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Investigation of Nutritional and Health Status of Indian Rural Hill Farm Women

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ABSTRACT

In hill region of India, women play a major role in agricultural production, livestock and cottage industries and remain busy from dawn to dusk to collect water, fuel wood and fodder which adversely affects their health. In order to study nutritional status of farm women information regarding food intake was obtained from 120 farm women from high, mid and low hills using 24 hours recall method with interview schedule cum observation worksheet. Physiological characteristics and anthropometric measurements related to nutrition like weight, height, skin fold measurements, blood pressure, heart rate, energy expenditure rate, VO, max and pulse rate of subjects were recorded. Results indicated that diet of farm women of high, mid and low hill region was inadequate in terms of energy, protein and β-carotene. It was also found that calcium and β-carotene consumption by farm women during winter was significantly higher. On the basis of BMI, about 45 per cent subjects were found Chronic Energy Deficient (CED) and 22.5 percent were in the category of Low-Normal. Only 30 percent subjects were in the category of Normal.

Keywords: Nutritional Status, Hill farm women, Chronic energy deficiency

INTRODUCTION

Uttarakhand is a small state in the northern part of India with a total area of 53,484 km² of which 93% is mountainous. Uttarakhand is located between 28° 43'–31° 27' N latitudes and 77° 34'–81° 02'E longitudes with an altitudinal variation ranging from 200 meter to more than 8,000 meter above mean sea level. The average annual rainfall of the state, as recorded is 1,547 mm. In Uttarakhand about 70 percent population resides in rural areas. More than three-fourths of state's total population depends on agriculture for their livelihood and the economy is predominantly dependent on mountain agriculture. Uttarakhand is one of the few states in India where women are the active workforce in agriculture, due to their total involvement with agriculture, animal husbandry, fodder and fuel-wood collection and household activities. (Population Foundation of India, 2002). Women here are therefore considered as the backbone of hill agriculture and are the mainstay of rural economy.

Small land holdings, low agricultural productivity and less job opportunities have given rise to out migration. This has dramatically dislocated Uttarakhand village communities. The large scale out-migration of men in search of employment in the plains or in the army has led to a demographic imbalance in the region. While men predominate in urban areas, the rural areas contain significantly high female population (Rawat, 2004). Further, changes in the climate usually have more impact on sectors that are traditionally associated with women, such as crop cultivation, collection of fuel and fodder etc. Seasonal migration of men in search of job is both widespread and linked to low agricultural productivity. Because of male migration and thus reduced workforce, women who already do a disproportionate share of work are now doing an ever-increasing portion of the work towards agriculture and earning livelihoods. This phenomenon is referred to as the 'feminization of hill agriculture and livelihood'. Increasingly women are left with no other choice but to cope with the food shortages and the management of the home and farm.

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According to an assessment (Bhati and Singh, 1987) in the Himalayan region, a pair of bullocks works for 1064 hrs, a man for 1212 hrs and a woman for 3484 hrs in a year on a one hectare farm. Unlike women in plain areas, the women here look after all the agricultural operations (except preparation of field) and trek longer areas to fetch fuel, fodder and water. This heavy work is bound to have its impact on the health of the women and girls in hills of Uttarakhand. Borah and Kalita (2002) revealed that, the average time devoted by women in agricultural operation is 8 to 9 hours per day in peak season and 4 to 5 hours in slack season. Several researchers have studied and confirmed that women work for 14-18 hours daily (Ancheta, 1982; Kaur and Punial, 1986) on live stock raising, fetching fodder, farming operations, collecting fuel and water from far off places and expend more total energy a day as compared to men. Kishtwaria *et al.* (2009) studied the extent of participation and time spent by women in different activities in three different zones of Himachal Pradesh. In the hilly areas, contribution of labors is the most important factor in livestock management and production. Majority of women were involved in performing various farm activities i.e. cutting/uprooting (85.52%) weeding (79.32%), bundling (74.20%), picking/doffing (72.79%). The women spent maximum time in transplanting (327.68 hrs/years) followed by transportation of manure (138.05 hrs/years). Most of the women in hills suffer from lower back pain due to carrying heavy loads over long distances; they also suffer from various skin problems due to long exposure to sun. Due to use of agro-chemicals women are exposed to several health hazards and gynecological infection. In case of rice transplantation, arthritis, intestinal and parasitic infections may take place due to long hours of work in mud and water (Pandey, 2001). Constantly carrying heavy weights/loads on spine, commonly on head and back has severe health implications. Backache and joints pain are common and in extreme cases curved spines and pelvic deformities can result creating complications in child birth. Women are particularly vulnerable to diseases during dry season. During this time the journey times to collect water are the longest, food stocks are lowest, the workload is highest and diseases most common.

