Original Article

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Effect of Flaxseed on Pain Relief and Quality of Life in Patients With Mastalgia: A Single Arm Interventional Study

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ABSTRACT

Objective: Mastalgia, a common complaint among women, denotes breast discomfort that can manifest as cyclical or non-cyclical. Reassurance, mechanical support and various non-pharmacological treatments, like flaxseeds, have been seen to have a good effect in treating mastalgia. Thus, the aim of this study was to investigates the efficacy of flaxseed in alleviating pain associated with mastalgia and its impact on the overall health-related quality of life among female patients.

Materials and Methods: Conducted at a tertiary care center in Northern India over 18 months, it employed a single-arm interventional design. The participants included females aged 18 years and older presenting with breast pain at the Department of General Surgery. The intervention involved daily consumption of 30 g of milled flaxseed for each participant, administered over a period of six months. Pain severity was assessed using the visual analogue scale (VAS) before supplementation and at follow-up intervals up to six months. Concurrently, the Short Form-12 (SF-12) items Health Survey measured health-related quality of life, encompassing both physical and mental health domains. Statistical analysis employed parametric (paired t-test) and non-parametric tests (chi-square, McNemar) where appropriate, with statistical significance set at $p<0.05$.

Results: Two hundred women with mastalgia were included with a significant reduction in mean VAS scores from 6.03±0.83 at baseline to 2.19±0.66 at six months post-intervention ($p = 0.0001$). This reduction in pain intensity demonstrated a positive correlation with duration of flaxseed supplementation, notably declining after the initial three months. The mean difference in physical and mental SF-12 score at first visit and at 6 months after intervention was significant ($p = 0.0001$).

Conclusion: This study underscores the potential of flaxseed as a therapeutic option for managing mastalgia and enhancing health-related quality of life among affected individuals.

Keywords: Flaxseed; mastalgia; pain measurement; quality of life; SF-12

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Key Points

- Mastalgia, a common complaint among women, denotes breast discomfort that can manifest as cyclic or non-cyclic. Reassurance, mechanical support and various non-pharmacological treatments like flaxseeds have been seen to have a good effect in treating mastalgia. So, the aim of this study was to investigates the efficacy of flaxseed in alleviating pain associated with mastalgia and its impact on the overall health-related quality of life among female patients.

Introduction

Mastalgia, a common complaint among women, is the term used to describe breast discomfort. Mastalgia may be cyclical or non-cyclical (1). While the exact etiology of mastalgia remains multifactorial and often elusive, hormonal fluctuations, particularly in relation to the menstrual cycle, are frequently implicated. Furthermore, lifestyle factors, such as stress, caffeine intake, and diet have been suggested as potential contributors to its prevalence (2). The complex interplay of physiological, psychological, and environmental factors underscores the need for tailored approaches in understanding and managing this prevalent breast-related symptomatology (3).

Reassurance, mechanical support and various non-pharmacological treatments, like flaxseeds, have been seen to have a good effect in treating mastalgia (4, 5). The seeds of flax (*Linum usitatissimum*) have garnered attention for their potential impact on various aspects of human health. Rich in alpha-linolenic acid (ALA), a plant-based omega-3 fatty acid, flax seeds have been associated with cardiovascular benefits, such as a reduction in blood pressure and improvement in lipid profiles (6). In addition, the lignans present in flax seeds, particularly secoisolariciresinol diglucoside, exhibit antioxidant properties and may contribute to anti-inflammatory effects within the body (7). The soluble fibre content of flax seeds, primarily in the form of mucilage

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gums, has been linked to gastrointestinal health by promoting regular bowel movements and potentially mitigating constipation (7, 8). Thus there is evidence that flaxseed helps in overall improvement in quality of life of an individual. There is a paucity of literature concerning the use of flaxseed for treating mastalgia and its effect on overall health. Therefore, the aim of this study was to measure the effect of flaxseed in reducing pain in mastalgia and the role of daily flaxseed intake in overall health related quality of life in patients with mastalgia.

