FITNESS-BANDS AS SELF-MOTIVATION TOOLS TO PROMOTE DIETARY HABITS AND PHYSICAL ACTIVITY - A STUDY ON USERS' PERCEPTIONS AND PAIRING THEIR USAGE WITH NUTRI-GUIDANCE

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ABSTRACT

Aims This study aims to assess the users' perceptions about the utility of fitness bands as self-motivating tools to promote physical activity (PA) and assess the impact of pairing their usage with nutri-guidance.

Methods: The study consisted of two phases: in phase I, cross-sectional data on users' perceptions were collected from 205 Indian adult fitness-band users using a pre-tested questionnaire. In the second phase, participants with low-level physical activity from the first phase were gathered in a virtual group and provided with nutrition and physical activity education through 1-minute short videos for four weeks. Participants were engaged in intra-group incentivized physical activity challenges.

Results: The majority (84.4%) considered fitness bands as useful self-motivating tools for self-motivating PA. The motivation level of the participants (n=117), checking their app data 'daily' was significantly higher (p=0.001). The low-active participants (n=40) showed significant improvement in perceptions about their diets, dietary practices and physical activity (p=0.007) post-intervention.

Conclusions: The limited contribution of fitness bands in improving dietary practices and gradual drop in motivation can be overcome with the inclusion of nutria-guidance.

Key words- Fitness-band, Social-media, nutrition education, fitness trackers; physical activity; wearable activity trackers; wristbands, digital health.

INTRODUCTION

Globalization, urbanization and economic liberalization have created multitudinous changes in human lifestyle. Changes are reflected in the incurred unhealthy dietary habits and increased sedentism, resulting in development of overweight-obesity and associated non-communicable diseases (NCDs) (Yadav & Krishnan, A (2008). NCDs cause approximately 40 million deaths each year, equivalent to 71% of all deaths globally. Similar trends are also observed in India, which was once considered to be a country grappling with undernutrition. The strong association between risk factors like physical inactivity and unhealthy diet and increased BMI is well-established (Liebman et al., 2003; Chakma, 2017; Abdulla et al., 2008; Guh et al., 2009; Lee et al., 2012; Warburton, Nicol & Bredin, 2006). On one hand, the advancement of technology is blamed in part for contributing to the creation of an obesogenic environment by making human life more sedentary, on the other hand, various technological tools, starting from workout equipment, pedometers, activity trackers, active video games, m-health services delivered through smartphones are being used for guiding lifestyle and weight management. Wearable activity trackers are technologically advanced tools which are in high demand among all age groups. Wearable devices have been taking over the market since 2011 (Statista, 2018) and are considered as promising monitoring tools for improving physical activity and health (Mercer et al., 2016). The number of users of wearable devices was expected to go beyond 830 million by the beginning of in this decade (Statista, 2018). The choices in the market of wearable activity trackers, most of them integrated in smart watches, are also increasing (Kaewkannate & Kim, 2016). Wearable devices usually have smart sensors and are connected to the internet for data exchange. They are tiny and state-of-the-art computers that users can comfortably wear in the form of smart glasses, wrist bands, or clipped into clothing (Techradar, 2015). Fitness-bands are the fastest growing technology among all the wearables. As of 2016, Fit bit was the market leader of all fitness tracker brands, leading over competitors like Xiaomi and Apple (Statista, 2018). Apart from the basic feature of step-counting, the newly marketed fitness-bands also hold features for the measurement of blood pressure, heart rate or blood glucose monitoring. The technologies behind these functions are accelerometer, bio impedance sensor, GPS, and thermometer (Alderson, 2015). Various behavioral change strategies like self-monitoring, goal setting, feedback, rewards are utilized by the fitness-bands to bring positive behavior change among the users. Since most of the studies so far have only assessed the technical accuracies of these devices but hardly any study has assessed users' perceptions, especially in the Indian context. Some studies which have assessed their utility as motivational tool for physical activity have not studied their efficacy as a standalone tool. Also we hypothesized that the utility of fitness-bands can be improved when paired with nutrition education and social media push. Hence this study was conducted with the following objectives:

1. To assess the perceptions of the users about the utility and functionality of the fitness-bands.
2. To find out if the utility of fitness-bands can be improved when paired with nutrition education and communication through social media push resulting in increased physical activity, motivation and better dietary practices.