Poor health has repercussions not only for women but also their families. Women with poor health and nutrition are more likely to give birth to low weight infants. They are also less likely to be able to provide food and adequate care for their children. Finally, a woman's health affects the household economic well being, as a woman with poor health will be less productive in the labour force. Women everywhere work for longer hours, the plight of poor rural women in hills is rather worse. It does not matter if the women are old, young or pregnant, crucial household needs have to be met every day. The agricultural and household workload in hill area is nightmarish to them in terms of drudgery involved in these activities. The strenuous physical tasks allocated to women, combined with limited food intake, exacerbate malnutrition. Efforts have been done by various institutions to raise the economic status of rural families through interventions in the field of agriculture. But nutritional status of women depends upon several factors like food intake, income, healthcare practices and status of women in the society. Therefore it becomes necessary to study whether improvement in economic status of farm families has led to improvement in nutritional status of farm women. Seasonal shortfall in food availability tends to affect women disproportionately since their already inadequate intake will be curtailed drastically. Even when more food is available, it tends to be preferentially allocated to men, thus preventing women from accumulating any reserves. If seasonal shortfall coincides with pregnancy or lactation, the implications for women and infants are particularly harsh (Chatterjee and Lambert, 1989).

In a study it was calculated that daily kilocalorie expenditure on various agricultural and domestic activities was 2473 for men and 2505 for women. Whereas average daily intake of kilocalories per man was estimated to be 3270 and 2410 for women (Batliwala, 1987). Thus, women faced both a relative deprivation in comparison with men, and an absolute deficit vis-à-vis their calorie expenditure. It was demonstrated that women's daily energy expenditure was likely to be higher than men's, particularly in rural settings where men's work is seasonal but women's is continuous and includes domestic and reproductive chores. Anand and Kumar (2015) also reported that there are adverse disparities seen amongst the entire population especially between men and women which seems convincing enough to evolve strategies to counter these disparities spread across economic and social domains. While much of data both from official

and non-official sources on the health of the women are missing, the few which is available after 2000, is casual and unhelpful to draw authoritative conclusions. One sphere that has yet to receive adequate attention is the relationship between women's work and women's nutritional status in the agricultural setting. There is a paucity of information on diet, dietary pattern and nutritional status of hill farm women. Therefore, an attempt has to be made to assess the dietary pattern and nutrition status of farm women in hill region of Uttarakhand. Therefore this study is being undertaken to assess nutritional status of hill farm women during different seasons.

MATERIALS AND METHODS

The present study was conducted on 120 farm women from low, mid and high hills of Uttarakhand. The subjects selected were in the age group of 18 to 45 years (excluding pregnant and lactating women) and actively engaged in farming. Those women who willingly cooperated to provide information required for the study were only included in the study. Anthropometric measurements of women recorded included weight, height, skin fold measurements, blood pressure and pulse rate. The method suggested by Gibson (1990) was followed for this study. Measurements were taken in triplicate and average values were recorded. The extent of malnutrition in women was assessed by computing the BMI (Body Mass Index).

$$\text{BMI } (kg/m^2) = \frac{\text{Weight (kg)}}{\text{Height (m) x Height (m)}}$$

The respondents were categorized into different grades of nutritional status using BMI index (James *et al.,* 1988).

BMI Grades	BMI Range
CED III	Less than 16
CED II	From 16-17
CED I	From 17-18.5
Low-Normal	From 18.5 to 20
Normal	From 20-25
Over weight & obesity	More Than 25

Information regarding food intake was obtained from 120 farm women using 24 hours recall method using pre-structured interview schedule. The data pertaining to the daily intake of foodstuff along with quantity was collected using 24 hours recall method (2 recalls). The quantity of raw food was calculated using the following formula:

$$\text{RFI} = \frac{\text{TRQ x II}}{\text{TCQ}}$$

Where, RFI = Raw amount of a food stuff consumed by the individual

TRQ = Total raw quantity of food stuff used in that preparation

II = Individual intake of the cooked amount of preparation

TCQ = Total cooked quantity of food prepared.

The average daily intake of foods by individual respondents was computed and compared with the suggested levels of intake (ICMR 2010). The nutritive value for the quantity of raw foods consumed by the individual respondents were calculated by using food composition tables (Gopalan *et al.,* 1989) and compared with the Recommended Daily Allowances (RDA).

