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Biological Risk Indicators for Non-specific Low Back Pain in Young Adults of Amritsar, Punjab, India

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ABSTRACT The purpose of the present study was to evaluate and correlate the various biological risk indicators of non-specific low back pain (NSLBP) in young adults. The study was based on a total of 100 purposively selected young adults (50 males and 50 females) aged 18 – 25 years with non-specific low back pain and 100 matched controls (50 males and 50 females) asymptomatic with no history of low back pain taken from Amritsar, Punjab, India. To solve the purpose, some anthropometric measurements, *viz.* height, weight, BMI, four skinfold measurements, (i.e. biceps, triceps, subscapular and suprailiac), back strength, flexibility measure and abdominal muscle endurance were taken on each subject. Results indicated statistically significant differences ($p<0.05$) in abdominal muscle endurance ($t= 2.58$) between NSLBP boys and controls and in weight ($t=3.22$), biceps skinfold ($t=3.04$), height ($t=2.67$), triceps skinfold ($t=2.83$), subscapular skinfold ($t=2.32$) and in percent lean body mass ($t= 2.80$) between NSLBP girls and controls. Both in boys and girls with non-specific low back pain, back strength has positively significant correlations ($p<0.05$) with height ($r=0.487$ and 0.360 respectively), weight ($r=0.495$ and 0.213 respectively), BMI ($r=0.299$ and 0.461 respectively) and flexibility measure ($r=0.386$ and 0.388 respectively) and negatively significant correlation ($r=-0.417$ only in NSLBP girls) with percent body fat.

INTRODUCTION

Low-back pain has been recognized as a common phenomenon that affects public health (Maniakis and Gray 2000). Low back pain and neck pain are significant health problems not only in adults but also in the young populations. Recurrent low- back pain during the adolescent years may be a precursor for chronic low-back pain during adulthood (Harreby et al. 1995; Salminen et al. 1995, 1999; Jones et al. 2005). Back pain is the most frequent cause of activity limitation in people aged younger than 45 years. Approximately 90% of all people experience low back pain at some time of their lives (Frymoyer 1988) and up to 50% of working adults have back pain every year (Nachemson 1992). It has also been estimated that over 80% of population would report low back pain with the risk factors included gender, age, history of spinal trauma, parental history of LBP, disc degeneration, increased height and sitting height, high level of physical activity, television viewing, smoking, depression and stress (Balague et al. 1999). It has also been reported that a large portion of adults suffered from a first onset of back pain in their twenties (Papageorgiou et al. 1996). Low levels of endurance of lumbar extensors are closely connected to the occurrence of the lumbar syn-drome (Sjolie and Ljunggren 2001). The cause of lumbar syndrome is the muscular disbalance between the lumbar and abdominal musculature (Huang et al. 2000). A decrease in the static endurance of the abdominal and lumbar musculature influences the occurrence of a muscular disbalance in the lumbar-abdominal region, which over time leads to lumbar syndrome (McGill 2004). It seemed likely that sex, lean body mass, body fat distribution, and physical findings are involved in the relation between obesity and chronic low back pain (Garzillo and Garzillo 1994). Increased lordosis in obese persons in order to maintain the centre of gravity due to excess weight may be responsible for the complaint of low back pain (Deyo et al. 1993; Heliowaara et al. 1991). Persons with a high percent body fat had high levels of disability (Visser et al.1998). Some have reported an association between obesity and LBP (Deyo et al. 1989; Lake et al. 2000; Strine et al. 2007). The association between obesity and LBP has been reported to be stronger among women than among men (Deyo et al. 1989; Lean et al. 1998; Croft et al. 1999; Lake et al. 2000). Decreased muscle flexibility and trunk strength have been postulated as risk factors for low back pain (Schmidt-Olsen et al.1991; Kujala et al.1992, 1997). Poor hamstrings flexibility has been associated with low back pain in cross-sectional studies in both adolescents and adults

(Mierau et al. 1989; Salminen et al. 1992; Hultmann et al. 1992; Esola et al. 1996). Decreased trunk muscle strength (extensors and abdominals) and increased body mass index are directly associated with chronic low back pain (Bayramoglu et al. 2001). One longitudinally designed study in adults did confirm a link between the lack of trunk muscle endurance and subsequent development of low back pain (Biering-Sorensen 1984).

