J Hum Ecol, 39(1): 19-25 (2012)
PRINT: ISSN 0970-9274 ONLINE: ISSN 2456-6608 DOI: 10.31901/24566608.2012/39.01.03

# An Epidemiological Study to Assess Fatigue Patterns at Kitchen Workstation

**Hema Bhatt* and M. Sidhu**

*Department of Family Resource Management, Punjab Agricultural University, Ludhiana, Punjab, India*
**E-mail: hemabhatt2000@gmail.com*

**KEYWORDS** Cooking Activities. Ergonomics. Anthropometric. Fatigue. Work Station

**ABSTRACT** Kitchen fatigue, according to scientific research, results from the endless retracing of steps and the back strain involved in continually bending, stooping, and stretching. Lifting and carrying heavy items or pushing and pulling can be a major source of back pain, while forceful or repetitive activities and poor posture can be linked to upper limb injuries. This paper describes the results of a study done to assess the fatigue felt by women in existing kitchen workstation. An epidemiological approach was adopted wherein the respondents were investigated about the time spent, posture adopted and body part where fatigue was felt etc. Results revealed that about 82.5 per cent of the respondents spent 5 to 7 hours per day in the kitchen activities. Most of the activities were performed in standing and sitting posture and very few activities like sieving where squatting posture (38.75 per cent) was adopted by the respondents. While performing the various kitchen activities mostly fatigue was felt in forearm and wrist. The maximum respondents felt fatigue, in activities like grating (40.00 per cent), kneading (38.75 per cent), dish washing (37.50 per cent) and rolling (33.75 per cent).

## INTRODUCTION

Women's work demands a high degree of physical efforts leading to fatigue and frustration. There is a large amount of energy spent, demands on the body due to the different types of activities. The manner in which these activities are performed leads the body segment to be manipulated in the space, and thus results in change in posture leading to increase in physiological cost of work, stress and fatigue. Many homemakers perform cooking activities in their own convenient posture. The static muscular efforts and incorrect posture if sustained for a long period of time can give rise to various types of health and musculoskeletal problems, wear and tear of muscles, tissues and ligaments can harm the neck, shoulders, arms, legs, wrists, and back. Haukka et al. (2008) undertook activity on co-occurrence of musculoskeletal pain among female kitchen workers. They concluded that there is widespread co-occurrence of musculoskeletal pain among female kitchen workers with slight predominance in the upper body. The fact that by keeping the body of the worker in natural alignment, the stress and strain of the women can be minimized without any excessive human input. Poorly designed work surface in terms of counter height, width and depth and kitchen storage space causes permanent body damage besides increasing the work hence it should be given careful attention (Kistwaria et al. 2007). Wrongly designed posture induces improper postures, leading to operational uneasiness and strain while working (Kumari and Dayal 2009). It may also result in permanent change in spine, in position of the joints, muscles, ligaments and tendons as well as in location of the organs of the body, thus enhancing the physiological cost of work and fatigue. Working in kitchen put a lot of stresses on women especially if conducted in awkward postures and poor work environment. Major cause of poor work practices was unconsciousness, unawareness and poor infrastructure of storage and work counter (Laddha and Shraddha 2007). Hence the study aims to analyze the fatigue and various other problems faced by the female workers while performing different kitchen activities at kitchen workstation.

## MATERIAL AND METHODS

Present study was conducted in Ludhiana district of Punjab State. A representative sample of 80 homemakers 40 each from east and west zones of Ludhiana district were selected for the study. The investigation adopted a self- structured interview schedule for collection of data. The interview schedule consisted of two main parts. First part dealt with socio-economic status of the family which gathered information re-

lated to occupation, education, income, family type and family size etc. Second part dealt with specific information like total time spent in kitchen activities, posture adopted during work, body part where fatigue is felt etc. Data for the study were collected through personal interview method. The data collected were tabulated and suitable statistical tools such as frequency, averages, and percentages were used for analysis of data.

## RESULTS AND DISCUSSION

### Demographic Characteristics of the Selected Respondents

Data revealed that the average age of the selected respondents was 38 years, the average height 156 cm, and the average weight was 58 kg. Majority of the respondents were graduates, that is, 70 per cent, followed by respondents who had qualification up to matriculation (16.25 per cent) and the least number (2.50 per cent) of respondents were having professional degree of doctorate. Further it was observed that most of the respondents were housewives (56.25 per cent), 35 % were self- employed and about 8.75 % were in government or private jobs (Table 1).