Body density, percent body fat and fat free mass of subjects were calculated using skinfold thickness from formula given by Durnin and Womersley (1974) as follows:

20-29 years, D = 1.1599 – (0.0717 x L)

30-39 years, D = 1.1423 – (0.0632 x L)

40-49 years, D = 1.1333 – (0.0612 x L)

D = Body Density

Siri Percent Fat Equation, 1961

Percent Body Fat = (495 / Body Density) – 450

Fat Mass (kg) = Body weight (kg) x (4.95/D – 4.5)

Fat Free Mass (kg) = Body weight (kg) – Fat mass (kg)

Physiological characteristics in terms of B.P., H.R. energy expenditure rate, VO, Max and Total Cardiac Cost of Work (TCCW) was recorded. Mean blood pressure (mmHg) was calculated using the measured Systolic and Diastolic pressures, SP and DP.

Mean blood pressure (mmHg) = DP + 1/3 (SP-DP)

Formula for calculating EER

Energy Expenditure Rate (kJ/min) = 0.159 x Avg. working HR – 8.72

Formula for calculating VO_2 max

VO_2 max (l/min) = 0.023 x Body weight (kgs) – 0.034 x Age (years) + 1.65

Formula for calculating

TCCW (Total Cardiac Cost of Work) = Cardiac Cost of Work (CCW)+Cardiac Cost of Recovery (CCR)

Where,

CCW = Average Heart Rate (AHR) x Duration of Activity

AHR = Average Working Heart Rate - Average Resting Heart Rate

CCR = Average Recovery Heart Rate- Average Resting Heart Rate (AWRHR)

PCW (Physiological cost of work)= TCCW/Total time of Activity

Frequency, Mean, Standard Deviation, Coefficient of correlation and t test were used for statistical analysis.

RESULTS

Nutrient intake: The results in Table 1 shows that average energy consumption per capita per day of farm women from high hills was 1802 (±252) kcal followed by 1716 (±245) kcal and 1712 (±293) kcal of farm women from mid and low hills respectively. It is evident from the Table 3 that 37.5, 42.5 and 32.5 per cent farm women from low, mid and high hills consumed energy less than 75 per cent of RDA (2230). A study also reported the average energy intake by the rural women of the central Himalaya below the standard requirement (Pant, 2002). Restriction in energy intake affects adversely the utilization of dietary protein. It is also evident from Table 2 that in low hills energy consumption by farm women in summer and winter differed significantly at 1 per cent level.

Protein plays an important role in many bio-chemical, bio-physical and physiological processes in the body. Table-1 reveals that average protein consumption of farm women in high, mid and low hills was 46.2 (±8.6) g, 41.6 (±7.8) g and 43.9 (±7.9) g which is 16, 24.3 and 20 per cent lower than RDA respectively. Results presented in Table 2 shows that in low hills protein consumption by farm women in summer and winter differed significantly at 1 per cent level. It is also evident from Table 3 that 17.5, 30 and 12.5 per cent farm women

Table 1: Average nutrient consumption by farm women in hills

Nutrients	Low Hills [Mean (SD)]	Mid Hills [Mean (SD)]	High Hills [Mean (SD)]	RDA
Energy (kcal)	1711.8(±292.6)	1716(±245)	1802(±251.7)	2230
Protein (g)	43.9(±7.9)	41.6(±7.8)	46.2(±8.6)	55
Calcium (g)	731(±182)	879(±329)	965.3(±398.5)	600
Iron (mg)	26.5(±5.4)	27.3(±8.9)	29.2(±7.5)	21
β-carotene (µg)	2837(±3015)	4459(±3463)	4504(±5020)	4800

Table 2: Nutrient consumption by farm women in hills during different seasons

Nutrients	Low Hills			Mid Hills			High Hills			RDA
	Summer Mean (SD)	Winter Mean (SD)	Paired t-value	Summer Mean (SD)	Winter Mean (SD)	Paired t-value	Summer Mean (SD)	Winter Mean (SD)	Paired t-value	
Energy (kcal)	1675.5 (±301.2)	1748.1 (±286.7)	5.993**	1751.8 (±255.7)	1681 (±234.8)	0.929	1818 (±285.2)	1786 (±219.4)	0.371	2230
Protein (g)	43.1 (±8.0)	44.7 (±8.0)	4.292**	42.1 (±7.9)	41.6 (±7.8)	0.286	47.9 (±7.7)	44.6 (±9.2)	1.121	55
Calcium (g)	653 (±151.2)	809.4 (±180.1)	4.395**	674.3 (±170.5)	1083.9 (±324.2)	5.858**	780 (±194.5)	1150.5 (±464.7)	3.120**	600
Iron (mg)	23.9 (±4.4)	28.9 (±5.3)	4.432**	22.6 (±3.6)	31.9 (±10.3)	3.497**	28.5 (±5.8)	29.9 (±8.9)	0.497	21
B-carotene (µg)	1808.8 (±1494.3)	3865.1 (±3768.2)	2.532*	3857.2 (±3786.4)	5061.9 (±3085.5)	0.970	1861.7 (±1963.2)	7146.3 (±5760.9)	3.804**	4800

