APPS FOR WEIGHT LOSS AND WOMEN'S HEALTH: EVALUATION AND IDENTIFICATION OF GAPS

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Abstract : Smartphone usage has increased over the past few years. Along with improving the mode of communication, it also has various features which have advance its users. Due to this advancement, mobile health or mhealth was discovered which eventually become a way to bridge the gap of communication between health practitioners and the general population. It has become a source of information as well as education for its users. Obesity is increasing worldwide and the field of healthcare is advancing towards controlling it. Along with obesity, issues relating to women's health like fertility problems, pregnancy as well as postpartum care is also on a rise. Mhealth has a major contribution to spreading awareness about obesity and women's health problems among the general population as well as encouraging them to adopt a healthy lifestyle. This study aimed at identifying and evaluating the health apps for weight loss and women's health on the Apple App Store and Google Play Store. A sample size of sixty was considered of which thirty apps were underweight loss category and thirty apps were under the category of women's health. The features, gaps, and user-ratings of these apps were listed and intensively reviewed. The collected data showed that there were numerous gaps present in these health apps which made it less user-friendly. Also, the presence of certain features in the app received high ratings by its users and the absence of those features made the app receive low ratings by its users. Several applications can be taken from this study in order to improve future mobile health applications.

IndexTerms – **Apps, weight loss, women's health, ratings.**

I. INTRODUCTION

1.1 Use of smartphones

The development of smartphones has caused users to shift from computers to mobile phones for several purposes because the latter have user friendly and emerging features and facilities incorporated in them. Smartphones are regarded as mini computers with the feature of accessing different applications according to people's needs. (Godwin-jones et al., 2011).

There has been a shift in the usage of smartphones from regular mobile phones. Mobile phones have helped people to become technologically advanced enough to use smartphones for innumerable functions from playing games to consulting the doctor. Ozaldga et al., (2012) have reported that about 85% of medical practitioners use smartphones for their professional work. A study conducted in the United States showed that 85% of the adult population owned a mobile, with 56% being smartphone users (Fox et al., 2013).

Smart phones have been reported to help improve the diagnosis of cardiovascular disease by five-fold according to a study done at University of Edinburgh. Smartphones have the advantages of faster communication and rapid access to information, which is useful to clinical practitioners and has an impact on the modern clinical practice. (Hogan et al., 2012)

1.2 Mhealth

Due to emergence of smartphones, mhealth has been introduced. This can play a role in the lives and health of the people, by improving the communication between the medical practitioners and the general population. (Zapata et al., 2015)

Use of mhealth or mobile health has increase as a source of healthcare services and information as well as for education and consultations. It has been reported that the number of health apps are increasing and actively being used by people for numerous activities ranging from scheduling an appointment with the doctor to using it as a self-monitoring device. The available apps are consumer friendly and motivate patients to manage their disease conditions. However, there is still a gap, when advanced apps related to complex patient activities are considered. (Ramachandran et al., 2014)

Mhealth has influenced ways of measuring clinical outcomes and efficacy for patients. In a study done across rural areas of Uganda by the University of Bergen, Norway, information about breastfeeding and child anthropometry were collected. It was reported that through the use of this technology, there was improved data collection, reduced data entry error and also it was cost effective and readily accepted by the users. Mhealth could be useful in a task as simple as to remind the patients to consume their medications by a text message or a SMS. (Wave et al., 2012)

1.3 Use of smartphone applications

Ventola et al., (2014) reported that 70% of health care professionals and medical students used at least one app regularly and 50% had a favourite app which they used daily. By 2008, Apple launched its app store which enabled iPhone and iPad users to access varieties of app from it. Similar to the app store another online store was launched by Google called Play Store which had similar apps that can be downloaded by the users on their android phones.

Choo et al., (2015) reported that there were more than 97,000 apps listed on 62 app stores in the year 2013. A number of disease-specific and population-specific apps are available as well, which help in managing chronic diseases, providing consultations with respective health professionals. Nutrition and diet-related apps have also been reported to be beneficial as they allows people to maintain a health diary or know more about the macro and micro nutrients or ill effects of various habits on the body etc.(Boulos et al. 2014)

1.4 Prevalence of obesity

Obesity has become a global issue as it has increased greatly over the past several decades. In a study conducted among US citizens, it was reported that there was significant increase in the number of overweight and obese children and adults (Ogden et al., 2014). An Indian study that aimed to estimate the prevalence of obesity reported that there were 18.2% and around 23.9% of overweight and obese individuals by International Obesity Task Force (IOTF) classifications and WHO classifications respectively (Khadilkar et al., 2010). The number of overweight and obese individuals is increasing to a point that the percentage of obese men and women has almost doubled since 1980. (Mateo et al., 2015)