RESEARCH METHODOLOGY

There were two distinct phases of the study. In phase-I, cross-sectional data on the perceptions of the fitness-band users about their utility were collected. In phase-II, the active fitness-band users from phase-I, who were physically less active were provided with nutrition and physical activity education through a social media/messaging platforms and were engaged in an incentivized intra-group physical activity challenge.

Participants and Recruitment

The participants of phase-I were apparently healthy, adult users (18-60 years) of fitness-bands. These participants were recruited through snowball sampling technique. Individuals owning a fitness-band or smart watch for a minimum of 1 week and willing to share their perceptions were included in the study.

After analysis of the cross-sectional data on regular physical activity levels of the participants of phase I, the less active participants [as per the Pedometer indices, WHO (taking >5000-7499 steps/day)] were approached for inclusion in phase-II of the study. Those who voluntarily agreed to take part in the intervention were included in phase II.

Measures and Procedures

Questionnaire: In phase-I, a closed-ended questionnaire consisting of questions on participants' demography, self-perceptions of weight, lifestyle, and details on fitness band usage was developed. This draft questionnaire was then subjected to content validity by five experts of diverse fields including- a nutritionist, a psychologist, a social scientist, a doctor, a social worker. The experts rated each question on a 4-point scale for their relevance, clarity, simplicity, ambiguity. The modified questionnaire was then pre-tested among 10 fitness band users. Their comprehension, confidence of response, response latency were considered to make some changes in the questionnaire. The final questionnaire consisted of 42 items including brand-names of the fitness-bands, duration of usage, interest and motivation behind usage, features of the band, frequency of usage, daily goals, problems of usage and overall experience with the band. It was administered in interview mode to the participants.

In phase-II another pre-coded questionnaire was developed and used for collection of data about nutrition knowledge, practices along with the food frequency of the less-active participants. It scored the participants' knowledge and perception regarding healthy dietary as well as physical activity practices. For collection of post-intervention data, the same questionnaire was used.

Intervention*:* In phase II of the study, a 4-week long intervention comprising of nutrition and physical activity education was provided to all the participants who were physically less active through social media and instant messaging platforms using 1-minute educational videos. This was complemented with online messaging support, discussion forums and group counselling. In addition, the participants could also interact directly with a trained nutrition expert from the research team. As a part of the intervention, the participants were also involved in an incentivized physical activity challenge, measured in terms of the number of steps taken by each participant as per the data of their fitness-bands.

Intervention Materials*:* Educational materials consisted of 16 one-minute educational videos, were shared through social media and instant messaging platforms. The topics of the videos were derived from the baseline knowledge and practices data obtained from the participants. These videos covered various topics like 'choosing heathy food when eating away from home', 'importance of breakfast', 'ideal portion size and frequency of meals', 'physical activity recommendations', 'calorie currency of different physical activities', 'relation between sleep and food', 'ideal time for tea/coffee consumption' and so on. The content was curated by a team of subject experts from disciplines like nutrition, medicine, public health and communication. These videos were shared with the participants through a social media platform, one video every alternate day for duration of one month. These were also complemented by online messaging support, discussion forums and group counselling. Additionally, the participants could directly interact with a trained nutritionist from the research team.

Data Collection and data analysis

Phase-I: The questionnaires were administered through one-on-one interview. Before administering the questionnaire, written informed consent was obtained from each participant.

Phase-II: These questionnaires were administered in online mode. Data on the physical activity of the users were collected in form of screenshots of the app data of the users' fitness-band at the end of each day for a period of 30 days.

All data were reviewed, coded and the content was entered manually in Microsoft Excel sheet, checked for consistency, and analyzed using SPSS® for Windows, version 21.00 (IBM, Chicago, USA). Descriptive statistics like percentages, frequency distribution, cross tabulations, regression analysis, and chi-square tests were performed. The significance of association between variables was assessed at 95% confidence interval ($p \leq 0.05$).

RESULTS

Phase 1: Users' Perception about the utility of the fitness-bands

Demographic Profile In phase-I, a total of 250 fitness-band users were approached, out of which, n=205 users volunteered to participate in the study. The participants were aged between 18-40 years.