* Significant at 5% level; **Significant at 1% level

from low, mid and high hills consumed protein less than 75 percent of RDA.

Intake of calcium was found to be higher than Recommended Dietary Allowance (RDA) among farm women of three hill region during both seasons. In hills, coarse grains i.e, ragi and barnyard millet which are rich in calcium content being the part of their daily diet contributes towards higher intake of calcium. Average calcium consumption by farm women in low, mid and high hills was 731 (±182) g, 879 (±329) g and 965 (±398) g which was 21.6, 46.5 and 60.8 per cent higher than RDA. Results presented in table-2 shows that calcium consumption by farm women of low, mid and high hills in summer and winter differed significantly at 1 per cent level. Table 3 shows that 92.5, 82.5 and 80 per cent farm women in high, low and mid hills were consuming calcium more than RDA respectively. Some studies also reported higher percentage of women consuming adequate calcium in their diet (Dobhal *et al.,* 2003). It is evident from table-2 that there was a significant variation in calcium consumption by farm women of three different altitudes in hills at 1 percent level of significance.

Results presented in Table 1 shows that the average iron consumption by farm women of low, mid and high hills was 26.5 (±5.4) mg, 27.3 (±8.9) mg and 29.2 (±7.5) mg/day. Data presented in Table 2 shows that iron consumption by farm women of low and mid hills in summer and winter differed significantly at 1 per cent level. It was also found that 85, 77.5 and 80 per cent farm women from low, mid and high hills were consuming iron more than RDA respectively. Whereas 15, 22.5 and 20 per cent respondents from low, mid and high hills were consuming iron more than 75 per cent of RDA but less than RDA respectively (Table 3). Diet of farm women was deficient in terms of energy, protein and iron due to which the physical work capacity is decreased (Singh 2012). In India nearly 70 percent of women are estimated to be iron deficient. Iron deficiency can exist without anemia. Iron deficiency Anemia (IDA) is very late manifestation of iron deficiency because iron deficiency is very well tolerated Anemia does not develop till storage iron is exhausted (Shah, 2004). The main reason for IDA have been determined to be inadequate intake of iron, low bioavailability (1-6 percent) of dietary iron from plant foods (Rao *et al.,* 1983).

Table 3: Percentage distribution of farm women in hills according to intake of nutrients

Nutrient	Group	≥ 100 % of RDA	100 – 75 % of RDA	≥75% of RDA
Protein	Low Hills	12.5	70	17.5
	Mid Hills	12.5	57.5	30
	High Hills	32.5	55	12.5
Energy	Low Hills	5	57.5	37.5
	Mid Hills	0	57.5	42.5
	High Hills	10	57.5	32.5
Calcium	Low Hills	82.5	15	2.5
	Mid Hills	80	17.5	2.5
	High Hills	92.5	7.5	0
Iron	Low Hills	85	15	0
	Mid Hills	77.5	22.5	0
	High Hills	80	20	0
B-carotene (µg)	Low Hills	15	15	70
	Mid Hills	42.5	10	47.5
	High Hills	35	2.5	62.5

Average consumption of β-carotene by farm women in low, mid and high hills was 2837 (±3015) µg, 4459 (±3463) µg and 4504 (±5020) µg. It is evident from Table 2 that in low hills consumption of β-carotene by the farm women in summer and winter season differed significantly at 5 percent level whereas in high hills consumption of β-carotene by the farm women in summer and winter season differed significantly at 1 percent level.

Table 3 shows that 70, 47.5 and 62.5 per cent farm women were consuming β–carotene less than 75 percent of RDA. It was found that intake of β-carotene was higher than RDA in three hill regions during winters due to the huge availability of green leafy vegetables like fenugreek leaves, spinach, amaranth, onion stalks, radish leaves and buck wheat. Over 80 percent of the dietary supply of vitamin-A in the Indian diets is derived from its precursors, β-carotene, a-carotene, g-carotene and b-cryptoxanthin which are present in much plant food. Among these carotenoids, β-carotene has the highest vitamin A activity. The important deficiency states due to vitamin A intake in diet are night blindness, xerosis conjunctiva, xerosis cornea, bitot's spots, keratomalacia and follicular hyperkeratosis.