Fairbank et al. (1984) and Nissinen et al. (1994) reported an association between LBP and height, or sitting height (height minus leg length). Similarly, a number of studies have demonstrated an association between LBP and body weight and/or BMI (Fairbank et al. 1984; Kujala et al.1997; Viry et al. 1999). Keeping all these in view, in the present study, an attempt has been made to evaluate and correlate the various biological risk indicators of non-specific low back pain in young adults of Amritsar, Punjab, India.

MATERIALS AND METHODOLOGY

The present study was based on a total of 100 purposively selected young adults (50 males and 50 females) aged 18-25 years with non specific low back pain and 100 normal individuals (50 males, 50 females) matched controls asymptomatic with no history of low back pain taken from Amritsar, Punjab, India. The age of the subjects were recorded from the records of their respective educational institutes. The subjects were divided in such a way that <<age 18>>, for instance refers to the individual aged 17 years and 6 months through 18 years and 5 months and 29 days. The study was registered with the local ethics committee.

Some anthropometric measurements, *viz.* height, weight, BMI, skin fold measurement of biceps, triceps, subscapular and suprailiac, back strength, flexibility measure, abdominal muscle endurance were taken on each subject. The height was recorded using a stadiometer (Holtain Ltd., crymych, Dyfed, UK) to the nearest 0.1 cm, and weight was measured by digital standing scales (Model DS-410, Seiko, Tokyo, Japan) to the nearest 0.1 kg. Body mass index was calculated manually using the formula weight (kg)/height^2 (m)^2. Skin fold measures were taken from four sites, *viz.* biceps, triceps, suprailiac and subscapular (to the nearest of o.1 mm) using Harpenden skin fold caliper (British indicators Ltd., West Sussex, UK). The sequential measure-ments were duplicated at each site and the mean values were considered. All the anthropometric measurements were measured as per Lohmann et al. (1988). The back strength was measured using back-leg-chest dynamometer. The subject was positioned with body erect and knees bent so that grasped-hand rests at proper height. Then straightening the knees and lifting the chain of the dynamometer, pulling force was applied on the handle. The body would be inclined forward at an angle of 60 degrees. The strength of the back muscles was recorded on the dial of the dynamometer as the best of three trials in kg. Abdominal muscle endurance was recorded using 60 second sit up test in repetitions per minute. Percent body fat was calculated by using four-skinfold method given by Durnin and Womersley (1974). Percent lean body mass was calculated subtracting the percent body fat from 100.

Data were analyzed using SPSS (Statistical Package for Social Science) version 14.0. Student's t test was applied for the comparison of all the variables between individuals with non-specific low back pain and controls. Pearson's correlation coefficients were also calculated to observe the correlations among various risk factors of non specific low back pain. A 5% level of probability was used to indicate statistical significance.

RESULTS AND DISCUSSION

Table 1 shows the descriptive statistics of various anthropometric parameters in boys with non-specific low back pain and controls. NSLBP boys have lesser mean values in height (172.60cm), weight (72.40kg), BMI (24.28kg/m^2), biceps skinfold (5.57mm), subscapular skinfold (14.22mm), suprailiac skinfold (8.67mm), percent body fat (15.03%), flexibility measure (8.49cm), back strength (117.84kg), abdominal muscle endurance (39.54reps) and have greater mean values in triceps skinfold (10.59mm) and percent lean body mass (84.93%) than their control counterparts (176.60cm, 69.48kg, 23.23 kg/m^2, 5.45mm, 13.43mm, 7.69mm, 14.65%, 7.92cm, 113.84kg, 39.54reps, 10.59mm and 84.93% respectively). However, statistically significant differences ($p<0.05$) were found only in abdominal muscle endurance ($t= 2.58$) between NSLBP boys and controls.

