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Development of A Mobile Phone Application and its Efficacy Assessment Concerning the Changes in Anthropometric Measurements, and Dietary and Nutrient Adequacy of Hundred Obese Females of Udaipur City Rajasthan

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A B S T R A C T

The present study was conducted to administer overweight and obesity by suggesting various nutritional and lifestyle intervention programs through planning, designing, and formulating mobile-based Mhealth technique. The study intended to assess the efficacy of the designed health mobile application in bringing out the various dietary and nutritional modifications in the lives of those who are at the risk of overweight and its related major health issues. To accomplish the above objective hundred obese women residing in Udaipur city were selected and studied. Mobile application was then developed by gathering authentic nutritional pieces of information from different sources, books, internet, journals. Application was then installed in the smart phones of the respondents' testing of anthropometric measurements like height, weight, BMI, WHR along with dietary and nutrient adequacy was assessed on 0 day the mean height was 164.74 ± 4.89 cm, the mean weight was 72.9 ±14.92 kg, and the mean BMI was 28.23 ±2.36 kg/m^2, and the mean WHR was 0.86 ± 0.07cm.Again, post assessment of Anthropometric measurement as well as dietary and nutrient adequacy was recorded on, 90, 120, 150, 180 and changes occurred was observed. It was observed that the mean height remained constant. Whereas there was a change in mean weight, bmi, where, it was evident from the data of dietary and nutrient assessment. It was considerably deficient in green leafy vegetables, other vegetables, and fruits. Cereals, pulses, milk and milk products, sugar, and fat, on the other hand, were substantially higher in consumption as compared to balanced diets. Also, the female respondents' diet was substantially deficient in the following nutrients: vitamin A, vitamin C, and iron. On the other hand, the diet was high in energy, protein, carbohydrates, fats, calcium. Significant improvements were observed in the post-assessment, with reduced intake of sugar, fats, and oil, and increased intake of roots, green leafy vegetables, other vegetables, fruits, and pulses.

Introduction

Obesity is a condition with excessive fat accumulation in the body to the extent that the health and wellbeing of the individual is adversely affected. It is an abnormal growth of adipose tissue due to enlargement of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or a combination of both (Park & Park 2002). It is a serious ailment that threatens global wellbeing (WHO Technical Report Series 2015). It has been described as the 'New World Syndrome' which creates an enormous socio-economic and public burden. The incidence of obesity is escalating at an alarming rate. Over the past decade, levels have increased at the global level on an average between 10-40 % globally over 1 billion people are overweight, including 805 million women, and among them over 300 million people are obese (WHO global report 2015). Overweight and obesity are emerging health problems in India. According to National health problems in India -3 (NFHS-3), thirteen percent of women (15-49) and nine percent of adults were overweight or obese in 2005-2006 and its prevalence was higher in urban areas as compared to rural areas. The prevalence is more profound in the women of age between 40–49 years (23.7%), residing in cities (23.5%), having high qualification (23.8%), belonging to the Sikh community (31.6%), and households in the highest wealth quintile (30.5%). The highest percentage of obese women is found in Punjab (29.9%).

The NFHS-4 survey 2015-2016 highlights that the urban population is more prone to obesity as compared to their rural counterparts. In Andhra Pradesh, 44.4 percent of urban men suffered from obesity, while the percentage in rural parts was 28 percent. Similarly, 45.6 percent of the urban women in the state were obese against the 27.6 percent of women in rural Andhra Pradesh.

Materials and Methods

Purposive sampling technique was used for sample selection. One fifty to one sixty women ranging between 20-40 years of age had been screened for baseline survey and inclusion in the study. Their weight, height was also recorded and BMI was calculated. Based on the BMI range i.e.(25->30) hundred women of 20-40 years had been selected for the study. A structured Performa was developed keeping in sight the information to be collected from the study sample regarding their pertaining obesity and lifestyle pattern and dietary habits and nutrition intake. The particulars of the age, sex, family history, past medical history, personal habits (alcohol, smoking, drugs, tobacco), food habits, height, weight, body mass index, were collected for pre-investigation of the study. Exhaustive literary study from books, journals, the internet was carried on obesity-related information to design the mobile application. Data were then converted into Power Point presentations and then converted into the mobile application which was then tested for post-intervention on the selected subjects in the interval period of 30 days starting from 0-day, 90 days, 120 days, 150 days, 180-day, Post assessment and efficacy concerning selected markers was recorded on 180 days.