Obesity needs to be tackled and it is not just the duty of health care professionals but also the patients to actively take part in reducing the world-wide problem. It is important to introduce the concept of healthy behaviour to the people and to motivate them to resort to dietary modifications rather than surgical interventions. (Noel et al., 2002)

1.5 Use of weight loss applications

The need for weight loss health applications has increased in order to make people conscious about their health and to motivate them to indulge in physical activity, monitor their food habits and consult appropriate clinical practitioners. The use of health apps for these purposes have increased and smart phone users tend to have these apps downloaded. Carroll et al., (2017) reported that out of 2392 smart phone users, 816 were accessing health apps on their phones in the United States.

Weight loss apps have specially gained popularity due to the increase in the worldwide prevalence of obesity. Mateo et al., (2015) reported that use of health apps for weight loss as compared with other controlled intervention resulted in reduction in body weight by 1.04 kg, body mass index (BMI) by 0.43 kg/m^2, and non-significantly increased physical activity by a standardized mean difference (SMD) of 0.40.

1.6 Barriers present in using weight loss apps

Although these health applications are improving the quality of life of people, there are a number of barriers in these apps for users to apply the directions for the weight loss program. For example, they may be lacking behavioural interventions which are required to improve motivation, reduce stress as well as assist in problem solving of the users. (Pagoto et al., 2013)

With the alarming rise in obesity, there is a need for appropriate weight loss apps in the market. Few studies have been carried out to assess the quality of the available weight loss apps. The recommendations required to improve the quality of these apps are also lacking. A systematic analysis of weight loss apps available on smartphones and iPad in Australia revealed that there were 54 good quality apps. There was also shortage of complete scientific accuracy of measurements and nutritional content linked to evidence-based guidelines recommendation like BMI and estimated energy requirements. (Chen et al., 2015)

1.7 Use of women's health applications

A study carried out on English and Spanish speaking pregnant and postpartum women reported that they use technology to gain information on health. 72.3% women had health apps downloaded in their phones and were actively using them and 26.9% were paying for these applications. (Osma et al., 2015). Pregnant women have been using mobile phone apps for information on pregnancy and growth of the foetus. These apps are offered by the two major application stores., Apple App Store and Google Play Store. (Thomas et al., 2015)

1.8 Rationale for the study

Prevalence of obesity is increasing worldwide. It is important to prevent this global challenge by educating the population on the need for maintaining healthy practices and weight loss. Weight loss apps have proven to be beneficial in this respect. to its users. It has shown results as these apps are making people conscious about their eating habits. They are also providing facilities like food databases to calculate the calorie intake and prescribing exercise regime. The barriers or the gaps in these apps have not been evaluated with appropriate recommendations to overcome them.

Moreover, there is significant improvement in treatment options available to women regarding problems like infertility, menstrual disturbances and irregularities. Postpartum care has also improved to a greater extent through apps. Numerous apps are available for tracking fertility and also providing information regarding obstetric and postpartum care, but there is lack of studies conducted in this field as well.

Thus, research related to the barriers or gaps in the available apps is lacking. The present study aimed at providing data about the barriers present in weight loss and women's health apps which can be used by app developers in order to develop user friendly apps.

RESEARCH METHODOLOGY

Smartphone discovery has impacted the lives of people as it has similar features to the computer and enhanced networking. Smartphones are being used as a device for providing health information. Due to the discovery of apps, there is improved self-monitoring and motivation for the patients. These health apps provide a range of benefits which in turn can help improve the health and quality of life of people. However, there may be barriers in the available mobile applications providing health information. Research in the areas identifying the barriers or gaps in these applications providing health information is limited. The present study was aimed at providing data about the information, features, usage details and barriers or gaps present in selected currently available weight loss and women's health apps in order to develop better user-friendly apps.

Aim- To evaluate selected apps available on weight loss and women's health on the Apple App Store and Google Play Store on a smartphone and to identify gaps in the existing apps

Objectives-

- To identify the weight loss and Women's health apps available on Google Play Store and Apple App Store (free and chargeable).
- To review and evaluate weight loss and Women's health apps for their features, content, clientele, merits, and limitations.

• To assess the ratings of these health apps.

2.1 Study Design:

2.1.1 Study Type- The study is a qualitative study.

2.1.2 Sample size and selection- Apps on weight loss including dietary and exercise-related apps as well as women's health apps related to issues like fertility tracking, pregnancy and post pregnancy were located and downloaded from Google play store and Apple App store in India between January 2019 and February 2019. A lot of apps related to weight loss were identified. There were apps related to women's health.