Materials and Methods

Study Design and Setting

This was a **s**ingle arm, interventional study conducted at the Department of General Surgery of a tertiary care centre in Northern India over a period of 18 months.

Study Participants

Any female patient, aged 18 years or above, coming to the Department of General Surgery with breast pain was eligible as a subject for this study. Those who were pregnant, who had not yet achieved menarche, skipped medication for three consecutive days or five periodic days, or with a history of breast cancer or congenital anomalies were excluded from the study. Those unwilling to participate were also excluded from the study.

Sample Size: For the purpose of sample size estimation, two studies were used (9). The sample size formula used was:

$X= (Z_{1-a/2 +} Z_{1-\beta}) * 2\ \sigma^2/d^2$,

$Z_{1-a/2}$ – critical value of the normal distribution at a/2 (for a confidence level of 95%, a = 0.05 and the critical value was 1.96.

$Z_{1-\beta}$ - critical value of the normal distribution at β (for power of 80%, β = 0.2 and the critical value was 0.84.

σ^2- Pooled variance calculated using the change in mean visual analogue scale (VAS) score before and after taking flaxseed (value was 1.25).

d- hypothesized difference (difference in the mean in the intervention group from baseline) (value was 0.6) (9).

To detect a hypothesized difference of 0.6 units in the outcome measure, at 80% power and 95% confidence interval, the required minimum sample size was 171. Taking an estimated 10% drop out rate, the final sample size was a minimum of 188 patients.

Study Procedure

Any female patient presenting with the complaint of breast pain and aged over 18 years was eligible. After applying exclusion criteria the remaining women were instructed in the use of the VAS, and written and informed consent was obtained. After that a detailed history was taken, including breast pain history, followed by a thorough physical examination. Investigations, such as breast ultrasonography (USG) including axilla USG if indicated, mammography and fine needle aspiration cytology was advised as per patient's symptoms andsigns.

Mechanical support and reassurance were given to all the patients by counselling her that symptoms are not associated with any major or serious breast conditions, especially cancer. Reassurance was also supported by normal findings on investigation. Each woman received 30 g of milled flaxseed, which was taken with a glass of water, juice, milk, soup or yogurt daily. Severity of pain was assessed before supplementation of flaxseed and every follow-up up to 6 months after starting supplementation of flaxseed.

Flaxseed used in this study was milled and consumed by dissolving it into a glass of water using a tablespoon (1 tbs~15g x2) per day. It should be noted that we did not measure the composition of the flaxseed used in our study. Instead, we obtained this information from the literature. A measure of 10 g ground flaxseed supplement was reported to provide approximately 50 kcal, 2.4 g of protein, 3.6 g of fat (50–60% α- linolenicacid), 2.4 g of carbohydrate, and 2.2 g of dietary fibre (including 1.2 g of soluble fibre) (8). Each of these measures should be increased three-fold for the daily doses received by the participants in ous study.

Tablet Paracetamol 650 mg was given for patient on SOS if the pain was of severe intensity. Quantity of tablet Paracetamol consumed was noted.

Health-related quality of life was measured using the The Short Form-12 (SF-12) Health Survey. SF-12 items Health Survey is a condensed version of the Short Form-36 (SF-36) items Health Survey, designed to gauge an individual's subjective perception of health as biopsychosocial well-being. The SF-12 addresses various aspects of physical health (e.g., "Have you experienced difficulties, such as climbing flights of stairs, in your work or daily activities due to your physical health?") and mental health (e.g., "Have you felt down-hearted and blue?"). The overall scores generate a physical health index (PSF-12) and a mental health index (MSF-12), with lower scores indicating higher levels of disability. In the current sample, both subscales demonstrated adequate internal consistency (PSF-12: ω = 0.80; MSF-12: ω = 0.85) (10).

A predesigned proforma, especially designed for this study, was used to record relevant information for each individual patient.