Results and Discussion

All respondent selected were laying in the age group of 20 to 40 years of age, and free from medical complications like hypertension, PCOS, cancer, diabetes, depression, lactation, and pregnancy. Out of 100 respondents, majority of them were married (55%), rest (40%) were unmarried and only a few (2%)and (3%)were Divorce and widow. Majority of the respondents i.e (40%) were postgraduate (35%) were graduates and the rest (25%) completed higher education only. It is evident from the data that (30%) were from

upper class (20%) and (20%)were from the upper-middle class and middle class simultaneously whereas (15%) and (15%)were from lower-middle and lower class respectively also no one was from B.P.L class. Changes in anthropometry were also recorded on 0 day.

Anthropometric measurements of female respondents assessed on 0 day

The height of an individual may vary depending upon his/her genes various environmental factors, consumption of food and the right amount of nutrients. The mean height of the respondents remained constant and it was observed in pre-investigation the mean height of the respondents were161.21± 4.65cm. Weigh tone of the important anthropometric measures to analyze the major body constituents like fat, fat-free mass, extracellular mass, and intracellular fluid.etc. Overall weight of the respondents on 0 day was 72.91±4.92 kg. Body mass index is a direct co-relation of body weight to its height it is commonly classified according to WHO IOTF standards. The mean BMI of the respondents on 0 day was 28.23±2.36 kg /m^2.The Waist-to-hip Ratio (WHR) identifies the proportion of fat stored on one's body around the waist and hip. The mean WHR on0 day it was 0.86±0.07cm.

Cereals are a major part of the Indian diet. They are the major source of energy and several other nutrients. On 0 day the mean Mean± SD is 194.66±44.38, and the Percentage was 71.85%. If we talk about the pulse consumption the suggestion for pulse consumption according to RDI is 60g/d. The mean intake of pulse consumed by the respondents on 0 day was 45.98±20.88. was 75% of R.D.A. Milk is an excellent source of protein, providing calcium and riboflavin. It was noted that the mean intake of milk and milk products on 0 day was 238.80±12.43 which was 79.6% of the diet. Observation of data reveals the mean intake of roots and tubers on 0 day was 113.52±83.62 which was 56.76% of the diet. Green leafy vegetables are loaded with iron, calcium, vitamin C, β-carotene, folic acid, riboflavin. Observation of data reveals the mean intake of green leafy vegetable on 0 day was 35.89±36.14 which was 15.84%. Other vegetables are those vegetables which are neither green leafy vegetable nor roots or tubers the mean intake of other vegetables on 0 day was 27.45± 21.70 which was 27% of diet. Fruits contain fiber and pectin. On 0 day the mean intake of fruits was 30.08 ±25.04 which was 30.08% of diet. As Sugar is an important ingredient of day-to-day life is consumed by almost everyone in some of the other forms. On 0 day it was visible that the mean intake of sugar was 17.10±4.4 which was 85.5% of diet. Fats are an excellent source of essential fatty acids. But excess fat intake often causes obesity on 0 day the mean intake was 25.66±5.04 which was 128.3% of diet. A non-vegetarian diet which primarily includes meat, fish, eggs, and dairy food is a good source of protein. Vitamin B 12, and iron. On 0 day it was 1.6±6.48 which was 2.6 % of diet.

Post Assessment of anthropometric measurements and dietary adequacy of 100 female respondents on 90, 120, 150, 180, day to check the efficacy of the developed mobile application.

The mean height of the respondents remained constant and it was observed as earlier as in pre-investigation i.e.161.21± 4.65cm. Talking about the weight. A visible difference in weight was clearly observed on 90, 120, 150- and 180-dayie on 90 day it was 71.17 ± 4.91 kg on 120 it was 71.15± 4.90kg and on 150 and 180 day it was 71.13 ± 4.88 kg and 70.88±4.91 kg simultaneously. Difference in BMI was also clearly observed on 90 day it was 27.13 ±1.74 kg /m^2 on 120 it was 27.11 ±1.73kg /m^2 and on 150 and 180 day it was 27.9 ±1.72 kg /m^2 and27.18±1.74kg /m^2.

Simultaneously a marked difference in the WHR was also clearly evident. On 90 day it was 0.84 ± 0.06cm on 120 day it was 0.82 ±0.05cm and on 150 and 180 day it was 0.80±0.03cm and 0.80±0.03cm simultaneously. The study was in line with the study of Binu and Rajendra, (2014) where they studied the prevalence of overweight and obesity and its influencing factors among rural geriatric population in Kerala stated the findings as total number of 89 subjects who were aged 60 years and above were screened for their height, weight and thus body mass index were calculated. Out of 89 subjects, 55 (62%) were women and 34 (38%) were men. Mean age of the population was 66 years. Average age of males was found to be 67 years and that of females is 65 years. The study reveals prevalence of geriatric overweight / obesity to be 54%.It was observed that 47% of males and 58% of females were overweight and obese.