Apps having ratings from zero to five were randomly selected out of approximately a thousand applications. Weight loss apps were selected based on the presence of features like dietary information and exercise regime. Women's health apps were selected based on information related to fertility, menstrual disturbances, obstetric and postpartum care.

A total of sixty apps was selected for review and consisted of two groups of thirty apps under the weight loss category and thirty apps under women's health category, respectively.

The criteria used for selection of apps were:

2.1.3 Inclusion criteria-

• Smartphone health applications specific to weight loss and women's health were included.
• Apps with ratings from zero to five were included.
• Weight loss apps with dietary and exercise regime were included.
• Women's health apps like fertility tracking apps, pregnancy, and postpartum care apps were included.
• Both Indian and international applications were included.

2.2 Tools for data collection:

Data were collected using the search bar of the Apple App Store and Google Play Store. Keywords like weight loss apps, workout apps, fertility apps, pregnancy apps, post-pregnancy apps, nutrition apps for weight loss and women's health were used to identify the number of applications that were displayed. Smartphone applications under the category of health and fitness were selected depending on the inclusion criteria of the study. The selected apps were downloaded on a smartphone and thoroughly reviewed for their features. These apps were then listed in a tabular form for details about the name, developer/owner, parameters asked, features, gaps, and ratings of the mobile health applications.

2.3 Analysis of data:

The data collated was analysed for the features and gaps present. First, the features of the weight loss and women's health apps were tabulated for information about the presence of same or similar features in all the apps selected for the study. Secondly, the gaps present in these health applications were tabulated similarly to that of the features of the apps. Also, from the literature review and features not present were considered as barriers or gaps. This gave data about the nearness of similar gaps present in various applications. In this manner, it gave the accurate number of applications which had a specific gap in them. These health apps were rated by its users on the Apple App Store and Google Play Store. The apps used in the study were analysed for their ratings by the users. These ratings were tabulated and the number of apps having similar ratings were grouped together.

I.   **RESULTS AND DISCUSSION**

The present study identified and evaluated sixty health application on a smartphone. These applications were downloaded from the Apple App Store and Google Play Store. They were divided into two categories, thirty apps under the weight loss category and thirty apps under women's health category. All these apps were reviewed for their features and gaps present.

3.1 Features in weight loss apps:

TABLE NO. 3.1.1: FEATURES OF WEIGHT LOSS APPS

FEATURES	NUMBER OF APPLICATIONS
Diet plans and recipes	8
Health tracker	4
Exercise regime	2
Both Diet information and exercise regime	2
Inspirational quotes	1
Progress chart and anthropometry	3
Progress chart, anthropometry and health tracker	1
Diet information, exercise regime and anthropometry	1
Diet plans, recipes and progress chart	1
Health tracker and anthropometry	2
Diet information, exercise regime and progress chart	1
Diet plans, recipes and anthropometry	1
Diet information, exercise regime, progress chart and anthropometry	1
Diet information, exercise regime and tracker	1
Diet information, exercise regime, tracker, anthropometry and coach	1

Table no. 3.1.1 shows that, out of the total 30 weight loss applications, 8 apps provided only diet plans and recipes. Out of these eight apps, two apps provided a 7-day diet plan, one app provided day wise diet, list of foods to eat and foods to avoid, diet recipes were given. one app provided with frequently asked questions (FAQ) of weight loss diet and healthy recipes, one app provided with healthy recipes, one app provided daily diet with meals, recipes meal timings, meal choices for vegetarians and non-vegetarians separately. Advantage of the diet was also explained. one app provided detailed recipes with dos, don'ts, ingredients, equipment and methods. Both vegetarian as well as non-vegetarian recipes for all types of meals i.e. breakfast, lunch, dinner, desserts were mentioned in the app. Another app provided the benefits of healthy eating.

Four apps had the feature of tracking health information and maintaining a diet diary, out of the four apps with the feature of tracking health information, one app tracked the water intake, one app could track the meals eaten during the day along with exercise and sleep, one app tracked the intake of calories, water, vitamins along with activity performed and one app was able to track intake of food.

Two apps provided only exercise regime of these two apps providing exercise regime, one app offered exercise plans for different parts of body along with trainer led videos and one app also offered exercise plans for different parts of body with additional feature of beginner,

intermediate and advanced level exercise options available. Two apps provided both diet information and exercise regime, one app offered exercise plans for different parts of body with options of easy, medium, hard and very hard work out plans along with healthy meal recipes and one app provided weight loss yoga asanas with the benefits as well as the cautions, list of foods beneficial for weight loss along with individual benefits, home remedies for weight loss, weight loss exercises, general weight loss tips and a list of different kinds of weight loss diet plans.