Table-1: Demographic classification of study participants (n=205)

Characteristics	Values
Age	
• 18-30 years	137 (66.8%)
• 31-40 years	68 (33.2%)
Sex	
• Male	152(74.1%)
• Female	53(25.9%)

Educational level	
• Under graduation	2(1%)
• Graduate	97(47.3%)
• Post-graduate	80 (39%)
• Professional degree	26(12.7%)
Occupation	
• Government service	14 (6.8%)
• Private service	109 (60%)
• Self-employed	15 (7.3%)
• Housewife	6(2.9%)
• Student	57(27.8%)
• Others	4 (2%)
BMI (WHO Classifications)	
• Underweight	7(3.4%)
• Normal	85 (41.5%)
• Overweight	88(42.9%)
• Obese	25(12.2%)
Activity level (WHO)	
• <5000 steps/day (sedentary lifestyle)	30 (14.63%)
• 5000-7499 (low active)	57 (27.80%)
• 7500-9999 (somehow active)	51 (24.87%)
• >10000 (active)	67 (32.68%)

Perception of the participants about their body weight*:* The BMI of the participants were calculated according to their self-reported weight and height. Though 103 (50.2%) participants considered themselves to be in normal weight range, 27.2% of them were overweight/obese as per the WHO BMI classification for Asians.

Features of fitness-bands: The different brands of fitness-bands owned by the participants were Apple, MI, Fit bit, Honor, Lenovo, Garmin, Tom-tom, Goqui, Fast track, Samsung. The most owned brand was MI (31.7%) followed by Fit bit (21%) and Apple (10.2%). All the fitness-bands offered features of step-counting; calories burnt. Distance travelled, stairs climbed, heart rate monitoring, BP or sleep monitoring were some other common features. Nutritional guidance and health tips were provided by very few brands (12.2%) or models of fitness-bands.

Reason and motivation of usage*:* Among 205 participants, 140 (68.3%) had bought fitness-bands out of own interest while some participants (30.2%) reported using it as they had received them as gifts. About 180 (87.8%) participants reported to be involved in intentional physical activity, of them 92.9% also mentioned that tracking their activity level from the synchronized fitness app data motivated them to be more physically active. A drop in the level of motivation with time was observed among the users. Though the association of duration of usage with persisting motivation to be active was not statistically significant, a trend was observed (p =0.07) of high interest level among the users who had been using the fitness-bands continuously for 3-6months (73.30%). The level of interest about the fitness-band was found to be comparatively lower among the participants (57.40%) who were using the fitness bands for 6-12 months than new users or consistent users **(Figure 1).** The most mentioned reason for using the fitness bands were to reduce weight (65.9%). While

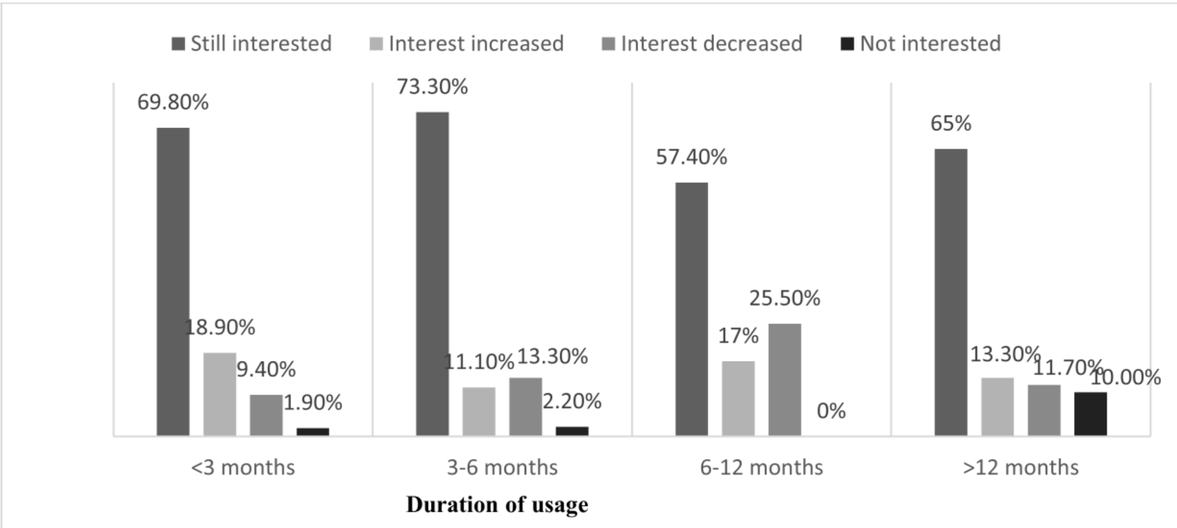

Figure-1: Persisting level of interest about the fitness bands among the study participants according to their duration of usage of fitness-bands