The descriptive statistics of various anthropometric parameters in girls with non-specific low

Table 1: Descriptive statistics of various anthropometric parameters in boys with non-specific low back pain and controls

Parameters	NSLBP boys (n=50)			Controls (n=50)			t-value
	Mean	S.D.	S.E.	Mean	S.D.	S.E.	
1. Height (cm)	171.23	7.44	1.05	172.60	6.85	0.97	0.02
2. Weigth (kg)	69.48	11.21	1.58	72.40	10.82	1.53	1.32
3. BMI (kg/m²)	23.23	2.80	0.39	24.28	3.40	0.48	1.70
4. Biceps Skin Fold (mm)	5.45	3.12	0.44	5.57	3.45	0.49	0.18
5. Triceps Skin Fold (mm)	10.86	4.59	0.65	10.59	4.56	0.64	0.30
6. Subscapular Skin Fold (mm)	13.43	4.04	0.57	14.22	5.07	0.72	0.86
7. Suprailiac Skin Fold (mm)	7.69	3.98	0.56	8.67	3.76	0.53	1.26
8. Body Fat Percentage(%)	14.65	4.51	0.64	15.30	5.02	0.71	0.40
9. Percentage Lean Body Mass (%)	85.93	4.51	0.64	84.93	5.01	0.71	0.43
10. Flexibility Measure (cm)	7.92	6.80	0.96	8.49	6.25	0.88	0.43
11. Back Strength (kg)	113.84	22.38	3.16	117.84	22.38	3.16	0.78
12. Abd. Msl. End. (reps.)	34.46	9.06	1.28	39.54	10.57	1.49	2.58*

*Indicates P<0.05; NSLBP-Non specific low back pain; Abd. Msl. End.-Abdominal muscle endurance

back pain and controls is shown in table 2. NSLBP girls have higher mean values in height (161.08cm), weight (58.30kg), body mass index (22.59kg/m²), biceps skinfold (8.38mm), triceps skinfold (14.93mm), subscapular skinfold (14.04mm), suprailiac skinfold (8.84mm), percent body fat (25.52%), back strength (45.72kg) and have lesser mean values in percent lean body mass (74.67%), flexibility measure (5.13cm), abdominal muscle endurance (30.16reps) than their control counterparts (157.51cm, 53.37kg, 21.44kg/m², 6.59mm,12.94mm, 12.10mm, 8.01mm and 43.80kg respectively). Nevertheless, highly significant differences ($p<0.001$) were noted in weight (t=3.22), biceps skinfold (t=3.04) and statistically significant differences ($p<0.05$) were found in height (t=2.67), triceps skinfold (t=2.83), subscapular skinfold (t=2.32) and in percent lean body mass (t= 2.80) between NSLBP girls and controls.

Table 3 shows the descriptive statistics of various anthropometric parameters in boys and girls with non-specific low back pain. NSLBP boys have higher mean values in height (172.60cm), weight (69.48kg), body mass index (23.23kg/m²), percent lean body mass (85.34%), back strength (113.84kg), abdominal muscle endurance (34.46reps) and have lesser mean values in biceps skinfold (5.45mm), triceps skinfold (10.86mm), subscapular skinfold (13.43mm), suprailiac skinfold (7.69mm) and percent body fat (14.65%) than NSLBP girls (161.08cm, 58.30kg, 22.59kg/m², 74.67%, 45.72kg and 30.16reps respectively). Nonetheless, highly significant differences ($p<0.001$) were noted in height (t=7.49), weight (t=6.19), biceps skinfold (t=4.59), triceps skinfold (t=4.95), percent body fat (t=12.35), percent lean body mass (t=12.41), back strength (t=18.81) and statistically significant differences ($p<0.05$) were found only in abdominal muscle endurance

Table 2: Descriptive statistics of various anthropometric parameters in girls with non-specific low back pain and controls