One app focused on motivating the people for weight loss and had inspirational quotes. Three apps had the feature of progress chart and adding anthropometry, one out of the three apps provided evaluation/feedback, coach, trophies/rewards, FAQ and a progress chart. One app calculates BMI, provided a progress chart, daily log with progress information and a summary of the weight loss journey till date. One app Suggested goal weight according to the height, Provided a progress chart and calculated BMI.

Another app had the additional feature of health tracker with progress chart and anthropometry, it provided a diet diary, daily statistics, progress charts and analysed Body Mass Index (BMI) and Basal Metabolic Rate (BMR). One app had three features of diet plans, exercise regime, and anthropometry, it provided a weight loss diet with exercise regime, detox diet, weight loss tips, fat burning foods, weekly meal plan and a BMI calculator.

One app out of thirty had the feature of diet plans, recipes and progress chart, it provided a progress chart and recipes for the recommended meals. Two apps provided health tracker and anthropometry, one app along with tracking the daily intake, it calculated BMI, body fat %, recommended calories required per day and was available in many languages. One app calculated BMI, recorded progress and was available in English as well as Japanese languages.

Diet information, exercise regime and progress chart were provided by one app, it provided detailed diet plan with meal timings, a shopping list for the week for which the diet plan is given in order for complete compliance to the diet, detailed day to day exercise regime, tracked progress towards weight loss and a photo comparison as well as a health calculator. The combination of diet information, exercise regime, progress chart, and anthropometry were present in one app, it provided calorie needed according to weight and height, different workout plans, yoga poses beneficial for weight loss, charts regarding BMI, fat % and weight, detailed 7-day diet plan, detailed information about micro nutrients beneficial for weight loss and information about 10 foods helpful in reducing weight. It also calculated BMI, fat % and BMR.

One app provided a different combination of features which was diet information, exercise regime, and tracker, it provided meal reminders, meal tracking, tips for weight loss, detailed diet chart with meal timings, workout regime, progress chart and calculated BMI. One app provided with features like diet information, exercise regime, tracker, anthropometry and coach, it provided coaching by certified coaches, personalized plans, workout goals, dietary guidelines, tracked foods consumed, water intake, steps taken, analysed the food consumed and calculated BMI.

3.2 Gaps in weight loss apps:

TABLE NO. 3.2.1: GAPS IN WEIGHT LOSS APPS

GAPS	NUMBER OF APPS
lack of motivational group	2
Dull presentation of app	1
lack of weight loss guidelines	1
No parameters are asked	4
no personalized plans	7
No progress chart available	5

lack of workout videos	1
no detailed diet chart	3
no benefits and side effects of the plan	3
no consideration of disease conditions or food allergies/ intolerance	6
Unnecessary advertisements	2
Calories depending on the current weight of the individual is not recommended	1
payment for accessing trial period	3
no consideration of activity	4
Lack of trainer led work out videos	1
no calorie counting	5
does not calculate calories burned	1
Doesn't calculate BMI	1
Different then what the name of the app suggests	1
Provides diet plan according to the weight of the person	1
no personalized tips	2
does not record the tips followed	1
lack of nutritive values of recipes	1
Cannot set alarm for exercise regime	1
To access diet coaches, the app has to be upgraded	1

Table no. 3.2.1 shows the types of gaps or barriers present in weight loss apps. Out of total 30 weight loss apps that were reviewed, two apps did not have a motivational group to encourage the users, one app has a very dull presentation and another app lacked weight loss guidelines. Four apps did not consider any parameters and seven apps did not provide personalized diet plans.

Progress chart was not available in five apps and one app lacked workout videos. Detailed diet chart was not provided by three of these apps. Three apps did not mention the benefits and side effects of the recommended diet plan. Six apps provided a diet plan without considering the presence of any disease condition, food allergies as well as food intolerance. Pop up advertisements was a barrier in the use of two apps.

Calorie requirement without considering the weight of the user was a gap identified in one app. Three apps required the entry of payment information for accessing trial period. Four apps recommended exercise regime without considering the current activity level of the users. One app lacked workout videos to guide the users about the proper postures of the recommended exercises. The feature of calorie counting was not

present in five of these apps. One of these apps did not calculate the calories burned. One app did not have the feature of calculating BMI. One app provides features different from what the name of the app suggests. One app provides a diet plan by only considering the weight of the person and no other parameters are considered.

