towards this is through acquiring a sound counseling. Diet counseling through computers is the new dimension in counseling at present welcomed by both patients and health team. Computer aided counseling is easy to use, interesting and effective, more accurate and is much faster than human brain (Mageshwari and Sunitha, 1995).

There is an urgent need in India to establish the magnitude of the problem risk estimate for chronic diseases and incorporate management/ precaution strategies within the existing health structure. In developed and developing countries, many projects have demonstrated that enhanced communication efforts can improve the health and well being of populations. Nutrition educators have many opportunities to enhance their work by using new technologies (Kolsa, 1995). Therefore, it was considered worthwhile to assess the impact of a Decision Support System on weight management and physical fitness.

METHODOLOGY

The Decision Support System (DSS) developed by Soni (2010) was used for assessing its impact on weight

management and physical fitness. A user friendly DSS was developed by the researchers based on the assessed needs of health centers working in the Udaipur City and after thoroughly reviewing literature. The DSS was having five main sections *viz.*, create profile, obesity, underweight, physical fitness and food exchange list. The developed DSS was providing facilities of creating profile, tracking meal and physical activity, suggesting nutritional and exercise requirements, menu planning, food diary and revision of meal and exercise plan.

Impact assessment of the DSS:

For assessing the impact of the developed DSS, 22 obese subjects were purposively selected and further divided in two groups, experimental group (12) and control group(10). Two subjects were selected extra in experimental group in case there was any drop out during the period of study. Experimental group was exposed to the DSS for one month. DSS was given to the experimental group in the form of CD and they were strictly asked to follow the DSS for one month.

Nutritional profile consisted of dietary intake, anthropometric measurements, body composition and physical fitness tests were assessed prior and after one month period. Dietary survey was done using 24 hours recall method. The mean intake of food and nutrients by the subjects were compared with the RDA and balanced diet suggested by ICMR, 1998.

Anthropometric measurements included height, weight, BMI, waist circumference, hip circumference and waist hip ratio measurements. Body composition consisted of measurement of per cent body fat, body fat mass, fat free mass and total body water. Tanita body composition analyzer was used to assess the body composition of selected subjects.

Physical fitness test included three minute step up test for assessing cardiorespiratory endurance, curl up test for assessing muscular endurance, the maximum bench press test for assessing muscular strength and sit and reach test for assessing flexibility of the subjects. Standard statistical techniques were applied to evaluate the effect of DSS on weight management and physical fitness of obese subjects.

OBSERVATIONS AND DISCUSSION

The findings of the study have as well as relevant discussion have been summarized under following heads:

Impact of DSS on anthropometric measurements:

Physical status revealed that the mean height of the male subjects was 169.27±1.25 cm and of females was 158.27±1.07 cm. Body weight ranged from 63.5 kg to 92.68 kg. The mean weight of males was 81.25±1.39 kg and of females was 70.68±1.97 kg. Waist circumference was 97.36±1.92 cm and 94.18±2.11 cm for males and females, respectively. On the basis of BMI, 81.81 % subjects were found to be obese (grade I) and 18.18 % were in obese grade II category, 63.63 % were in high risk zone according to waist hip measurement and 40.90 % were in overfat category.

After following DSS for one month, body weight (-2.02%), BMI (-3.32%), waist circumference (-5.07%),

Table 1: Impact of decision support system on mean anthropometric measurement of the subjects

Sr. No.	Parameters	Mean ± SE values		't' value a v/s b
		Before 0 day(a)	After 31 day (b)	
1.	**Experimental group (n=12)**			
	Weight (kg)	75.75±2.16	74.08±2.08	**12.98
	Height (m)	164±1.94	164±1.94	-
	BMI kg/m²	28.6±0.74	27.65±0.77	**4.94
	Waist circumference (cm)	94.91±2.20	89.5± 2.24	**12.47
	Hip circumference (cm)	107.16±1.02	105.25±1.25	**4.24
	Waist – Hip ratio	0.87±0.01	0.84± 0.01	**11.33
2	**Control group (n=10)**			
	Weight (kg)	76.21 ± 2.65	76.3±2.46	0.35 NS
	Height (m)	163.5 ± 2.27	163.5 ± 2.27	-
	BMI kg/m²	28.78±0.55	28.74± 0.61	0.50 NS
	Waist circumference (cm)	96.8±1.81	96.96±1.37	0.29 NS
	Hip circumference (cm)	105.2±0.799	105.09±0.012	0.333 NS
	Waist – Hip ratio	0.921±0.016	0.92± 0.012	0.142 NS

** indicates significance of value at P=0.05
NS- Non significant

hip circumference (-1.78%) and waist hip ratio (-3.44%) were reduced significantly (P<0.01) in the experimental group. Whereas no significant change was observed for control group (Table 1).