**Table 1: Personal profile of the respondents**

| *Respondents' profile* | *Number (n=80)* | *Percentages* |
|---|---|---|
| *Age (yrs)* | | |
| 26 – 35 | 27 | 33.75 |
| 35 – 45 | 36 | 45.00 |
| Above 45 | 17 | 21.25 |
| Average age: 38 yrs | | |
| *Height (cm)* | | |
| 145 – 155 | 37 | 46.25 |
| 155 – 165 | 28 | 35.00 |
| Above 165 | 15 | 18.75 |
| Average height: 156 cm | | |
| *Weight (kg)* | | |
| Below 55 | 10 | 12.50 |
| 55 – 65 | 46 | 57.50 |
| 65 – 75 | 24 | 30.00 |
| Average weight: 58 kg | | |
| *Qualification* | | |
| High school | 13 | 16.25 |
| Graduate | 56 | 70.00 |
| Post-graduate | 9 | 11.25 |
| Doctorate degree | 02 | 02.50 |
| *Occupation* | | |
| Housewife | 45 | 56.25 |
| Self-employed | 28 | 35.00 |
| Pvt. job | 03 | 03.75 |
| Govt. job | 04 | 05.00 |

### Family Background Information of the Respondents

It can be observed from the Table 2 that 56.25 per cent of the respondents were having annual family income more than Rs. 2.5 lakhs, only 20% respondents were having annual family income less than Rs. 1 lakh. As we know, that urbanization and industrialization have led to more number of nuclear families especially in urban areas. Similar trend was observed in the selected samples. Majority of the respondents were from nuclear families (86.25 per cent) and rest were from joint families. Family size varied from 2 to 8 and more but most of the respondents had 2 to 4 family members (60 per cent) in their family.

**Table 2: Family profile of the respondents**

| *Family profile* | *Number (n=80)* | *Percentages* |
|---|---|---|
| *Annual Family Income* | | |
| Less than 1 lac | 16 | 20.00 |
| 1 to 2.5 lac | 19 | 23.75 |
| More than 2.5 lac | 45 | 56.25 |
| *Family Type* | | |
| Nuclear | 69 | 86.25 |
| Joint | 11 | 13.75 |
| *Family Size (No.)* | | |
| 2 to 4 | 48 | 60.00 |
| 5 to 7 | 17 | 21.25 |
| 8 and above | 15 | 18.75 |

### Family Composition of the Respondents

Data pertaining to family composition is depicted in Table 3. It reveals that the number of adult males varied from 1 to 5 with majority of families having 1 male (60.00 per cent). Number of adult females was either 1 or 2 with majority of families having 1 female (73.75 per cent). In most of the families 2 male children and one female child (55 per cent and 53.75 per cent respectively) were there. Further, it may also seen that majority of the respondents' families had no elderly member in their family.

### Average Time Spent for Doing Kitchen Activities

In the recent years, a major shift is taking place in the amount of time the homemaker gives to kitchen activities. The time is decreasing gradually due to many reasons like; employment of women, increased use of equipment in kitchen, trend of fast food and ready to make foods, being the important ones. But even today despite women's high educational levels and increasing

**Table 3: Family composition of the respondents**

| *Family composition* | | *Number of members* | | | | |
|---|---|---|---|---|---|---|
| | | *0* | *1* | *2* | *3* | *5* |
| Adult | Males | - | 48 (60.00) | 19 (23.75) | 11 (13.75) | 2 (2.50) |
| | Females | - | 59 (73.75) | 21 (26.25) | - | - |
| Children | Males | - | 8 (10.00) | 44 (55.00) | 28 (35.00) | - |
| | Females | 14 (17.50) | 43 (53.75) | 20 (25.00) | 3 (3.75) | - |
| Elderly | Males | 71 (88.75) | 9 (11.25) | - | - | - |
| | Females | 70 (87.50) | 10 (12.50) | - | - | - |

Figures in parenthesis indicate percentages.

engagement in the paid work force, they still have the main responsibility for household and child care and have to spend a much time at kitchen activities. Table 4 highlights that majority of the respondents, that is, 58.75 per cent spend 5 to 7 hours per day in the kitchen activities, 31.25 per cent 3 to 5 hours and only 10 per cent spend less than 3 hours for performing kitchen activities.