The lack of personalized tips was a gap seen in two apps. One app did not have the feature to record the tips followed which were recommended. The nutritive value of the given recipes was not present in one app. One app did not have the feature of setting an alarm as a reminder for exercise. One app provided the feature of connecting with diet coaches but, an upgrade was required to access it.

3.3 Ratings of weight loss apps:

TABLE NO. 3.3.1: RATINGS OF WEIGHT LOSS APPS

RATINGS	NUMBER OF APPS
0-1	3
1-2	0
2-3	0
3-4	3
4-5	24

Smartphone heath applications are rated out of 5 by its users on the Apple App Store and Google Play Store. These weight loss apps were also accessed for their user ratings from these online stores.

Table no. 3.3.1 shows that rating of the 30 weight loss apps considered for this study. I was observed that 3 out of 30 apps hade user ratings between 0 to 1. None of these apps received rating between 1 to 3. User ratings between 3 to 4 were given to 3 apps. Maximum number of apps (24) apps had ratings between 4 to 5.

3.4 Features in women's health apps:

TABLE NO. 3.4.1: FEATURES IN WOMEN'S HEALTH APPS

FEATURES	NUMBER OF APPS
Health tracker	4
Record symptoms	3
Record moods	2
Access blogs	1
Exercise regime	11
Anthropometry	2
Fertility tracker	5

Records medical information	1
Available in more than one language	3
Forum to ask questions	3
Forum to meet new people	2
Diet plans and tips	7
Meditation	1
Health tips	9
Medical/disease information	5
Frequently Asked Questions (FAQ)	2
Research articles	1
Postpartum information	1
Calculates calorie requirement	2
Set reminders	3
Home remedies	2
Benefits of exercise	2
Pregnancy tracker	2

Table no. 3.4.1 shows the presence of different features provided by apps for women's health. Out of the total thirty women's health applications, four apps provided the feature of health tracker, one app recorded and provided graphs for steps taken, exercise, calories consumed, water intake, sleep hours and body temperature, one app Tracked daily calorie intake and expenditure, one app provided a graph regarding activity level, steps taken, duration of activity, calories as well as distance, recorded weight and sleep pattern and one app recorded exercise, bathrooms visits, urine leaks and sexual intercourse.

The feature of recording symptoms was present in three apps, one app recorded symptom like acne, backaches etc. one app recorded basal body temperature, physical discomfort and symptoms like acne, appetite, backache etc. and one app recorded symptoms experience on a particular day. Two apps had the feature of recording moods and one app had the feature of accessing blogs from the internet.

Eleven out of the total thirty applications provided an exercise regime to the users. Among these an app provided 11-week workout program with different exercises every four weeks, asanas beneficial in weight loss, benefits and various techniques of a jumping rope and barbell, list of exercises beneficial for arms, legs, glute and chest and stomach, list of Pilates exercise. One app provided exercises for home workouts as well as gym. One app provided yoga asanas useful in preventing common illnesses seen in women. One app provided a customized exercise routine, two app Provides exercises helpful in the recovery of c-section. One app provided light exercises, list of exercises with Pilates, ab rehab workout and dance steps to follow along with the baby as a mode of workout. One app provided weight loss exercise regime at beginner and intermediate level, ab rehab exercise at beginner and intermediate level, yoga and a 60-day challenge. One app provided the benefits of pregnancy exercises and exercises safe to do during pregnancy. One app provided different workout regime for people trying to conceive, pregnant women and lactating women. It also provided different exercise every day. One app provided different yoga poses.

Two apps had the feature of recoding anthropometry, one app calculated BMI and one app recorded the weight. Fertility tracker was provided by five applications out of which one app tracked menstrual cycle. One app recorded the start date of the menstrual cycle, average cycle length, shortest cycle, longest cycle and average length of menstruation, one app tracked information related to sexual intercourse, cervical mucus amount. One app provided day of the cycle, list of start date of menstruation up to 12 months and graph about the cycle length and duration. One app provided calendar with expected date of next menstruation marked boldly.

Another app recorded medical information for its users, it entered the results of recently done medical examination, provided a list of common vaccines and can also track the date at which the vaccines are administered, recorded the medicine intake with dosages and upcoming medical appointments. Three apps were available in more than one language. The presence of a forum to ask questions were provided by three applications in one app, questions asked were answered by experts. One app provided a chat bar to ask questions. One app provided forum with latest trends regarding menstruation.

Two apps had a forum to meet new people who were also using that particular app. The feature of providing diet plans and tips were present in seven apps of which one app provided a 24-hour diet plan for weight loss, one app provided dietary tips of each month of pregnancy. Two app provided information about the foods useful in postpartum recovery. One app provided foods to avoid during breastfeeding. One app provided information about fats to eat and avoid during pregnancy, salt intake, list of vitamins essential, list of foods rich in folate, list of prenatal super foods and a sample menu for pregnant women. One app provided dietary guidelines for nursing mothers and a detailed 7-day diet plan.