Post assessment and Changes in dietary adequacy of the female respondents with respect to developed mobile phone application on 90, 120, 150, 180 day. Diet is a major determinant of the health and nutritional status of people. The dietary habits may vary according to socio-economic factors, regional customs, and traditions. One such technique of 24 recall method for three days was used to find out their dietary adequacy which was then computed as expressed as a percentage of balance diet (NIN 2020). Dietary adequacy of cereals, pulses, milk and milk products, roots and tubers, green leafy vegetables, fruits, fats and oils, meat and meat products, sugar was assessed on 0, 90, 120, 150, 180 day.

Post observation of dietary adequacy of hundred female respondents it was very well observed that the dietary adequacy of the female respondents saw a major change on 90, 120, 150, 180 day. This clearly signifies that the application thus developed created a positive impact on their dietary habits.

Cereals

Cereals are a major part of the Indian diet. They are the major source of energy and several other nutrients. These are the cheapest accessible resource of nutrients, predominantly in developing countries.90th day which was 169.83±17.1i.e 69.2% of the diet, Similarly the mean intake of cereals on 120thday was 166.86±32.89which was 61.8% of the diet, the mean intake reported on 150th day reported was 173.86±20.38 which was64.39% of the diet and on 180th day the mean intake was 175.5±21.9 Which was 65% of the diet.

Pulses

On 90th day which was 41.81±9.51 i.e 69.68% of the diet, Similarly the mean intake of cereals on 120 was 40.20±10.32 which was 67% of the diet, the mean intake reported on 150th day reported was 40.15±10.92 which was 66.91% of the diet and on 180th day the mean intake was 30.48±9.38 Which was 50.8% of the diet

Milk and milk products

On 90th day which was 232.08±24.35 i.e 77.36% of the diet, Similarly the mean intake of milk products on 120thDaywas 219.51±43.86 which was 67% of the diet, the mean intake reported on 150th day was 217.87±27.11which was 72.62% of the diet and on 180th day the mean intake was 217.87±27.11 which was 72.62% of the diet.

Roots and tubers

On 90th day was 30.20±25.98 i.e., 11.80% of the diet, Similarly the mean intake of roots on 120th Day was 30.20±25.98 which was 15% of the diet, the mean intake reported on 150th day was 26.16±18.84 which was 13.08% of the diet and on 180th day the mean intake was 28.51±23.29.which was14.25% of the diet.

Green leafy vegetables (GLVs)

90th day green leafy vegetable was 65.45±66.52 i.e., 65.45% of the diet, Similarly the mean intake of roots on 120thDaywas 66.29±63.31 which was 66.29% of the diet, the mean intake reported on 150th day was 65.79±66.71 which was 65.79% of the diet and on 180th day the mean intake was 68.48±71.03. Which was 68.48% of the diet.

Other Vegetable

On 90th day other vegetable was 127.96±92.68 i.e.63.98% of the diet, Similarly the mean intake of other vegetables on 120thDaywas 128.15±77.10 which was 64.07% of the diet, the mean intake reported on 150th day was 124.63±92.12 which was 62.31% of the diet and on 180th day the mean intake was 126.96±94.56. which was 63.48% of the diet.

Fruits

Fruits are normally a high-quality source of vitamin C. Also, they offer β carotene energy and iron. Fruits also contain fiber and pectin, which helps in relieving constipation. On 90th day the mean fruit intake was 69.33±35.82 i.e.63.98% of the diet, Similarly the mean intake of fruits on 120thDaywas 128.15±77.10 which was 64.07% of the diet, the mean intake reported on 150th day was 124.63±92.12 which was 62.31% of the diet and on 180th day the mean intake was 126.96±94.56. which was 63.48% of the diet.

Sugar

As Sugar is an important ingredient of day-to-day life is consumed by almost everyone in some of the other forms be it beverages, or chocolates, sugar-based confectionaries.

On 90th day was 7.06±2.18 i.e., 35.3% of the diet, Similarly the mean intake of sugar on 120th Day was 6.9±2.06 which was 34.5% of the diet, the mean intake reported on 150th day was 7.8±2.9 which was 39% of the diet and on 180th day the mean intake was 7.9±2.9, which was 39.5% of the diet.