Parameters	NSLBP boys (n=50)			Controls (n=50)			t-value
	Mean	S.D.	S.E.	Mean	S.D.	S.E.	
1. Height (cm)	161.08	7.93	1.12	157.51	5.24	0.73	2.67*
2. Weigth (kg)	58.30	6.11	0.86	53.37	8.96	1.25	3.22**
3. BMI (kg/m²)	22.59	3.05	0.43	21.44	3.13	0.44	1.87
4. Biceps Skin Fold (mm)	8.38	3.26	0.46	6.59	2.63	0.37	3.04**
5. Triceps Skin Fold (mm)	14.93	3.57	0.50	12.94	3.51	0.49	2.83*
6. Subscapular Skin Fold (mm)	14.04	4.62	0.65	12.10	3.77	0.53	2.32*
7. Suprailiac Skin Fold (mm)	8.84	3.27	0.46	8.01	3.57	0.50	1.22
8. Percent Body Fat (%)	25.52	4.28	0.60	24.04	8.62	1.21	1.09
9. Percent Lean Body Mass (%)	74.67	4.08	0.58	77.00	4.29	0.60	2.80*
10. Flexibility Measure (cm)	5.13	5.02	0.71	6.78	4.60	0.64	1.72
11. Back Strength (kg)	45.72	12.45	1.76	43.80	12.24	1.71	0.78
12. Abd. Msl. End. (reps.)	30.16	8.18	1.16	31.29	5.62	0.79	0.81

*Indicates P<0.05; **indicates P<0.001; NSLBP-Non specific low back pain; Abd.Msl.End.-Abdominal muscle endurance

Table 3: Descriptive statistics of various anthropometric parameters in boys and girls with non-specific low back pain

Parameters	*NSLBP boys (n=50)*			*NSLBP girls (n=50)*			*t-value*
	Mean	*S.D.*	*S.E.*	*Mean*	*S.D.*	*S.E.*	
1. Height (cm)	172.60	7.44	1.05	161.08	7.93	1.12	7.49**
2. Weigth (kg)	69.48	11.20	1.58	58.30	6.11	0.86	6.19**
3. BMI (kg/m²)	23.23	2.80	0.39	22.59	3.05	0.43	1.09
4. Biceps Skin Fold (mm)	5.45	3.12	0.44	8.38	3.26	0.46	4.59**
5. Triceps Skin Fold (mm)	10.86	4.59	0.65	14.93	3.57	0.50	4.95**
6. Subscapular Skin Fold (mm)	13.43	4.04	0.57	14.04	4.62	0.65	0.71
7. Suprailiac Skin Fold (mm)	7.69	3.98	0.56	8.84	3.27	0.46	1.57
8. Percent Body Fat (%)	14.65	4.51	0.64	25.52	4.28	0.60	12.35**
9. Percent Lean Body Mass (%)	85.34	4.51	0.64	74.67	4.08	0.58	12.41**
10. Flexibility Measure (cm)	7.92	6.81	0.96	5.13	5.02	0.71	2.33
11. Back Strength (kg)	113.84	22.38	3.16	45.72	12.45	1.76	18.81**
12. Abd. Msl. End. (reps.)	34.46	9.06	1.28	30.16	8.18	1.16	2.49*

*Indicates P<0.05; ** indicates P<0.001; NSLBP-Non specific low back pain; Abd.Msl.End.-Abdominal muscle endurance

(t=2.49) between boys and girls with non-specific low back pain.

The correlation co-efficient (r) of back strength with other anthropometric parameters in boys and girls with non-specific low back pain is given in table 4. Both in boys and girls with non-specific low back pain, back strength has significant correlations ($p<0.05$) with height (r=0.487 and 0.360 respectively), weight (r=0.495 and 0.213 respectively), BMI (r=0.299 and 0.461 respectively) and flexibility measure (r=0.386 and 0.388 respectively) and negatively significant correlation (r=-0.417 only in NSLBP girls) with percent body fat. In rest of the cases the correlations were not statistically significant.