Statistical Analysis

The effect of flaxseed was defined by either a reduction in the severity of pain to lower pain or a decrease in pain duration (days) based upon the VAS scale. In the statistical analysis, parametric or non-parametric tests were used, as appropriate. The parametric tests used was the paired sample t-test and the non-parametric test was chi-square and the McNemar test. A value of p<0.05 was considered to be statistically significant. R statistical software, version 4.2.1 used for statistical analysis.

Informed consent was obtained from all the participants. Ethical approval for the study was obtained from the Dr. Ram Manohar Lohia Institute of Medical Sciences Ethical Committee (approval number: 96/22, date: 15.09.2022). Confidentiality in respect of participating patients was maintained.

Results

A total of 200 women with mastalgia were treated with flaxseed. The mean age of the study population was 34.3±4.7 years. Most of the study participants lived in urban areas (70.5%), a quarter were illiterate (25.5%) followed by intermediate level of education (23%). Moreover, 60% were unemployed and 90.5% were married. Most of the study participants were of lower middle socio-economic status (28%) followed by middle socioeconomic status (22.5%). Of 200

patients, 104 (52%) were in the normal weight body mass index (BMI) category 18.5–24.9 kg/m^2 (Table 1).

Most of the study participants were multiparous (94%) and 93% had breastfed their babies. With respect to menstrual history, 82.5% had normal bleeding, 85% had normal regularity and 73% were painless (Table 2). The mean VAS score at first visit was 6.03±0.83. At one month after flaxseed administration mean VAS was 4.00±0.79 and at three and six months after flax seed administration, VAS was 2.72±0.63 and 2.19±0.66, respectively. This difference in mean VAS scores at various intervals was significant (p = 0.0001) (Table 3).

Table 1. Baseline characteristics of the study participants (n = 200)

Variable		*n*	%
Residence	**Rural**	59	29.5%
	Urban	141	70.5%
Education	**Illiterate**	51	25.5%
	Primary	41	20.5%
	Secondary	30	15%
	Intermediate	46	23%
	Graduate and above	32	16%
Employment	**Employed**	78	39%
	Unemployed	122	61%
Marital status	**Married**	181	90.5%
	Unmarried	19	9.5%
Socioeconomic status	**Lower**	42	21%
	Lower middle	56	28%
	Middle	45	22.5%
	Upper middle	31	15.5%
	Upper	26	13%
Body mass index	**<18.5 kg/m^2**	11	5.5%
	18.5–24.9 kg/m^2	104	52%
	25–29.9 kg/m^2	76	38%
	>30 kg/m^2	9	4.5%

Table 2. Distribution of study participants on the basis of menstrual and birth history

Variable		*n*	%
Parity	**Nulliparous**	12	6.0%
	Multiparous	188	94.0%
Breast feeding	**No**	14	7%
	Yes	186	93%
Menstrual bleeding	**Scanty**	8	4%
	Normal	165	82.5%
	Heavy	27	13.5%
Menstrual regularity	**Polymenorrhea**	8	4%
	Normal	170	85%
	Oligomenorrhea	22	11%
Pain during or before menstruation	**Painless**	146	73.0%
	Painful	54	27.0%

The mean difference of VAS score from baseline to one month after flax seed administration was 2.03±0.78. This difference in mean VAS score had a positive and strong correlation (r = 0.646; p = 0.0001). The mean difference of VAS score from first visit to 3 months after flax seed administration was 3.31±0.96. This difference in mean VAS score had a moderate positive correlation (r = 0.542; p = 0.0001) The mean difference in VAS score from first visit to six months was 4.120.95±, again with a moderate positive correlation (r = 0.565; p = 0.0001) (Table 4).

Changes in mean VAS scores among the 200 women with mastalgia, categorized by BMI grouping (underweight, normal, overweight and obese) were compared (Table 5). At the first visit, mean VAS scores were slightly higher in participants with higher BMI, but the differences were not significant. At three months, pain levels decreased across all BMI categories, with higher BMI groups still reporting slightly higher pain, yet without significant differences between the groups. By six months, pain reduction was sustained, and VAS scores were similar across all BMI groups, showing no significant differences. Overall, pain levels decreased over time regardless of BMI, indicating that BMI did not significantly influence the change in pain levels. The mean improvement in physical and mental SF-12 score at first visit and at six months after intervention was significant (Table 6).