Table.1 Anthropometric measurements of the 100 female respondents on 0 day

(N=100)

S. No.	0 Day
Height (cm)	161.21± 4.65cm
Weight (kg)	72.91±4.92 kg
BMI (kg/m^2)	28.23±2.36 kg /m^2
WHR(cm)	0.86±0.07cm

Table.2 Mean anthropometric assessment of female respondents on 90, 120, 150, 180 day

(N=100)

S. No	90	120	150	180
Height	161. 21± 4. 65cm	161. 21± 4. 65cm	161. 21± 4. 65 cm	161. 21± 4. 65 cm
Weight	71. 17 ± 4. 91 kg	71. 15 ± 4. 90 kg	71. 13 ± 4. 88 kg	70. 88±4. 91 kg
BMI	27. 13 ± 1. 74 kg /m^2	27. 11 ± 1. 73 kg /m^2	27. 9 ± 1. 72 kg /m^2	27. 18±1. 74kg /m^2
WHR	0. 84 ± 0. 06cm	0. 82 ± 0. 05cm	0. 80 ± 0. 03cm	0. 82±0. 06cm

Values arein Mean±SD

Table.3 Mean dietary adequacy assessment of female respondents on 90, 120, 150, 180 day (N=100)

S no.	Food Product	RDI gm	90 day	120 day	150 day	180 day
1	**Cereal**	270gm				
	Mean± SD		169.83±17.1	166.86±32.89	173.86±20.38	175.5±21.9
	Percentage		69.2%	61.8%	64.39%	65%
2	**Pulses**	60gm				
	Mean± SD		41.81±9.51	40.20±10.32	40.15±10.92	30.48±9.38
	Percentage		69.68%	67%	66.91%	50.8%
3	**Milk &Milk**	300ml				
	Mean± SD		232.08±24.35	219.51±43.86	217.87±27.11	217.87±27.11
	Percentage		77.36%	73%	72.62%	72.62%
4	**Roots & Tuber**	200gm				
	Mean± SD		23.61±18.07	30.20±25.98	26.16±18.84	28.51±23.29
	Percentage		11.80%	15%	13.08%	14.25%
5	**Green leafy Vegetables**	100gm				
	Mean± SD		65.45±66.52	66.29±63.31	65.79±66.71	68.48±71.03
	percentage		65.45%	66.29%	65.79%	68.48%
6	**Other Vegetable**	200gm				
	Mean± SD		127.96±92.68	128.15±77.10	124.63±92.12	126.96±94.56
	Percentage		63.98%	64.07%	62.31%	63.48%
7	**Fruits**	100gm				
	Mean± SD		69.33±35.82	74.66±37.86	68.41±35.12	69.41±35.41
	Percentage		69.33%	74%	68.41%	69.41%
8	**Sugar**	20gm				
	Mean± SD		7.06±2.18	6.9±2.06	7.8±2.9	7.9±2.9
	Percentage		35.3%	34.5%	39%	39.5%
9	**Fats &Oils**	20gm				
	Mean± SD		4.40±1.04	4.4±1.04	4.8±1.43	5.0±1.4
	Percentage		22%	22%	24%	25%
10	**Meat products**	60gm				
	Mean± SD		6.5±16.39	8.0±17.32	7.5±12.83	9.8±16.08
	Percentage		10.8%	13.3%	12.5 %	16.33%

Values are in Mean ± SD

RDA - Recommended Dietary Allowances, ICMR-2020

Fats and oils

Visible fats in the form of hydrogenated fat, oil, ghee is an essential part of a regular Indian diet. Fats are an excellent source of essential fatty acids. Intake of fats and oils on 90th day was 4.40±1.04 i.e.22% of the diet, Similarly the mean intake of fats on 120th Day was 4.4±1.04 which was 22% of the diet, the mean intake reported on 150th day was 4.8±1.43 which was 24% of the diet and on 180th day the mean intake was, 5.0±1.4 which was 25% of the diet.

Meat products

A non-vegetarian diet which primarily includes meat, fish, eggs, and dairy food is a good source of protein. Vitamin B 12 and iron. The mean intake of meat on 90th day was 6.5±16.39 i.e., 10.8% of the diet, Similarly the mean intake of meat on 120th Day was 8.0±17.32 which was 13.3%of the diet, the mean intake reported on 150th day was 7.5±12.83 which was 12.5 % of the diet and on 180th day the mean intake was, 9.8±16.08 which was 16.33% of the diet.

The developed application brought a significant change in the lives of the female respondents. It was evident from the above results that the mean consumption of foods like cereals, pulses, sugar, fat and oils, and milk as well as roots and tubers was high on 0 day as compared to 90, 120, 150, 180, and the intake of fruits, vegetables, and other vegetables was very low on 0 day which drastically got increased on 90, 120, 150, 180 days due to increase in consumption of these food products. The study was in line with the study of Singh *et al.,* (2010) where they studied the intervention for weight reduction among selected overweight obese women in an urban community of Varanasi studied overweight and obese women in the age group 20 to 49 years. Out of 619 eligible women screened in the community, 215 had BMI ≥ 25 from 215 cases, 33 highly motivated women with an arbitrary cut off BMI of more than 28 were selected for an intervention programme to reduce their weight by enhancing their physical activities and modification in their dietary habits for three months after initiation of weight reduction programme, the average reduction in weight was 3.42 ±3.2 kg and it was statistically significant if compared to their baseline weight.

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