Meditation option was provided by one app that provided two different types of meditation which were fertility meditation and real meditation. Nine apps provided its users with the feature of health tips, one app provided fitness tips, nutrition tips, skin care tips, exercise tips, feelings tips, environment and health tips. Two apps provided tips regarding health care, diet tips, weight loss tips, disease specific tips, beauty and personal care, natural beauty tips, hair style tips etc., sexual health, marriage, pregnancy etc., lifestyle tips about social activities, entertainment, fashion and attitude, fitness tips along with tips for weight loss and stress management. One app provided ayurvedic, homeopathic and home remedies for common diseases seen in women. Two apps provided tips for recovery after a c-section, ease constipation and sexual intercourse after c-section, overcome postpartum depression, train the pelvic floor and care for vaginal stiches. One app provided tips to lose baby belly and tips to ease back into a fitness routine. One app provided tips regarding oil massage for improving loose skin and stretch marks, way to apply aloe Vera and rose water. One app provided tips to new moms, 51 tips starting from before the baby's arrival to when the baby arrives, tips for vegetarian moms to increase breast milk, tips to make breast milk more nutritious and tips on how to stop breastfeeding at night).

Medical/disease-specific information in detail was provided by five applications of which one app provided detailed information about breast cancer. One app provided information on bacterial vaginosis and vaginal yeast infection. 1 app provided facts related to baby belly. One app provided information about breastfeeding from birth to back to work. One app provided chapter wise detailed information about menstruation, menopause and general and random facts about periods.

A list of frequently asked questions (FAQ) was provided by two apps, one app provided answers of commonly asked questions about menstruation and another app provided a list of frequently asked question with answers about vagina. One app provided its users with the latest research articles under the topic of women's health. Detailed postpartum information was provided by one app. The feature of calculating calorie required was present in two apps, one app provided calorie requirement for each trimester of pregnancy. One app calculated calorie requirement. Three apps provided the feature of setting reminders for its users, one app could set reminders regarding expected period date, late period, fertility and breast examination. one app could set reminders regarding menstrual cycle and ovulation. One app could set reminders for check-ups due for pregnant females.

A list of home remedies for varies conditions was provided by two apps of which one app provided nature remedies for vaginal itching. One app provided ways to reduce heart burn. Two health applications provided the users with the benefits of exercises, one app provided benefits of exercise on skin. One app provided benefits of pregnancy exercises. The feature of pregnancy tracker was provided by two applications for women's health, one app calculated and recorded due date and provided details starting from week 1 of pregnancy. One app could record the baby's details.

3.5 Gaps in women's health apps:

TABLE NO.3.5.1: GAPS IN WOMEN'S HEALTH APPS

Gaps	Number of apps
Lack of forum to discuss issues with experts	8
Lacks of instructions on how to use the app	3
No consideration of activity level	4
Side effects of exercise lacking	3
Lack of workout videos	4
No tracking of meals	1
Cannot record existing food allergies or intolerances	1
Complicated to use	1
No personalized exercise regime	1
Chance of receiving wrong information	3
No detailed diet plans	3
Unnecessary advertisements	1
Too much written information	7
Incomplete information	3
Language barrier	1
Computerized coach	1
No parameters were considered	2
No personalized diet plan	1
Cannot access the 7-day free trial without entering the payment	2
Lack of benefits of yoga on pregnancy	1
Benefits or side effects of the recommended diet is not mentioned	2
cannot record dietary habits	1

Table no. 3.5.1 shows the different types of gaps or barriers present in apps for women's health. eight apps out of the total thirty applications did not have a forum to discuss issues and ask questions to the experts. Three apps lacked instructions on how to use the app. Four apps did

not consider the activity level of its users before recommending a workout program. Side effects of the recommended exercises were not provided by three apps. There was an absence of workout videos in four apps to guide the users about the correct way to follow the exercise regime.

One app lacked the feature of tracking meals. The feature of recording food allergies and intolerance was absent in one app. One app was very complicated to use. One app lacked a personalized exercise regime. Due to the presence of an open forum to ask and answer questions, the chance of receiving wrong information was high in three apps. Detailed diet plans were not provided by three apps. The presence of unnecessary advertisement was seen in one app. Seven apps had a too much-written matter in them and lacked pictorial representation. Two apps provided incomplete information.