about 120 (58.5%) participants found monitoring intentional physical activity as the most useful feature of fitness-bands, few participants (17.6%) used them as they found it trendy or fashionable. Out of 180 participants who reported to be involved in intentional physical activity; 117 participants (92.9%) had reported that daily monitoring of their synchronized mobile-app data helped them to be more physically active than participants who used to check their app data occasionally, rarely or never. There is a strong association between regular monitoring of app data with increased engagement in physical activity (χ^2 = 0.23) **(Figure 2)**. 'Achieving the recommended steps goal everyday' was the most motivating feature according to 167 (81.5%) participants. Sedentary alert feature, that sends out alarm when users were inactive for a long time made 69.3% (n=205) participants conscious for initiating physical activity. Overall, 173 participants (84.4%) reported to be more active than before using the fitness-bands**.**

These 'less active' or 'somewhat active' (<9999 steps/day) participants were approached to take part in the second phase of the study to evaluate if the utility of the fitness-bands could be improved when paired with nutritional guidance and social media push.

Phase II: Utility of fitness-bands when paired with nutrition education and social media push.

Changes in physical activity level after physical activity challenge:

Out of the 205 participants in Phase I of the study 93 (45.36%) participants were categorized as less-active as per the WHO pedometer indices. These participants were approached to participate in Phase II of the study. A total of 63 participants initially agreed to take part in the 4-weeks of social media-group messaging intervention. However, data on regular physical activity levels were shared daily by only 21 (33%) participants till the end of study tenure, while other had dropped out at different time points during the intervention period.

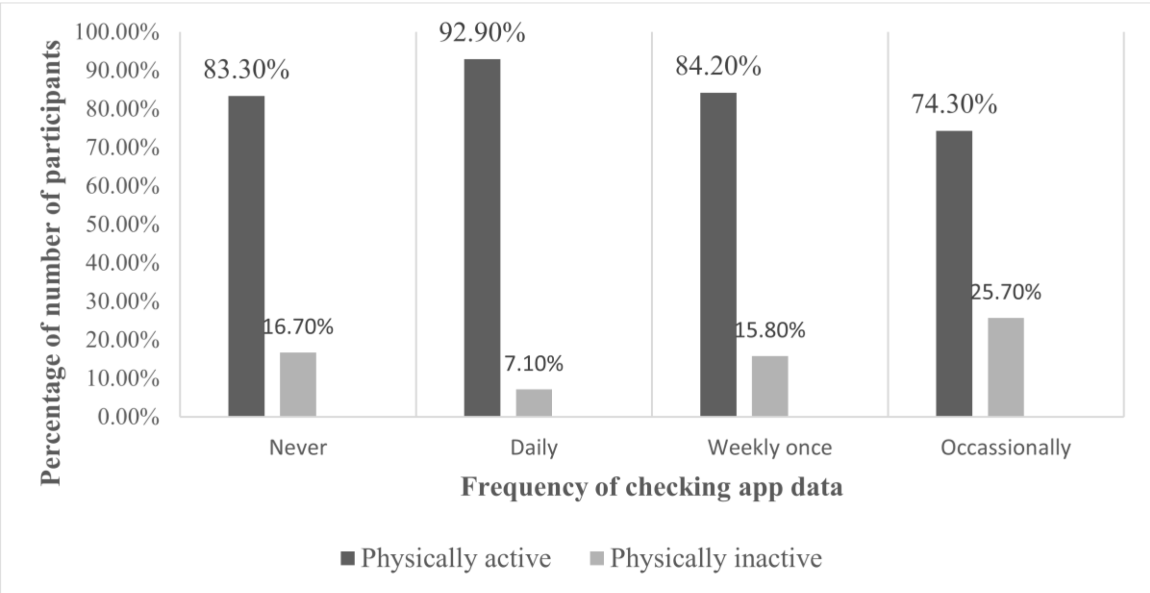

Figure-2: Frequency of checking app data and involvement in physical activity

Deterrents of usage: Low battery life (7.8%), problem in synchronizing with the mobile application (5.4%), not suiting outfit (3.9%), not giving accurate data (3.4%) and skin irritation (5.9%) were the commonly reported deterrents of regular usage of the fitness bands.