Protein-Calorie adequacy among farm women in hills: Table 4 clearly illustrates that majority of farm women of high, mid and low hills consumed inadequate protein and calorie. It was found that 87.5 per cent

Table 4: Protein calorie adequacy (%) among farm women in hills

Group	P+C+	P+C-	P-C+	P-C-
Low Hills	5	7.5	0	87.5
Mid Hills	0	12.5	0	87.5
High Hills	10	22.5	0	67.5

farm women in low and mid hills each and 67.5 per cent farm women in high hills consumed inadequate protein and calorie in their diet. Only 10 per cent and 5 percent subjects in high and low hills respectively consumed adequate protein and calorie. Without correcting the exiting calorie gap, the provision of protein concentrates will not prevent protein-calorie malnutrition (Reddy and Rao, 2000).

Physiological Characteristics: As per the physiological characteristics of the subject (Table 5) the mean age of the subjects was 23.5 years with ±4.31 standard deviation. The corresponding mean heart rate (rest) was found to be 73.51 beats/min. The maximum heart rate was with a mean value of 172.10 beats/min with ± 6.54 SD. The mean VO2 max was observed to be 1.80 l/min. In general, it was observed that the VO2 max of female decreased with increase in age. Similar results of VO2 max of Indian female subjects were also reported earlier (Nag *et al.*, 1988; Gite, 1996; Vidhu, 2001). The mean blood pressure of the subjects was 81.44 mm Hg with ± 2.15 SD which is normal in Indian women. The corresponding pulse rate was found to be 68.24 with ± 4.58 SD.

The Total Cardiac Cost of Work (TCCW) and Physiological Cost of Work (PCW) were found 2017.5 and 134.5 respectively, after 10 hours of agricultural and household works.

Anthropometric measurements and body composition of farm women in hills: Anthropometric data related to nutrition were recorded with anthropometric kit. Skin-fold thickness was measured at four sites i.e. biceps, triceps, subscapula and suprailiac. The data (mean ± Standard Deviation) pertaining to Bicep was 6.54 (±1.13) mm, Tricep 8.53 (±1.18) mm, Subscapular SFT 12.42 (±1.51) mm, Suprailiac SFT 10.36 (±1.19) mm, Body Density (D) 1.033 (±0.002), % Body Fat 24.61 (±1.32), Fat mass 10.58 (±1.62) kg, and Fat free mass (kg) 31.93

Table 5: Physiological characteristics of the subject

Physiological characteristics	Range	Mean	Std. deviation
Age (Years)	20-45	23.5	4.31
Weight (kg)	38-59	48.5	3.19
Stature, cm	142.5-161.5	152.5	3.1
HR rest, beats/min (3 replication)	65-78	73.51	2.19
HR max, beats/ min (3 replication)	168-196	172.10	6.54
Mean Blood Pressure (3 replication)	75.24-96.56	81.44	2.15
Pulse Rate (per min)	64-78	68.24	4.58
VO, rest, l/min	0.16 – 0.28	0.20	0.03
VO, max, l/min	1.61 – 2.11	1.8	0.06
TCCW, beats/min (3 replication)	1870.5-2183.5	2017.5	5.12
PCW, beats/min (3 replication)	129.5-137.5	134.5	6.14

Table 6: Anthropometric measurements and body composition of farm women in hills

Parameters	Mean ± SD	95th Percentile	50th Percentile	5th Percentile
Bicep (mm)	6.54 ± 1.13	8.41	6.54	4.67
Tricep (mm)	8.53 ± 1.18	10.48	8.53	6.57
Subscapular SFT (mm)	12.42 ± 1.51	14.92	12.42	9.92
Suprailiac SFT (mm)	10.36 ± 1.19	12.33	10.36	8.39
BMI, kg/m^2	18.80 ± 2.69	23.25	18.80	14.36
Body density (D)	1.033 ± 0.002	1.038	1.033	1.029
% Body fat	24.61 ± 1.32	26.80	24.61	22.43
Fat mass	10.58 ± 1.62	13.26	10.58	7.90
Fat free mass (kg)	31.93 ± 3.55	37.80	31.93	26.07

(±3.55) kg, which shows that women in N-W Himalayan region is malnourished and they have very lean body mass and fat free mass. Along with mean and standard deviations 95th and 5th percentiles were also calculated and presented in Table 6.