Discussion and Conclusion

Our study prospectively assessed women with mastalgia and advised intake of 30 g of flaxseed daily for six months to assess its role in relieving mastalgia. During the study period 74 females with mastalgia with no underlying cause were enrolled.

The mean age of women in our cohort with mastalgia was 34.3±4.7 years which was similar to the age reported by Fakhravar et al. (11), and Mohammed (12), in their studies, suggesting that the most

Table 3. Descriptive statistics VAS score of study participants at first visit and at follow-up after intervention

Visual analogue scale	Mean ± standard deviation	Greenhouse geisser value	*p*
First visit	6.03±0.83	0.613	**0.0001**
1 month	4.00±0.79		
3 months	2.72±0.63		
6 months	2.19±0.66		

Table 4. Change in VAS at various follow-up from baseline

VAS	Mean difference ± standard deviation	Correlation coefficient *(r)*	*t*-value	*p*
VAS First visit & VAS 1 month	2.03±0.78	0.646	9.480	**0.0001**
VAS First visit & VAS 3 month	3.31±0.96	0.542	22.474	**0.0001**
VAS First visit & VAS 6 month	4.12±0.95	0.565	21.726	**0.0001**

VAS: Visual analogue scale

Table 5. Change in mean VAS at each follow-up based on the BMI of the study participants

VAS	BMI (kg/m²)				*p*
	<18.5	18.5–24.9	25–29.9	≥30	
First visit	6.01±0.27	6.11±0.21	6.32±0.56	6.66±0.41	0.414
3 months	2.45±0.13	2.96±0.71	3.61±0.84	3.74±1.01	0.312
6 months	2.11±0.49	2.28±0.68	2.35±0.77	2.37±0.61	0.992

VAS: Visual analogue scale; BMI: Body mass index

Table 6. Effect of flaxseed on overall quality of life of study participants

SF-12 score	First visit	After 6 months of treatment	*p*
Physical SF-12 score	56.03±15.83	83.36±7.61	0.0001
Mental SF-12 score	64.71±11.79	84.27±5.32	0.0001

SF-12: Short Form-12

common occurrence of mastalgia was seen around 35 years of age and this was statistically significant. Moreover, the majority of the patients with mastalgia in our cohort were married and this was in agreement with Fakhravar et al. (11) and Sunil Krishna and Shenoy (13).

Flax is notable as a major source of lignans, one of the phytoestrogens. Lignans can act as both agonists and antagonists to estrogen and also have antioxidant properties. As a result, flaxseed and its lignans can produce strong anti-estrogenic effects on estrogen receptors (14). In addition, flaxseed is rich in other phytoestrogens, which are effective in reducing symptoms of premenstrual syndrome, such as headaches and premenstrual breast tenderness (15). Research by Goss et al. (16) found that consuming 25 g of flaxseed daily significantly alleviates cyclical breast pain. Similarly, Rosolowich et al. (17) recommended flaxseed as the primary treatment for cyclical breast pain.

There was a significant reduction in mean VAS score from first visit to six months of flax seed intake. We also observed that there was a positive correlation between VAS score reduction from baseline to the first, third and six months of flax seed intake. Studies have shown the positive effects of phytoestrogens such as soy phytoestrogens (18, 19) in alleviating cyclical breast pain. Phytoestrogens have structural similarities to 17-estradiol and selectively influence estrogen receptors (20). Traditionally, flaxseed has been used to relieve cyclical breast pain and menopausal symptoms in humans and these authors proposed the hypothesis that the hormonal effects of flaxseed might improve symptoms of cyclical breast pain and tenderness.