The dropping level of interest noted among the 'less active' or 'somewhat active' (<9999 steps/day) participants was reported to be due to their perception of not having 'anything new to know', and lack of nutritional guidance feature in the fitness-bands.

Increase in daily physical activity level was noted in all participants. Average steps of these 21 participants at baseline were 7009±1660 and at the end line it increased to 9140±965 (p<0.000). The changes in average number of steps of each participant from the baseline of phase II till the end of the intervention period are given in **Figure 3.** However, over a third of the participants (38%) were able to reach the WHO recommended level of >10000 steps/day.

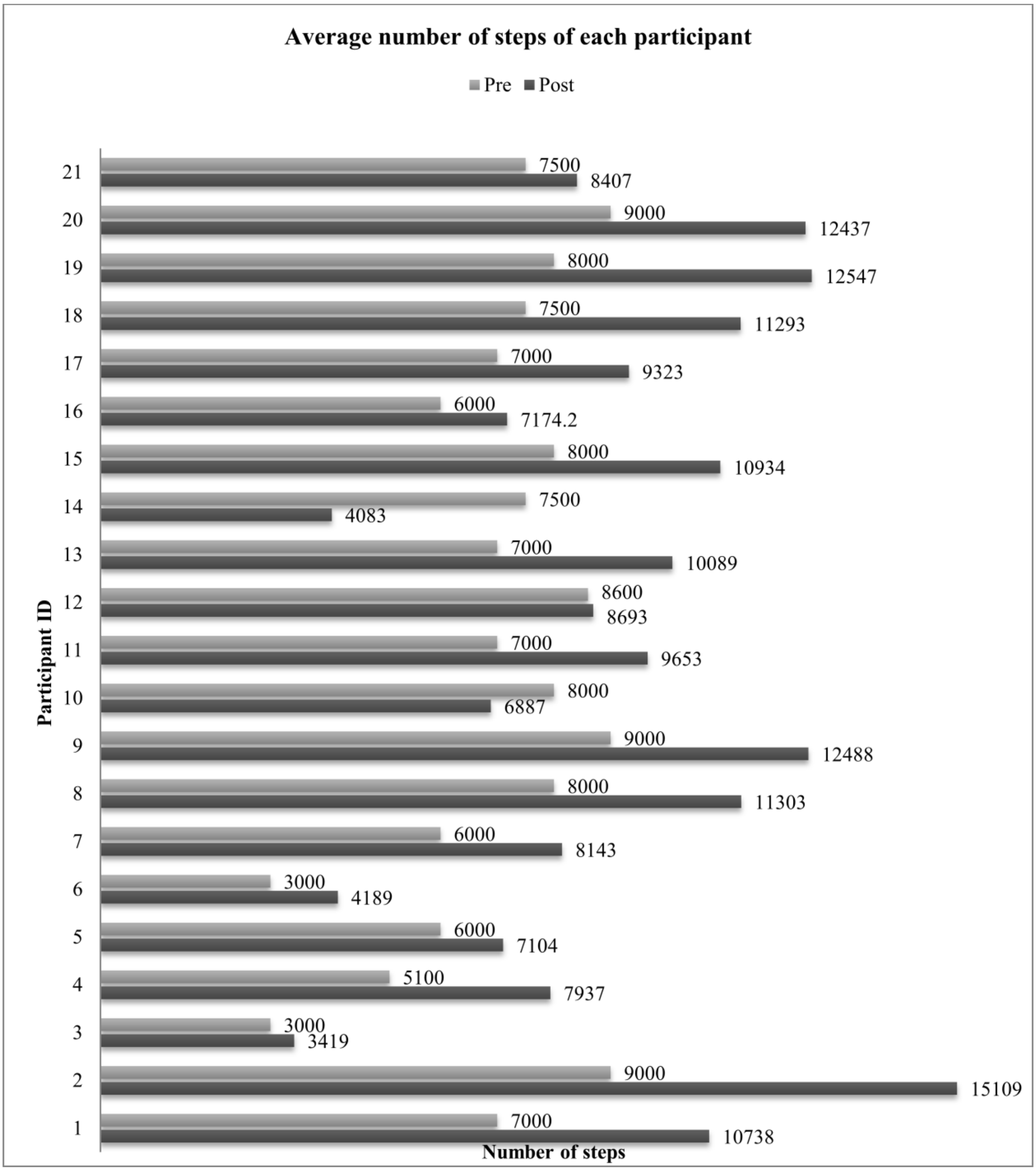

Figure-3: Changes in average number of steps taken per day by each participant pre and post-intervention

Changes in nutrition knowledge and dietary practices*:* It was observed that most participants lacked evidence-based nutrition knowledge and had wrong perceptions and choices of foods before the intervention. Comparison of total pre and post intervention knowledge score of the participants using McNemar Test revealed significant improvement (p=0.000).

Most of the participants significantly improved their dietary practices and habits. Participants gained knowledge about several dietary practices and reported to practice them. The number of participants skipping breakfast and frequency of eating outside reduced significantly. Participants reported choosing nutritionally better food options while eating outside. The changes noted in dietary practices of the participants from baseline to the end of intervention period are given in **Table 2.**

A significant reduction in the consumption of fats and oils (p=0.000), sweets and savories (p=0.000), and deep-fried snacks (0.001) was seen after the intervention period and fruits and vegetables consumption were increased than the baseline level (**Table 3**).

Table-2: Changes in dietary pattern of the low active participants (n=40) before & after the intervention in phase II of the study

Dietary Practices		Baseline (n=40)	Post-intervention (n=40)	Significance (p>0.05)