**Table 4: Average time spent per day for performing kitchen activities**

| *Average Time spent (hrs per day)* | *Number* | *Percentage* |
|---|---|---|
| Less than 3 | 8 | 10.00 |
| 3 to 5 | 25 | 31.25 |
| 5 to 7 | 47 | 58.75 |

Average time spent : 6 hrs

## Posture Adopted During Different Activities

The investigation found that all the respondents (100%) had standing type of kitchen. So in these kitchen workstations one has to stand for a long time. Prolonged standing in the same position on a hard surface decreases the blood circulation in the legs. The muscles of the legs tend to become constricted and the blood circulation is reduced in the constricted muscle area. When one stands, gravitational force acts on your body and all the fluids in the body flow towards your legs. The heart has to pump blood faster, which results in fatigue and you get stressed out at the end of the day after cooking.

Working in standing type of kitchen has its own set of disadvantages for Indian women. This type of kitchen is more suitable in western culture because their cooking is less laborious and less time consuming. They generally do not get into elaborate food preparations unlike Indian concept in which women have to stand for prolonged hours due to typical, conventional and tedious way of cooking, particularly *chapatti*-making and *dosa*- making. Table 5 gives the information regarding the time spent and posture adopted during the performance of individual

**Table 5: Time spent and posture adopted while performing different activities**

| *Activity* | *Duration of activity* | | | *Posture adopted** | |
|---|---|---|---|---|---|
| | *3-5 min* | *5-15 min* | *More than 15 min* | *Sitting* | *Standing* |
| Boiling | 43 (53.75) | 30 (37.50) | 07 (8.75) | | 80 (100) |
| Sieving | 80 (100) | - | - | 49 (61.25) | 15 (18.75) |
| Kneading | - | 72 (90.00) | 08 (10.00) | 69 (86.25) | 11 (13.75) |
| Peeling | - | 76 (95.00) | 04 (5.00) | 65 (81.25) | 15 (18.75) |
| Cutting | - | 48 (60.00) | 32 (40.00) | 65 (81.25) | 15 (18.75) |
| Washing Vegetables | 80 (100) | - | - | - | 80 (100) |
| Rolling | - | 21 (26.25) | 59 (73.75) | - | 80 (100) |
| Puffing | - | 21 (26.25) | 59 (73.75) | - | 80 (100) |
| Stirring | 80 (100) | - | - | - | 80 (100) |
| Grinding | 76 (95.00) | - | 04 (5.00) | 04 (5.00) | 76 (95.00) |
| Grating | - | 06 (7.50) | 74 (92.50) | 13 (16.25) | 67 (83.75) |
| Dish washing | - | 68 (85.00) | 12 (15.00) | - | 80 (100) |

*Multiple responses; Figures in parenthesis indicate percentage

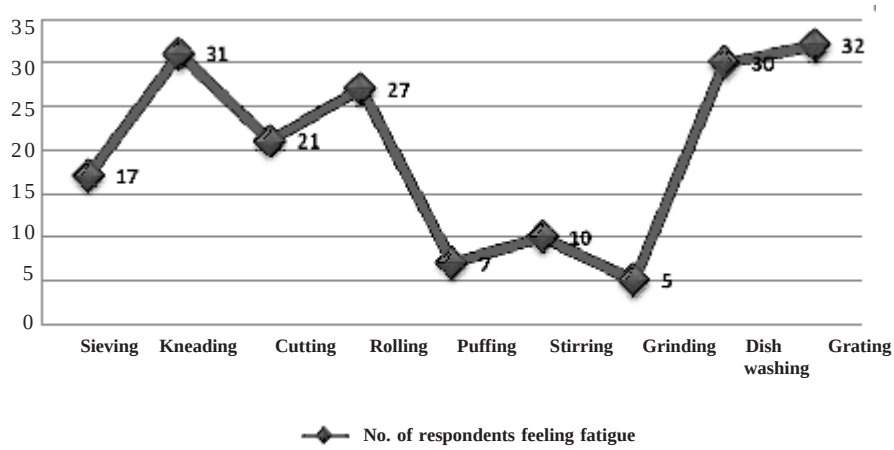


**Fig. 1. Distribution of respondents according to fatigue experienced while performing different activities**

activities in the selected kitchens. It was observed that most of the respondents gave least time, that is, approximately 3 – 5 minutes to activities like sieving, washing vegetables, stirring, grinding and maximum time of more than 15 minutes was given to activities like kneading, dish washing, rolling, cutting, and grating.