One app was in Hindi language and cannot be used by people who cannot read or understand Hindi. One app had a computerized coach which made receiving accurate answers for the questions asked by the users difficult. No parameters were asked or considered by two apps. One app did not provide personalized diet plans. Two apps required its users to enter payment information even to access the free 7-day trial. One app did not mention the benefits of yoga recommended in pregnancy. Benefits, as well as the side effects of the recommended diet, were not mentioned in two apps. One app lacked the feature of recording dietary habits.

3.6 Ratings of women's health apps:

TABLE NO. 3.6.1: RATINGS OF WOMEN'S HEALTH APPS

RATINGS	NUMBER OF APPS
0-1	3
1-2	1
2-3	1
3-4	3
4-5	22

Table no. 3.6.1 shows the user ratings of thirty apps for women's health considered in this study. It was observed that three apps received ratings between 0 to 1. One app had ratings between 1-2. Ratings between 2-3 was received by one app. Three apps were given ratings between 3 to 4 by its users. Lastly, ratings between 4-5 was received by maximum number pf apps (22).

3.7 DISCUSSION:

In this section, conclusions are summarized on the basis of data analysis along with suggestions for future research. This study gave insights on the detailed features provided as well as gaps present in the apps for weight loss and women's health. Also, there were limited studies which investigated the features, gaps as well as ratings of smartphone health applications offered by Apple App Store and Google Play Store.

3.7.1 Features of weight loss apps:

The present study aimed at reviewing the features, gaps, and ratings of apps for weight loss and women's health. The findings of the study indicated that apps for weight loss had a number of features which included different kinds of diet plans, exercise regimes, health tracker, etc. these apps had different features in them some apps had the feature of only diet plans, some provided with only an exercise regime for weight loss and some apps had both a diet plan and exercise regime features in them.

Health apps providing more than one features were given high user-ratings by its users on the Apple App Store and Google Play Store. The apps which provided only one feature for example only the feature of health tracker had low user-ratings on the Apple App Store and Google Play Store.

3.7.2 Gaps present in weight loss apps:

There were different kinds of gaps present in weight loss apps which made either using the apps difficult or lacked some necessary features in them. There were apps which did not provide motivational groups of people to encourage each other in their journey of weight loss. Dull representation of the app was also seen as a gap as it made the users lose interest and eventually uninstall the app from their smartphones. Weight loss guidelines were not mentioned which again was seen as a hurdle in the usage of these apps. Diet plans were provided without the consideration of any parameters like height, weight, and BMI of the user. Personalized diet plans according to the needs as well as the presence of any disease conditions along with food allergies or intolerances were not provided which was again a gap present in these apps.

Progress charts help the user track their progress towards a healthy lifestyle and it also records the amount of weight lost during the course of using the app, absence of this feature was a barrier observed in these apps. Apps providing workout plans are bound to provide videos to support the recommended exercises so as to guide the users about the correct postures and positions to be followed in the plan. A detailed diet plan along with the mention of the benefits and possible side effects of the recommended diet helps the users follow the diet without cheating i.e. diet compliance is higher. Unnecessary pop-up advertisements in these apps made the app difficult to use and also data entry burdensome. Calorie requirement suggested without considering the weight of the individual increases the chance of providing false information and guidelines. The chargeable apps were difficult to use as they provided a free trial period of 7 days but even for using the trial period, entry of payment information like details about the card that would be used for the payment was mandatory.

Providing exercise regimes and workout plans without considering the current activity level of the user was seen as a barrier. These apps did not consider whether the user was sedentary, moderately active or very active. Workout videos provided by the apps were lacking trainer led videos which would grasp the interest of its users even more. Calorie counting is a feature which encourages the user and also helps in promoting weight loss and absence of it was seen as a gap. Counting the calorie burned is another feature which provides the users with an idea of their progress after using the app. Body mass index is a parameter mandatory for all weight loss apps and the absence of it is one of the barriers. An app gives an idea of what it provides with its name but the features provided does not match the claims it makes. Weight loss diet plans are supposed to be provided considering the weight, height, and BMI of the person and so plans provided based on only the weight of the person is a gap present in the app.

There was an absence of personalized tips for the users depending on the disease conditions as well as food allergies and intolerances. The apps providing tips also lacked a checklist where the users can record the tips they followed in a day. The recipes provided by the apps had a gap that the nutritive values of these recipes were missing. The feature of setting a reminder for following the exercise regime in the form of an alarm was missing in these apps. Apps proving the feature of coaches required its users to upgrade the app which was time-consuming and can make the users lose interest.