Preference of not taking tea and coffee before and after meal		36(90%)	40(100%)	0.125
Habit of not skipping breakfast		29(73%)	36(90%)	0.016*
Habits of not taking large meals		28(70%)	33(83%)	0.063
Proper washing of vegetables		34(85%)	40(100%)	0.031*
Proper cutting of vegetables		2(5%)	11(27%)	0.004*
Reduced frequency of eating outside		16(40%)	31(77%)	0.000*
Preference of food while eating outside	Grilled items	24(60%)	35(87%)	0.001*
	Salad	16(40%)	29(73%)	0.000*
	Soup	12(30%)	29(73%)	0.000*
	Broiled items	9(23%)	17(42%)	0.008*
	Fried items (reduction)	20(50%)	33(83%)	0.000*
Choice of dessert	Fresh fruits	19(48%)	26(65%)	0.016*
	Sweets (reduction)	21(52%)	33(83%)	0.000*
	Ice cream (reduction)	18(45%)	25(62%)	0.016*
Daily consumption of fruits		18(45%)	33(83%)	0.000*
Habits of taking fruits after meal		14(35%)	29(73%)	0.000*
Minimum sleep duration		27(68%)	32(80%)	0.063
Late night food craving (Reduction)		28(70%)	31(78%)	0.250
Maintaining sleeping timing		14(33%)	26(65%)	0.000*
Usage of different types of oil		17(43%)	29(73%)	0.000*
Sugar consumption (Reduction)		35(88%)	37(93%)	0.500
Being active in middle of work		14(35%)	16(40%)	0.500

Table-3: Changes in food frequency pattern of the low active participants (n=40) before & after the intervention in phase II of the study

Food Groups	Baseline (n=40)	Post intervention (n=40)	Significance
	Mean and SD	Mean and SD	
Sweets and savories	38.78±7.708	42.55±6.954	0.000*
Deep fried snacks	60.300±8.5130	62.550±7.2993	0.001*
Fruits	15.625±7.5708	20.550±5.7332	0.000*
Vegetables	67.075±21.2596	73.950±15.1910	0.018*
Dairy products	23.375±7.5301	24.78±5.418	0.267
Cereals	23.38±5.669	23.25±3.643	0.890
Flesh foods	14.03±7.468	15.33±5.726	0.049*
Breakfast items	9.60±5.900	10.20±4.542	0.529
Fats and oils	18.68±7.322	22.98±5.989	0.000*

DISCUSSION

This study focused on user's perceptions on effectiveness of fitness-bands as self-motivating tools to promote physical activity and assessed the impact of pairing their usage with nutri-guidance. There is hardly any study done in India in this regard. All previous studies have focused on the accurac y of fitness-bands and its effectiveness in various disease conditions (Mercer, 2016; Rosenberg, 2017). Hence a study with 205 participants was initiated.