Further, it was observed that most of the activities were performed in standing and sitting postures and very few activities like sieving where squatting posture (20.00 per cent) was adopted by the respondents. In a similar study by Khatoon et al. (2007), they reported that majority of the respondents adopt bending posture from bringing utensils from kitchen to cleaning area and 70 per cent respondents adopted sitting with bending posture for scrubbing the utensils.

## Perceived Fatigue in Different Body Parts

At kitchen workstation there are many tasks that, without proper controls, can cause back pain or upper limb injuries that can affect hands, wrists, shoulders and neck. Figure 1 shows the number of respondents who reported fatigue while performing different activities. Further Table 6 gives the information regarding the various body parts where the fatigue was felt and reported by the respondents. It was observed that minimum number of respondents complained fatigue while performing activities like puffing *chapattis* (8.75 per cent), stirring (12.50 per cent) and sieving (21.25 per cent). While performing the above mentioned kitchen activities fatigue was felt by the homemakers forearm and wrist. Figure 1 shows that the maximum respondents felt fatigue, while performing activities like grating (40.00 per cent), kneading (38.75 per cent), dish-washing (37.50 per cent) and rolling *chapattis* (33.75 per cent). During these activities trouble spots disclosed were mainly the wrist, fore arm, followed by discomfort in the shoulders, upper arm, lower back and neck. The amount of exertion perceived by the sample during performance of selected kitchen activities showed a linear relationship with heart rate and energy expenditure.

The findings of similar studies conducted by Mundt et al. (1993), Yip et al. (2001), Josephson et al. (2003) have also found an association between housework and upper extremity and lower back disorders. Many other researches in this direction have also revealed that housework can be more energy intensive than some types of paid work (Joshi et al 2001; Brooks et al. 2004) and is a source of hazards comparable to other occupational settings (Messing et al. 2001; Rosano et al .2004; Yip et al. 2004; Habib et al. 2006).

## Reasons for Feeling Fatigue While Performing the Kitchen Activities

Poorly designed kitchen is one of the cause of fatigue at the kitchen workstation; and in lots of houses women feel that either shelf are very

**Table 6: Fatigue realization in different body parts while performing activity**

| *Activity (n)* | *Body part** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Neck* | *Shoulders* | *Upper back* | *Upper arm* | *Fore arm* | *Wrist* | *Lower back* | *Feet* |
| Grating (32) | 02 (6.25) | 27 (84.37) | - - | 31 (96.87) | 22 (68.75) | 28 (87.50) | - - | 12.00 (37.50) |
| Kneading (31) | 05 (16.13) | 24 (77.41) | 17 (54.84) | 28 (90.32) | 11 (35.48) | 27 (87.09) | 1 (58.06) | - |
| Dish washing (30) | - - | 07 (23.33) | - - | - - | - - | 27 (90.00) | - - | 03 (10.00) |
| Rolling (27) | 03 (11.11) | - - | - - | 24 (88.88) | 14 (51.85) | 22 (81.48) | 10 (37.03) | 07 (25.92) |
| Cutting (21) | - | - | - | 02(9.52) | 05(23.89) | 19(90.47) | - | - |
| Sieving (17) | - | - | - | - | 16(94.11) | 14(82.35) | - | - |
| Stirring (10) | - | - | - | - | 02(20) | 10(100) | - | - |
| Puffing (7) | - | - | - | - | - | 3(42.85) | - | 05 (71.42) |
| Grinding (5) | - - | 04 (80) | 03 ) (60) | 04 (80.00) | 03 (60) | 04 (80.00) | 02 (40.00) | - |