Similarly, significant difference in BMI was observed by the Stella *et al.* (2008), who concluded in their study that a combination of diet and exercise resulted in a significant decrease in body weight, BMI and body fat in obese (90 adult overweight women and men aged: 44.2 ± 7.2 years; BMI = 30.5 ± 2.7 kg/m^2) subjects, after six months diet and exercise intervention programme, but this decrease was not maintained at one year follow-up.

Impact of DSS on body composition:

The mean body fat per cent for males was 27.01±0.95 per cent and for females it was 36.91±1.22 % , which indicates that the subjects had higher body fat per cent than normal values (8-19% for males and 21 – 32 % for females). The mean total body water at the initial level for males was 43.11±0.68 kg and was 32.07 ± 0.55 kg for females indicating low body water values in females which could be due to the fact that as the fat increases in the body total body water decreases. At the end of the study significant (P<0.01) reduction was observed in the per cent body fat and total fat mass in the subjects of the experimental group after the completion of the study. There was 5.72 % reduction in body fat and 8.50 % reduction in total fat mass of the experimental group. On the other hand, total body water was increased significantly in experimental group with 4.68 % increment. While no significant change in body composition was observed in the control group (Table 2).

Impact of DSS on dietary intake:

Food and nutrient intake assessed by "24 hours recall method" revealed that diet of the obese when compared with intake suggested by ICMR, 1998 was found to be higher in fat, energy, calcium, vitamin A and vitamin C while intake of fibre, iron, protein, and B complex vitamins was found to be lower. It indicates that obese subjects were consuming more oil and ghee and sugars. But the inclusion of fruits, pulses and leafy vegetables was inadequate in both male and female. Effect of DSS on food and nutrient intake was when evaluated, it was found that the intake of pulses, fruits and green leafy vegetables increased significantly and intake of oil/ ghee and sugars reduced significantly in the experimental group after the programme. Among nutrients, intake of energy, fat and carbohydrates was found to be decreased significantly in experimental group, owing to their participation in the study and use of DSS. No significant improvement and reduction was observed in food and nutrient intake of control group except for pulses which was increased significantly after the completion of the study.

Impact of DSS on physical fitness:

Results of the physical fitness tests showed that cardiorespiratory endurance of 36.36 % subjects were categorized as very poor, 13.6 % as poor, 31.81 % as fair and only 13.46 and 4.5 % were categorized as good and excellent. No respondent reached to the level of superior. For the assessment of muscular endurance, curl up test was used. Subjects were asked to perform as many curl ups they could perform without stopping. Test results revealed that all the subjects except one (95.45 %) were falling under the category of very poor. Muscular strength was measured with the help of maximum bench press test. Repetition maximum was calculated for each subject. All the subjects were assessed as very poor in muscular strength test however men

Table 2 : Effect of decision support system on body composition

S. No.	Parameters	Mean ± SE values		't' value a v/s b
		Initial 0 day (a)	After 30th day (b)	
1.	**Experimental group (n = 12)**			
	Body fat %	31.591± 2.019	29.783±2.049	**17.25
	Body fat mass (kg)	23.83± 1.612	21.803± 1.611	**13.604
	Fat free mass (kg)	51.954±2.404	52.313± 2.415	*3.042
	Total body water (kg)	37.77±1.809	39.541± 1.919	**5.976
2.	**Control group (n = 10)**			
	Body fat %	32.41± 1.700	32.61± 1.798	0.454 NS
	Body fat mass (kg)	24.55± 1.215	24.61± 1.104	0.154 NS
	Fat free mass (kg)	51.66±2.644	51.69± 2.710	0.107 NS
	Total body water (kg)	37.37±1.898	37.43± 2.06	0.194 NS

* and ** indicate significance of values at P=0.05 and P=0.01, respectively.
NS= Non-significant

Table 3: Effect of decision support system on physical fitness

S. No.	Physical fitness test	Mean ± SE values		't' value a v/s b
	Experimental group			
1	3 minute step up test	Initial (a)	After (b)	
	15 Sec. pulse count	46.33 ±2.202	42.5±1.744	**6.132
	VO_2max (ml/kg/min)	33.07± 2.950	37.139±2.409	**3.182
2.	Curl up test			
	Maximum curl ups performed	22.83 ± 3.700	28.75±3.410	**6.413
3.	Maximum bench press test			
	1RM (kg)	23.166±1.488	23.5±1.519	0.804 NS
4.	Sit and reach test			
	Maximum distance covered (cm)	27.25±1.024	29.783±0.913	**12.416
	Control group			
1.	3 minute step up test			
	15 Sec. pulse count	41.7± 1.654	42.4±1.400	0.985 NS
	VO_2max (ml/kg/min)	37.53±2.26	36.43±1.481	0.932 NS
2.	Curl up test			
	Maximum No. of curl ups performed	18.2±1.397	17.7±1.578	1.470 NS
3.	Maximum bench press test			
	1 RM (kg)	23±1.820	23±1.820	0 NS
4.	Sit and reach test			
	Maximum distance covered (cm)	26.1±0.900	26±0.931	0.318 NS

* and ** indicate significance of values at P=0.05 and P=0.01, respectively.
NS- Non-significant, RM – Repetition maximum

showed better flexibility as compared to women when assessed with the help of sit and reach test.