3.7.3 Ratings of weight loss apps:

User ratings of these apps for weight loss were also assessed and it was observed that app that provides with features like diet plan, as well as an exercise regime, were given high user ratings by their users. Also, the app providing the feature of tracking that allowed its users to track their food intake as well as exercise regime along with a progress chart to track their progress after using the app were also among the highest rating app from the 30 weight loss apps reviewed. Apps which were lacking progress charts and also had unnecessary pop-up advertisement received low user ratings on the Apple App Store and Google Play Store.

3.7.4 Features of women's health apps:

The findings of the study also reported that apps for women's health-focused more on fertility, pregnancy and postpartum care. These apps had a number of different features for its users. Among the total of 30 apps for women's health, maximum of them provided exercise regime

for various purposes like weight loss, prevention of common illnesses seen in women, recovery after c-section, dance steps to follow along with the baby as a mode of workout as well as for women trying to conceive, pregnant women and lactating women. It was also observed that numerous apps provided their users with various health tips like fitness tips, pregnancy tips, lifestyle tips, fashion tips as well as tips for weight loss and stress management.

An interesting feature of providing a forum to the users where they can ask questions which are most of the time answered by experts was available in these apps. These apps also provided the feature of meeting new people with similar health issues and who are using the same app. Another interesting feature observed was research articles provided by an app regarding the latest researches done in the field of women's health.

3.7.5 Gaps present in women's health apps:

Along with the features, there were a number of gaps or barriers present in the apps for women's health which made the app usage difficult for its users. There were apps which did not provide a forum to ask questions to experts in order to solve their queries. Instructions on how to use the apps were absent which was a barrier observed. Exercise regime was recommended to the users without considering the current activity level of the user, whether the user is sedentary, moderately active or very active was not taken into consideration while recommending a workout plan. Another gap observed was the absence of side effects of the exercise plan which were recommended to the users. Apps providing workout plans are bound to provide videos to support the recommended exercises so as to guide the users about the correct postures and positions to be followed in the plan.

The absence of the feature of tracking meals, recording food allergies and intolerances was also a gap observed in these apps. The apps providing open forums for asking questions allowed any user to answer those questions which increased the chances of receiving false information. The unnecessary pop-up advertisement made using the app difficult and also data entry burdensome. Diet plans provided by some apps were not detailed and was difficult by the users to follow it. A number of apps had too much-written information in them which made the app appear too heavy on the eyes and not appealing to its users. Some apps provided incomplete information for the topic they target. An Indian app was in the Hindi language which is a gap for users who cannot read or understand this language. apps providing computerized coach makes it difficult for the users to ask questions and receive personalized answers rather than computerized answers. Lack of personalized diet plans considering the individual requirements and parameters like weight, height, and BMI of the users was another barrier observed.

The chargeable apps were difficult to use as they provided a free trial period of 7 days but even for using the trial period, entry of payment information like details about the card that would be used for the payment was mandatory. The absence of benefits of yoga on pregnancy was another barrier observed which can be a way to motivate pregnant females to engage in yoga. The diet recommended for various conditions lacked the mention of benefits and side effects which can again be a way to motivate the users. The feature to record dietary habits was also absent in some apps.

3.7.6 Ratings of women's health apps:

User ratings of apps for women's health were accessed and it was observed that apps providing features like detailed medical information, diet as well as health tips received highest user ratings. Also, apps providing a forum to ask questions and meet new people with similar health issues as well as apps that recorded the symptoms and moods and provided fertility tracker was among the highest rating apps. Apps providing generalized diet plans without considering the weight, height or BMI of the user received the lowest ratings by its users. Also, apps that did not provide a forum to ask questions also received low ratings.

3.8 LIMITATION

The present study did not fulfil all the hypothesis. The sample size of the study was small which can again affect the results outcome. I retained thirty apps in the weight loss category and equal number of apps in the women's health category. Also, the apps were randomly selected which can be a limitation in the study.

The apps considered in the study are mostly in English language and hence, apps from other languages were not considered. Secondly, for women's health, apps providing features for fertility, pregnancy and post pregnancy were only selected. Furthermore, these apps were reviewed without considering the users of the apps and their feedback was not taken into consideration.

3.9 SUGGESTIONS

Further research is required on the numerous health apps available on a smartphone besides weight loss and women's health apps. Also, along with the gaps, features and ratings of the apps, the evaluation of apps through its users is a possible area of study. People using these health apps can be considered in a study and their feedback can be taken along with their recommendations on how to improve the barriers or gaps present in the apps.

Another possible area of research is that considering the gaps and features of the existing app, a new health app specific to a disease condition can be developed which lack these gaps and a user-friendly app is developed.

I. ACKNOWLEDGMENT

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