Prevalence of Chronic Energy Deficiency (CED) among farm women by physiological status: Prevalence rate of Chronic Energy Deficiency (CED) is used as a measure of (adult) nutrition and health status for any region. Nutritional status of farm women was assessed using Body Mass Index (BMI). Body Mass Index of the respondents was computed using height and weight values and subjects were classified into various categories of Chronic Energy Deficiency (James *et al.,* 1988). The nutrition deficiency disease may not essentially be due to lack of single nutrient. It may occur due to lack of more than one nutrient in the diet taken by the people for a specified duration of the year Nutrition deficiency is one of the major problems in the hilly region (Pant, 1994; Pant, 1998; Jalal *et al.,* 2001).

The findings in Table 7 and Figure 1 shows that 45 percent subjects were Chronic Energy Deficient and 22.5 percent were in the category of Low-Normal. Only 30 percent subjects were in the category of Normal. The

Table 7: Prevalence (%) of chronic energy deficiency (CED) among farm women by physiological status

BMI Grades	BMI Range	Frequency	Percentage
CED III	Less than 16	15	12.5
CED II	From 16-17	11	9.2
CED I	From 17-18.5	28	23.3
Low-Normal	From 18.5 to 20	27	22.5
Normal	From 20-25	36	30
Over weight & obesity	More than 25	3	2.5

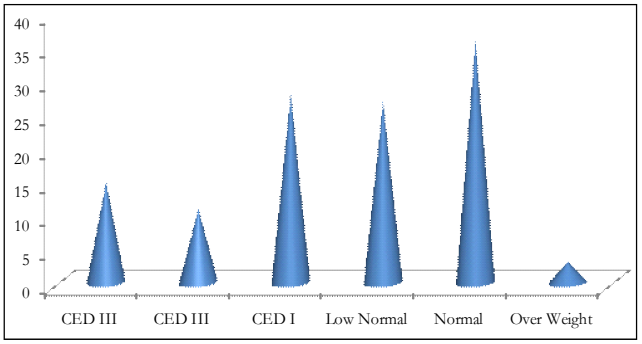

Figure 1: Chronic Energy Deficiency (CED) among farm women by physiological status

Mean Body Mass Index (BMI) of the subject was found to be 18.96 (±2.8) kg/m² with the range from 13.1 kg/m² to 25.6 kg/m².

The deficiencies restrain their physical growth and mental development and make them more susceptible to morbidity and mortality due to infectious disease. A significantly positive relationship was found between protein and Body Mass Index (0.52) at 1 per cent level. Also a significantly positive relationship was found between energy and Body Mass Index (0.58) 1 percent level (Table 8). A study also reported that in case of hill region a total of 52 per cent women were reported as Chronic Energy Deficient and 20 per cent were found to be low normal (Sharma *et al.,* 2016).

Table 8: Relationship between nutrient consumption and body mass index

Nutrients	Correlation co-efficient
Protein	0.518*
Energy	0.578*

*Significant at 1% level

CONCLUSION

The study concludes that the diet of farm women of high, mid and low hill region of Uttarakhand is inadequate in terms of energy protein and iron. It was also found that calcium and β-carotene consumption during winter was significantly higher than consumed during summer season. This is due to huge availability of green leafy vegetables like fenugreek leaves, spinach, amaranth, onion stalks, radish leaves and buck wheat. Climate of hill region of Uttarakhand is suitable for cultivation of off-seasonal vegetables. But most of the farmers are cultivating vegetables based on other traditional knowledge. There is huge yield gap in cultivation of vegetables. Off seasonal vegetable production will provide nutritional security to hill population in Uttarakhand during lean seasons. About 45 per cent respondents were Chronic Energy Deficient. The negative effects of malnutrition among women are compounded by heavy work demands, poverty, child bearing and rearing and special nutritional needs of women, resulting in increased susceptibility to illness and consequently higher morbidity. The study population being active workforce in hilly region of Uttarakhand, their health and nutritional status should be considered as an important public health issue. Creating awareness

and making them self sufficient in modifying food behavior and life style pattern within their accessible environment should be included as an intervention strategy in the regional programs.