*Multiple responses
Figures in parenthesis indicate percentages

high or very low but just ignores to do it proper (Sandhu et al. 2008). Many repetitive motions are required at kitchen due to repetitive bending while taking utensils or ingredient from lower shelf, movements of wrist while chopping, stretching to reach the articles or ingredients to cook, vibration with over use of mixer, sustained or constrained postures due to very high or low height of cooking area, forceful movement while carrying heavy loads as rice packets or while chopping meat etc. Highly repetitive works may directly damage tendons through repeated stretching and elongation as well as increase the likelihood of fatigue and decrease the opportunity for tissue to recover (Silverstein et al. 1987). Data in the Table 7 gives the similar information regarding the reasons for feeling fatigue while performing the selected kitchen activities. For sieving, cutting and grinding majority of the respondents, that is,76.47 per cent, 90.47 per cent and 80 per cent respectively, felt that the static work was being the main cause of fatigue. For kneading majority of the respondents (90.32 per cent) felt the physiological stress as the main reason of fatigue. For rolling, it was prolonged adoption of posture (88.90 per cent) and static work (88.90 per cent), which were the reasons felt by the respondents. In dish washing activity, it was again prolonged adoption of posture (83.3 per cent) and physiological stress (80.00 per cent) which were the main reasons given by respondents for fatigue during this activity.

**Table 7: Reasons for feeling of fatigue while performing various kitchen activities**

| *Activity* (n)* | *Prolonged adoption of* | *Physiological stress* | *Discomfortin adopting posture* | *Static work* | *Repetitive work* |
|---|---|---|---|---|---|
| Sieving (17) | - | - | - | 13 (76.47) | 05 (29.41) |
| Kneading (31) | 18 (58.06) | 28 (90.32) | 26 (83.87) | - | - |
| Cutting (21) | - | - | - | 19 (90.47) | 07 (33.33) |
| Rolling (27) | 24 (88.88) | 15 (55.55) | 06 (22.2) | 24 (88.88) | 21 (77.77)) |
| Puffing (7) | 3 (42.85) | - | - | 2 (28.57) | 2 (28.57) |
| Stirring (10) | - | 4 (40.00) | - | - | 08 (80.00) |
| Dish washing (30) | 25 (83.33) | 24 (80.00) | - | 22 (73.33) | 16 (53.33) |
| Grinding (5) | 3 (60.00) | - | - | 04 ( 80.00) | 02 (40.00) |
| Grating (32) | 20 (62.50) | 12 (37.50) | 22 (68.75) | 11 (34.37) | 10 (31.25) |

*Multiple responses; Figures in parenthesis indicate percentage

**Table 8: General Problems felt while performing activities***

| *Activity (n)* | *Irritation in eyes* | *Stressful back bending* | *Swelling of feet* | *Roughness of fingers* | *Hurt with steam/ heat* | *Injury whileusing tools* |
|---|---|---|---|---|---|---|
| Kneading (31) | - | 31(100.00) | - | | - | - |
| Cutting (21) | - | - | - | 07 (33.33) | - | 14 (66.66) |
| Rolling (27) | 19 (70.37) | 06 (22.20) | 05 (18.51) | - | - | - |
| Puffing (7) | 06 (85.71) | - | 3 (42.85) | - | 05 (71.42) | 04 (57.14) |
| Stirring (10) | 06 (60.00) | - | - | - | 05 (50.00) | - |
| Dish washing (30) | - | 07 (23.33) | 05 (16.66) | 22 (73.33) | - | - |
| Grating (32) | - | 17 (53.12) | - | - | - | 24 (75.00) |

*Multiple responses
Figures in parenthesis indicate percentages

### General Problems Felt by the Respondents While Performing Activities

The various general problems felt by the respondents while performing activities at the kitchen workstation have been presented in Table 8. Many simple but repetitive kitchen activities can aggravate pain in the hand, wrist, elbow, shoulder and neck. Peeling potatoes, chopping, grating and picking up heavy pots and kettles are few of the stressful kitchen tasks. Traumatic and repetitive injuries related to kitchen tasks include lacerations, cut, wrist fractures from slips and falls due to spills, tendonitis, carpal tunnel syndrome, thermal strains and burn caused by poor work practices, poor quality equipment, and poorly maintained equipment. The investigation into this aspect revealed that for activities like kneading and dish-washing, the respondents felt problem of back ache (100.00 per cent and 23.33 per cent respectively) and roughness of fingers (33.33 per cent for cutting and 73.33 per cent due to dish washing). The reason for the first problem may be due to the posture which was adopted while doing the kneading. In cutting, besides roughness of fingers, majority felt the problem of injury while using the tools (66.66 per cent). During rolling, majority had the problem of eyes getting sore as well as irritation in the eyes (70.37 per cent), whereas for puffing it was getting hurt with steam or heat which majority of the respondents felt as main problem (71.42 per cent).