A study conducted in Australia reported that the primary motivation of fitness-band usage in most cases was self-driven and most commonly participants had bought them with an intention to lose weight (Maher et al., 2017), similar results were observed in the current study. All participants in our study had reported to be physically more active since they had started using the fitness-bands. Tracking of daily activity level and working towards 'achieving goal' were reported to motivate most participants to be more active. Participants who reported monitoring their activities 'daily' were found to be more active than those who reported to do it weekly occasionally, or never. Similar results regarding higher motivation level with regular monitoring have been put forward in another study (Rosenberg et al, 2017). As it was observed in our study, the motivation of usage had dropped with time among some users but retained among sustained users (Karapanos et al., 2016) had also reported that some segments of users use, or intend to use, their device for a sustained period because the devices were helpful to enhance their sense of self along with accumulation of future data.

The main purpose of including the participants in the intra-group physical a ctivity challenge during the intervention phase through sharing of their fitness-band data was social cognition and comparison which is likely to motivate people by comparing themselves with others. However, the irregularity in sharing screenshots of their tracked data was possibly due to disinterest in sharing personal data in public forum.

Though the fitness-bands were well accepted by most participants and 90.2% intended to use it further but they were not very effective in changing the dietary patterns. Most participants were found to have poor dietary knowledge and practices. This is probably because most fitness-bands do not provide a feature of dietary guidance. Only 12.2% participants reported having nutrition advice feature in their fitness-bands. Similar results were obtained in another study (Maher, 2017) that there are limited changes in diet (14-40%) compared to physical activity. But the role of proper diet is also as essential as physical activity and conducive to 'fitness'. We observed that providing nutritional guidance had significantly improved the dietary perceptions and practices of the users. Hence, we believe inclusion of nutritional guidance feature in fitness-bands either in the band or in the allotted software of the tagged mobile device can contribute to the effectivity of this promising tool.

The purpose of using a fitness-band is primarily to track physical activity level and be more active, but in spite of using one, about 93 out of 205 participants were found to be 'low active' and not meeting the recommended 10000 steps/ day goal for extended period of time. This was probably because of their lost motivation of usage. There were different probable deterrents of usage such as, users felt their devices did not track their activity accurately or did not synchronize with the app properly. These technical barriers need to be addressed with improved technological features.

Another reason reported was that users felt they had 'nothing new to know' from their device. In that case interactive feature in the bands and inclusion of social media physical activity challenges can motivate users to sustain its usage with interest. Social media push can be helpful to overcome the lost interest that fitness-bands cannot provide alone. A study reported that the most reported brands of fitness-bands used were Fit bit, followed by Garmin, Apple, Jawbone, Samsung, and Polar (Maher et al., 2017). There was no mention of popularity of MI brand in the study, unlikely MI was found to be the most frequently used brand in our study. This might be because recent availability of MI brands at more affordable ranges in India in comparison to other brands. Although limited sample size and self-reported data are the limitations of this study, it contributes to the scholarship in this area as very few studies have been conducted in India.

Implications for Research & Practice

The data obtained from this study regarding the users' perception of utility of fitness bands, feedback on missing features and probable deterrents of usage can help in development of newer varieties of fitness-bands with improved features and technology. Since there is positive feedback and acceptance about this device from users and these have promising uptake, with certain modification in their features their utility can be improved further. The limitation of these devices of not being able to contribute to nutritional guidance requires inclusion of dietary guidance feature. Apart from various motivational techniques used in fitness-bands, inclusion of social physical activity challenge with other users of fitness-bands can be helpful as social comparison and cognition tools. With changing and constantly evolving technology, a larger study covering a broader population can provide further insights into using these tools for promoting physical activity along with nutri-guidance.

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