Significant improvements were observed in various components of physical fitness including cardio respiratory endurance, muscular endurance and flexibility of the subjects of the experimental group after following the DSS for one month (Table 3). The 15 second pulse count during three minute step up test was reduced from 46.33 to 42.5 after the completion of the study. There was 8.23 % reduction in the pulse count which was statistically significant at both 0.05 and 0.01 per cent level of significance. The maximum volume of oxygen (VO_2 max) was increased from 33.07 to 37.13 in the experimental group after the completion of study. This was statistically significant at both 0.01 and 0.05 per cent level of significance. No significant reduction was observed in 15 second pulse count and VO_2 max of the control group.

The DSS was proved efficient in improving muscular endurance of the subjects of the experimental group after one month of use. The maximum number of curl ups performed by the subjects was increased from 22.83 to 28.75 at the end of the study in the experimental group. This increase was 25 %. Mean values of curl up test of control group remained static.

Besides these above mentioned tests, flexibility test also underwent significant change after the use of DSS in experimental group. Experimental group included stretching exercises in their exercise programme which resulted in significant improvement in terms of maximum distance that the subjects could cover during the sit and reach test after the completion of the study. The mean value increased from 27.25 cm to 29.78 cm which was 9.25 %, whereas control group did not endure any such change.

The muscular strength of the subjects of both the groups did not undergo any significant change. The repetition maximum value remained almost static for both experimental and control groups, may be because of short duration of the study (Table 3).

These results are in agreement with the findings of Himeno *et al.* (2001) who implemented a weight reduction programme to improve cardio-vascular functioning in obese subjects. A combination of aerobic exercises and mild hypo-caloric diet resulted in significant reduction in weight and improvement in dyslipidemia and exercise performance.

The findings of the present study are in harmony with the results of Missier *et al.* (2004). There was also found significant improvement in 6 minute walk distance ($p<0.05$), stair climb time ($p<0.05$) and knee pain ($p<0.05$) in a group of 116 obese subjects (aged 60 year or older) after following modest weight loss plus moderate exercise

program for 18 months compared with diet only and exercise only group. The combination of modest weight loss plus moderate exercise provides better overall improvements in performance measures of mobility in older overweight and obese adults with knee osteoarthritis compared with either intervention alone.

Conclusion:

The results of the study clearly bring out the fact that increasing sedentary lifestyle and faulty dietary habits are the major cause for obesity among adult population. The increasing knowledge and use of DSS resulted in loss of weight and improvement in physical fitness. The improvement in physical fitness and in body composition and decrease in weight after the use of DSS stressed the need for sound counseling method where computers can be made use of to impart it effectively.

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REFERENCES

Flegal, K., Gail, M. and Williamson, D. (2004). Both obesity and underweight linked to excess deaths. *American J. Medical Assoc.,* **20** : 741 – 748.

Himeno, E., Nishino, K., Nanri, H., Okazahi, T. and Komastu, T. (2001). Evaluation of the effect of exercise and mild hypocaloric diet on cardio vascular risk factors in obese subjects. *J. Occupational & Environmental Health,* **23** : 1 – 12.

ICMR (1998). Nutrient requirement and recommended dietary allowances for Indians. An expert group of ICMR, NIN, Hyderbad, 66 pp.

Kolsa, K. (1995). New development of computer mediated technology in nutrition education. *J. American Medical Assoc.,* **49**:322-327.

Magheshwari, U. and Sunitha, V. (1995). Development of a software and its impact on weight reduction. *Indian J. Nutrition & Dietetics,* **32**: 238-241.

Mahan, L.K. and Escott-stump, S. (2000). *Krause's foods nutrition and diet therapy*. Elsevier Publishers, USA.

Missier, S.P., Locser, R.F., Miller, G.D., Morgan, T.M., Rajeski, W.J., Sevick, M.A., Eittnger, W.H., Pahor, M. and Willamson, J.D. (2004). Exercise and dietary weight loss in overweight and obese adults with knee osteoarthritis. *Arthritis & Rheumatism*, **50**: 1501- 1510.

NIN (1998). *Dietary guidelines for Indians.* A manual, National Institution of Nutrition, ICMR, Hyderabad.

Soni, R. (2010). Development and impact assessment of a Decision Support System on weight management and physical fitness. Ph.D. Thesis, Maharana Pratap University of Agriculture and Technology, UDAIPUR, RAJASTHAN (India).

Stella, L.V., Kobusingye, H., Baslur, S. and Stanek, E. (2008). Effect of diet and exercise on body composition, energy intake and leptin levels in overweight women and men. *J. American College of Nutrition*, **27**: 195-208.

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