## CONCLUSION

Most of the activities were performed in standing and sitting posture and very few activities like sieving where squatting posture was adopted by the respondents. The maximum respondents felt fatigue, in activities like grating, kneading, dish washing and rolling *chapatis*. During these activities trouble spots disclosed were mainly the wrist, fore arm, followed by discomfort in the shoulders, upper arm, lower back and neck. The main reasons given by respondents for fatigue during these activity were, static work being, physiological stress, prolonged adoption of posture stress.

## RECOMMENDATIONS

It is beyond doubt that kitchen activities demand a high degree of physical efforts leading to various fatigues. In maximum society domestic kitchen is the most important place for home makers. Being the most important room in a house, kitchen should be adequately designed and properly arranged in order to reduce the physical fatigue, physiological and temporal cost of the homemaker. Kitchen design should be developed on the basis of anthropometric and reach measurements of the homemakers to ensure enhanced work efficiency, health and safety of the workers

## REFERENCES

Brooks AG, Withers RT, Gore CJ, Vogler AJ, Plummer J, Cormack J 2004. Measurement and prediction of METs during household activities in 35- to 45-year-old females. *Eur J Appl Physiol*, 91: 638–648.

Haukka E, Leino-Arjas P, Vikari-Juntura E, Takala E-P, Malmivaara A, Hopsu L, Mutanen P, Krtola R, Virtanen T, Pehkonen MI, Holtaru-Leino M, Nykanen J,Stenholm S, Nykri E, Rihimaki H 2008. A randomised controlled trial on whether

a participatory ergonomics intervention could prevent musculoskeletal disorders. *Occu and Enviro Med*, 65: 849-856.

Josephson M, Ahlberg G, Harenstam A, Svensson H, Theorell T, Wiktorin C 2003. Paid and unpaid work, and its relation to low back and neck/ shoulder disorders among women. *Women Health*, 37: 17–30.

Joshi TK, Menon KK, Kishore J 2001. Musculoskeletal disorders in industrial workers of Delhi. *Int J Occup Environ Health*, 7: 217–21.

Khatoon J, Verma B, Dayal R 2007. Grip assessment of rural women performing dish-washing activity in Deoria district (U.P.). In: LP Gite, CR Mehta, N Kotwaliwale, J Majumdar (Eds.): *Developments in Agricultural and Industrial Ergonomics*. Vol II. New Delhi: Allied Publishers Pvt. Ltd., pp. 125-131.

Kistwaria J, Mathur P, Rana A 2007. Ergonomic evaluation of kitchen work with reference to space designing. *Journal of Human Ecology*, 21(1): 43-46.

Kumari P, Dayal R 2009. Feeling of discomfort perceived by rural women while working in the existing kitchen arrangements. *Asian Journal of Home Science*, 3(2): 158-160.

Laddha S, Shraddha 2007. Impact of work practices on musculoskeletal problems of rural women. *International Ergonomics Conference, HWWE* 2007, December 10-12, P. 67.

Messing K, Kilbom Å 2001. Standing and very slow walking: Foot pain-pressure threshold, subjective pain experience and work activity. *Appl Ergon*, 32: 81–90.

Mundt DJ, Kelsey JL, Golden AL, Pastides H, Berg AT, Sklar J 1993. An epidemiologic study of non-occupational lifting as a risk factor for herniated lumbar intervertebral disc. The Northeast Collaborative Group on Low Back Pain. *Spine*.18: 595–602.

Rosano A, Moccaldi R, Cioppa M, Lanzieri G, Persechino B, Spagnolo A 2004. Musculoskeletal disorders and housework in Italy. *Ann Ig*, 16: 497–507.

Sandhu P, Malik M, Kaur H 2008. Study into problems faced by Punjabi housewives while working on existing kitchen work spaces. *J Hum Ecol*, 23(4): 331-337.

Silverstein B, Fine L, Armstrong T 1987. Occupational factors and carpal tunnel syndrome. *American Journal of Industrial Medicine*, 11: 343-358.

Yip YB, Ho SC, Chan SG 2001. Socio-psychological stressors as risk factors for low back pain in Chinese middle-aged women. *J Adv Nurs*, 36: 409–416.

Yip YB, Ho SC, Chan SG 2004. Identifying risk factors for low back pain (LBP) in Chinese middle-aged women: A case-control study. *Health Care Women Int*, 25: 358- 369.