Vaziri et al. (9) investigated the effects of flaxseed and omega-3 fatty acids on mastalgia. They demonstrated that flaxseed significantly reduced the mean score of cyclical breast pain compared to omega-3 fatty acids. In their study, 61, 60, and 60 women, respectively, were given flaxseed used to make bread, omega-3 fatty acids as pearls, and wheat bread as part of their diet for two menstrual cycles. Participants could consume the bread slices in one or three meals as preferred. Flaxseed and wheat bread were produced by the same companies, and the intervention method for wheat bread was identical to that of flaxseed. The results indicated that a flaxseed bread diet effectively reduced cyclical mastalgia and could be recommended to women as a straightforward treatment with minimal complications (9). Similarly, Godazandeh et al. (21) observed a significant reduction in VAS score (p<0.001) after using flaxseed oil to treat mastalgia from baseline to two months.

Flaxseed contains essential unsaturated fatty acids that stimulate the synthesis of omega-3 fatty acids. This process results in a decrease in the production of certain arachidonate metabolites, leading to the generation of eicosanoids with reduced pro-inflammatory effects. Eicosanoids derived from omega-3, which is present in flaxseed, demonstrate anti-inflammatory properties, contrasting with the inflammatory nature of omega-6 found in evening primrose. Furthermore, flaxseed is rich in lignan, an antioxidant that inhibits aromatase enzyme activity. This inhibition reduces estrogen production, thus playing a role in preventing estrogen-related cancers like breast cancer (22). The chemical structure of lignans is akin to estrogen receptor selective modulators like tamoxifen, a hormonal drug treatment for periodic breast pain (23).

Flaxseed is gaining recognition as a crucial functional food ingredient due to its abundant content of α-linolenic acid (ALA, an omega-3 fatty acid), lignans, and fiber. Flax protein contributes to the prevention and treatment of heart disease and supports immune system function, offering potential benefits for conditions such as osteoporosis, autoimmune disorders, and neurological conditions (24).

In the present study, flaxseed intake notably enhanced the quality of life for mastalgia patients across both physical and mental domains. Patients reported an overall health improvement, including alleviation of lower back pain, increased stamina, and reduced hair fall in many cases. In those patients who had dysmenorrhoea and irregular menstrual cycle also had improvement in their menstrual abnormalities. Prior studies had not investigated the impact of flaxseed on quality of life, though mastalgia's effect on quality of life had been examined. Kanat et al. (25) discovered that patients with mastalgia, assessed using the SF-36 questionnaire, had lower quality of life compared to a control group without mastalgia, with significant differences observed in physical function (p = 0.04), body pain (p = 0.02), general health (p = 0.03), and energy (p = 0.008). Another study compared quality of life between eastern and western populations in Turkey. Based on SF-36 results, the mean scores for physical function, physical role difficulty, and social function were significantly lower in the eastern group than in the western group (p = 0.029, p = 0.002, and p = 0.001, respectively). The mean scores in both groups were comparable to the baseline mean SF-36 scores in the present study (26). Although these studies didn't assess pre-post changes in SF-36 scores following intervention, they did highlight the lower quality of life scores among mastalgia patients.

The limitation of our study was that sample size was less which does not allow the generalisability of the results. Secondly, there was no control group to compare with. The results of the current study when compared with a control group would give a better insight towards the role of flaxseed in treating mastalgia. No scales were used to measure the patient's anxiety and depression, a limitation which should be addressed in further studies of the effect on qulaity of life with control groupsc to assess the effect of flaxseed intake in patients with mastalgia.

Evidence suggests that flax seed is beneficial in treating mastalgia and also has other benefits. The only drawback observed in our study participants was that, because of an intake of 30 g of roasted flax seed powder (approximately two tablespoons daily), it was difficult to swallow and prepare. Some participants also complained of increased stomach acidity due to flax seed powder intake. Other studies have used flaxseed in other forms, such as baked into bread to make it palatable. It was also observed that participants had a better digestion, lesser hair fall and reduced back ache after long term use of flax seed.

Ethics Committee Approval: Ethical approval for the study was obtained from the Dr. Ram Manohar Lohia Institute of Medical Sciences Ethical Committee (approval number: 96/22, date: 15.09.2022).

Informed Consent: Informed consent was obtained from all the participants.

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