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Use of Revolving Stool for Drudgery Reduction among Farm Women Involved in Milking Dairy Animals

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ABSTRACT

Women engaged in dairy farming maintain their own convenient posture for performing the task. Use of revolving stool has been popularized through various extension activities such as training, demonstration and field days to reduce drudgery involved in milking activity. Technology on revolving stool provided by the Department of Family Resource Management, College of Home Science, G.B. Pant University of Agriculture and Technology, Pantnagar has been used for conducting extension activities by Krishi Vigyan Kendra, Kashipur during the year 2014-15 and 2015-16. Ten demonstrations were conducted in five villages of Rudrapur block, district U.S. Nagar namely Danpur, Bhoorarani, Chattarpur, Khanpur-1 and Anandkhera-1. The observations and experiences of respondents were collected through questionnaire and field visits for its ease in operation and reduction in musculo skeletal disorders. Results revealed mean score for the parameters for two years i.e. 2014-15 and 2015-16 such as bio- mechanical- 4.3, 4.8; physical stress- 4.6, 4.6; work output-3.6, 4.0; tool factor- 4.8,4.8; field acceptability- 4.6,4.6 and the average mean score were found to be 4.38 and 4.56 whereas acceptability score was found to be 70.8 and 71.8, respectively. Percent change in knowledge pre exposure 11.36% and post exposure of training and field day it was found as 90.96%, profitability (in terms of health benefits) pre exposure 5.68% and post exposure it was found as 93.18% and awareness regarding revolving stool pre exposure -7.95% and post exposure it was found as 98.86%. The results of ten demonstrations conducted on revolving stools revealed that they were highly acceptable and relevant for drudgery reduction among farm women for milking operation of dairy animals.

Keywords: Dairy farming, Drudgery reduction, Milking, Revolving stool

INTRODUCTION

Dairy farming involves backbreaking tasks as all the activities are carried out in arduous posture. Drudgery is concerned as physical and mental strain, fatigue, monotony and hardship experienced by women (AICRP-1997-98). Milking is a strenuous activity as it requires adoption of squatting posture for longer period which induces static muscular strain in lower body extremity. Further muscles remain in a contracted state for a long time. Prolonged muscular contraction stops the flow of blood into the muscles which heads to the diminished supply of oxygen and build-up of waste products. Building up of waste products particularly carbon dioxide and lactic acid brings about a painful stage of fatigue (Sharma, 1997). The women adopt long static postures for some of the activities, which increase the static muscular effort resulting in physiological cost and low productivity. In some cases, the angle of body deviation in lumbar region is affected. Angle of body deviation from its natural alignment due to habitual error can damage the curve of backbone permanently because in pulling and pushing inter vertebral disc which join the vertebrae is torn away, making fluid (viscous fluid) to flow away sciatic nerve causing the severe sciatic pain. With the going away of discs fluid, the backbone becomes less flexible and continues to pain at the time of work and after work (Oberoi, 1997). Work related to animal husbandry is being conducted by women and major role has been played by the farm women of Punjab, Haryana,

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Gujarat and Uttarakhand in white revolution. Researchers proved that any work design or work environment that helps to perform the work with minimum energy and put minimum stress on cardio vascular system and muscular system is the best design of work (Varghese *et al.*, 1994). Deepali Chauhan (2013) carried out a study on ergonomic assessment of farm women performing weeding and winnowing operations. She assessed impact of work related risk factors of weeding and winnowing operations on anatomical body structure of female. Muscular and postural stress were observed higher in weeding operation as compared to winnowing operation. It may be due to squatting poster adopted by females during weeding operation. Panwar and Gupta (2008) carried out a study on appropriateness of drudgery reducing technologies as perceived by farm women. They reported that use of serrated sickle and wheel hoe as highly appropriate technologies in terms of drudgery reduction. So working posture becomes an important factor while designing ergonomically sound tools and equipment. Use of improved tools for performing the selected activities reduce the angle of deviation of the back and minimize the muscular efforts to perform the task. Lower muscular efforts lead to lower fatigue. Therefore, improved tools for performing the selected activities are beneficial because they lead to the reduction of drudgery and reduce the muscular stress and help the women to adopt correct posture work and also reduce the angle of deviation. Corlett *et al.* (1983) showed the effect of poor working posture in order to perform task could lead to postural stress, fatigue and pain which may in turn force the operator to stop work until the muscle recovers. Pinzke *et al.* (2001) opined that the high muscle loads in combination with extreme positions and movements of the hand and forearm might contribute to the development of injuries among milkers. Tripathi and Pandey (2011) reported 26 per cent saving in cardiac cost of women workers per unit of out put for milking a buffalo using a revolving stool as compared to the continuous squatting position while milking an animal traditionally. Naik and Sumangala (2015) reported that there was a significant reduction in energy expenditure, physiological cost of work, total cardiac cost of work, time taken and body angles when the activities were carried out by using drudgery reducing tools i.e., revolving stand and stool for milking activity and Gopal khore spade in cleaning of animal shed activity. Therefore, improved tools for performing the selected activities are beneficial because they lead to the reduction of drudgery, reduce the muscular stress, help the women to adopt correct posture work and also reduce the angle of deviation. The use of revolving stool may significantly reduce the physiological and muscular cost of milking activity. Appropriate height of the stool improves the posture, therefore reduces the musculoskeletal problems of women while performing the activity. Benefits of stools have been realized because use of revolving stool saves energy and heart speed upto 6 percent. It helps in maintaining posture (spinal cord) and hence reduces the problem of backache. It provides comfort to legs and knees and thus helps in reduction of pain in legs. It reduces the load on heart upto 13.48 percent during working time and reduces energy expenditure upto 8.75 per cent. This type of stool can be easily made by local carpenter hence cost of the stool can also be reduced by using wooden or tin plate instead of steel. Ball bearing type of stool makes convenience in movement. Revolving stool can be used contrary to squatting posture of worker engaged in milking operation to reduce the work stress of dairy workers involved in milking which was designed as per the sitting height measurements of females.