It was reported earlier that there is an association between LBP and body weight and/or BMI (Fairbank et al. 1984; Kujala et al.1997; Viry et al. 1999). Bayramoglu et al. (2001) observed a correlation between the weakness of lower abdominals and low back pain. The findings of the present study follows the same direction highlighting lesser abdominal muscle endurance in NSLBP boys and girls than their control counterparts showing highly significant positive correlation between these variables both in boys and girls. Watson et al. (2002) reported that girls were more susceptible to low back pain than boys. The cause of lumbar syndrome is the muscular misbalance between the lumbar and abdominal musculature (Huang et al. 2000). Decreased muscle flexibility and trunk strength have been postulated as risk factors for low back pain (Schmidt-Olsen et al.1991, Kujala et al.1992, 1997). Decreased trunk muscle strength (extensors and abdominals) and increased body mass index are directly associated with chronic low back pain (Bayramoglu et al. 2001). Biering-Sorensen (1984) confirmed a link between the lack of trunk muscle endurance and subsequent development of low

Table 4: Correlation co-efficient (r) of back strength with other anthropometric parameters in boys and girls with non-specific low back pain

Variables	*NSLBP boys (n=50)*		*NSLBP girls (n=50)*	
	r	*p*	*r*	*p*
1. Heigth (cm)	0.487	p<0.01	0.360	P<0.05
2. Weight (kg)	0.495	p<0.01	0.213	P>0.05
3. BMI (kg/m²)	0.299	p>0.05	0.461	P<0.01
4. Biceps Skin Fold (mm)	-0.137	p>0.05	0.385	P<0.01
5. Triceps Skin Fold (mm)	-0.151	p>0.05	0.476	P<0.01
6. Subscapular Skin Fold (mm)	-0.108	p>0.05	0.404	P<0.01
7. Suprailiac Skin Fold (mm)	0.113	p>0.05	0.196	P>0.05
8. Percent Body Fat (%)	-0.093	p>0.05	-0.417	P<0.01
9. Percent Lean Body Mass (%)	0.093	p>0.05	0.417	P<0.01
10. Flexibility Measure (cm)	0.386	p<0.01	0.388	P<0.01
11. Abd. Msl. End. (reps.)	0.101	p>0.05	0.008	P>0.05

NSLBP-Non specific low back pain; Abd.Msl.End.-Abdominal muscle endurance back pain in adults. Mierau et al. (1989), Salminen et al. (1992), Hultmann et al. (1992) and Esola et al. (1996) reported poor hamstrings flexibility associated with low back pain in both adolescents and adults. The findings of the present study also followed the same direction. Females had higher prevalence of low back pain compared to males (Schneider et al. 2006; Wijnhoven et al. 2006). It has been associated with hormonal changes, irregular or prolonged menstrual cycle, different pain perception and recall of symptoms (Wedderkopp et al. 2005; Wijnhoven et al. 2006). In the present study too NSLBP girls also have lower mean values for back strength, flexibility measure, abdominal muscle endurance than NSLBP boys. The association between obesity and LBP has been reported to be stronger among women than among men (Deyo et al. 1989; Lean et al. 1998; Croft et al. 1999; Lake et al. 2000).These differences may be due to physical and physiological changes in both the sexes. The findings of the present study reported higher mean values in percent body fat in NSLBP girls (25.52%) than NSLBP boys (14.65%).

Four biological risk indicators were identified by Jones et al. (2005) for recurrent low back pain: hip range of motion, abdominal muscle endurance, lumbar flexibility and lateral flexion of the spine. In the present study, only abdominal muscle endurance and flexibility measures were considered as risk factors. The symptomatic group had significantly lower abdominal muscle performance. It has been suggested that trunk muscle endurance has a prophylactic role in preventing NSLBP in adults. There is a strong scientific rationale for a link between trunk muscle endurance and low back pain as studies suggested that active motion of the lumbar spine is accomplished with large amounts of co-contraction in trunk flexor muscles (Cholewicki and McGill 1996; Cholewicki and Vanvliel 2002). It may be concluded that special care should be taken to strengthen the back in non-specific low back pain young adults.

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