MATERIALS AND METHODS

Creation of awareness towards the use of revolving stool for drudgery reduction: This was achieved by the following methods:

- Frequent visits made by the home scientists of Krishi Vigyan Kendra, Kashipur to the field sites.
- Continuous and healthy discussions with the farm women during field visits on need and importance of drudgery reduction.
- Creating awareness by conducting trainings and demonstrations on related aspects of drudgery reduction.
- Field day organized by the home scientists to motivate other farm women. The purpose was to introduce a new idea and to stimulate the interest of as many farm women as possible to offer general guidance to answer questions and queries for popularization and adoption of revolving stool.
- Technical and scientific guidance provided to each farm women in using revolving stool
- Demonstrations conducted on the use of revolving stool.

Selection of farm women for demonstrations and training: Ten physically fit farm women belonging to 24-48 yrs of age were purposively selected from Danpur, Chattarpur, Bhoorarani, Khanpur-1 and Anandkhera-1 villages of Rudrapur block, district Udham Singh Nagar, Uttarakhand state for conducting demonstrations possessing dairy animals viz cows and buffalos for milk production. The technology provided by the Department of Family Resource Management, College of Home Science has been used for conducting demonstrations on revolving stool through various extension activities such as training, demonstration and field days. Ninety women were randomly selected for imparting trainings, field day and for identifying the factors and attributes in production system that prioritizes the use of revolving stool for milking activity. These extension activities were organized by Krishi Vigyan Kendra, Kashipur during the year 2014-15 and 2015-16 to motivate other farm women towards using revolving stool for milking activity.

Method of data collection: The observation and experiences of respondents were collected through a questionnaire (Table 1) and field visits as far as its ease in operation and reduction in musculo skeletal disorders were concerned. The information was collected from the farm women purposively selected for conducting demonstrations. These farm women were interacted during field visits and other extension activities for

Table 1: Statements to measure user opinion on the improved technology after ergonomic intervention

Activity: Milking Technology: Revolving Stool

S.No.	Statements	HR	R	N	IR	HIR
Bio Mechanical	I feel					
1	I am able to maintain comfortable body posture at sitting position while using the revolving stool					
2	Twisting of trunk while doing the activity was minimized with the use of the revolving stool					
3	I could synchronize the movements of the animal					
Physiological Fatigue/Physical Stress	I feel					
4	No pains and cramps in the region of my body after performing the activity with the revolving stool					
Work Output	I Feel					
5	The tool is effective as per time cost					
6	The revolving stool is effective in improving the production efficiency					
Tool Factor	I feel					
7	The milking activity is light enough when I use the revolving Stool					
8	The height of the revolving stool needs to be adjusted to my working height					
9	The revolving stool is compact enough to store					
10	Easy to maintain or repair this tool					
11	The revolving stool serves multiple purposes					
12	The revolving stool is stable while sitting and performing the activity					
13	It is difficult to move the revolving stool on uneven grounds					
14	The seat of revolving stool is smooth and soft					
Field Acceptability	I feel					
15	The improved tool is a good replacement to the existing work practice					
16	I shall possess the revolving stool					
17	The tool requires modification					

HR = Highly Relevant; R = Relevant; N = Neutral; IR = Irrelevant; HIR = Highly Irrelevant