

Variations in the age of onset of menarche among inhabitants of rural and urban areas in delta state south-south Nigeria

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Abstract

Background: The major landmark for puberty in females is menarche. There seem to be change in the age of menarche over the years which may have resulted from some factors like environment, socio and economic status of subject.

Aim: This cross-sectional study was carried out to determine the average age of menarche in the study population and ascertain whether the place of residence and socioeconomic status play any role.

Method: The study population was 510 female students, 243 of which had attained menarche. 130 of them were in the urban areas and 113 in rural areas. The study was carried out among students of Junior Secondary schools one to three that met the inclusion and exclusion criteria in six selected schools where eighty five students from each of the schools were randomly selected.

Results: Findings show that the most frequent age of menarche in urban areas was 12years and that of rural was 13years. The average age of menarche from this study was (12.68 ± 1.365years) while that from urban and rural areas were (12.18 ± 1.287years) and (13.26 ± 1.223years) respectively. There was a significant difference ($p < 0.05$) between the age of menarche in rural and urban areas. Similarly significant difference ($p < 0.05$) was observed between age of menarche across the five socioeconomic classes in the rural and urban areas.

Conclusion: The mean age of menarche was earlier among residents of urban areas. The effect of place of residence and socio-economic status affected the mean age of menarche.

Keywords: Menarche; Age of onset; Variations; Rural and Urban Area

1. Introduction

Puberty is the stage of human development where physical growth and sexual maturity occur. The major landmark for puberty in females is menarche. Menarche is one of the stages of puberty and on average, the process from fast growth and breast budding (Thelarche) is approximately 4.5 years with a range of 1.5 to 6 years [1]. Menarche is the first menstrual bleeding which indicates commencement of the female's reproductive life. It is seen as the most significant event in female puberty. There is a global trend in the mean age of menarche with a gradual decrease in the past few decades [2, 3]. Girls experience menarche at varying ages. It can be as low as 9 years and as high as 18 years. The timing of menarche is determined by female biology as well as genetic and nutritional factors. The average age of menarche is about 12.5 years in the United States [4]. According to Al Sahab *et al.*, [5], the average age of menarche is 12.72 years in Canada while in the United Kingdom, it is 12.9 years [6]. A study carried out in the Northern part of Nigeria, precisely

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Sokoto Metropolis in the year 2011 produced a mean age of 13.67 ± 1.2 years [7]. The mean age of menarche was estimated to be 12.3 ± 1.18 years in a cross-sectional study in Benin city in 2014 [8].

Age at menarche has major implications for female fertility [9, 10] and, more so, this can act as an indication of potential health complications in the future. Earlier menarche is linked with an increased risk of other diseases, such as breast cancer [11], gynecological cancers [12] and various cardiovascular diseases [13, 14]. Girls with early menarche showed increased blood pressure and glucose intolerance compared with girls who matured later [15]. Overall, earlier menarche (before 12 years) led to higher mortality [14]. In another vein, there is a strong link between early menarche and high bone mineral density [16]. Recent data reveal that age at menarche is significantly linked with body composition, insulin sensitivity and blood lipid levels [17]. Age at menarche is reducing worldwide [18]. Earlier age at menarche is related to increased risk for breast cancer [19], reduced stature and increased risk of obesity [20] and type 2 diabetes [14], whereas late menarche may be associated with an increased risk of Alzheimer's disease [21] and stroke [22], as well as lower fertility [23]. Recognizing societal and economic variants determining variation in the age at menarche may thus shed light on their relationship with many chronic diseases in women.

Identification of the factors that contribute to the timing of menarche may add to our understanding of the physiological mechanism of this development and the associated fertility and health risks. The current study sought to determine the variation in the age of onset of menarche with a view to setting a baseline for the age of menarche by specifically investigating the mean ages gotten from this study and compare them to mean ages gotten from prior studies in other parts of the world. It will also determine its association with socio-demographic profile and the correlation between the average age of menarche in sample urban and rural populations.

2. Material and methods

2.1. Study area

The study was carried out in Ughelli local government area, Delta State, South-south Nigeria. Three secondary schools each in the rural and urban areas were selected for the study.

An urban area is a region that is very developed, meaning, human structures are dense such as houses, commercial buildings and roads. It is an area that can be easily accessed and where most of the inhabitants have non-agricultural jobs. In urban areas, homes and businesses are very close to one another. While a rural area is an area with fewer homes, buildings and low population density when compared to the urban area. Rural areas are not developed as urban areas and the majority of the inhabitants have agricultural jobs though with poor accessibility. The above definition was used to determine our urban and rural settings in this research.

The schools in the rural areas are Oteri Secondary School, Oteri-Ughelli; Adagwe Secondary School, Eruemukohwarien and Esejuvwevwo Secondary School, Iwhrenene-Ughelli. The schools in the urban areas are Kogbodi International School, Ughelli; Oharisi Secondary School, Ughelli and Heroes of Faith School, Ughelli.

2.2. Study design

It is a cross sectional study that was carried out to determine the average age of onset of menarche among junior secondary school students in urban and rural areas in Ughelli Delta central senatorial district of Delta State Nigeria. Other variables investigated were socioeconomic class of the students between the ages 8 to 16 years.

2.3. Study Population

The study was conducted among the female students of JSS 1 to JSS 3 in six secondary schools age-matched between 8-16 years. A total population of 510 students (N) was used for this study. 85 students were gotten from each school.

2.4. Study duration

The study duration was for six months.

2.5. Selection Criteria

2.5.1. Inclusion criteria

Female students of the school who were in classes JSS 1, JSS 2 and JSS 3, those that gave consent, age between 8-16 years.

2.5.2. Exclusion Criteria

Those who could not remember their ages of menarche, students who did not give consent to participate in the study, students who were absent on the day of data collection.

2.6. Data Collection

Data was collected using a questionnaire that was a combination of the open-ended and the close-ended type. It covered such areas like age, class, parents' occupation and educational levels, type of house they lived in, respondent's family size as well as questions about onset of menarche and age. Using modified socioeconomic scale-I, II, III, IV, V [24].

At the various schools, a brief introduction and inquiry were made to find out if the students understood what Menstruation was and explanation also followed. The respondents gave their oral consent after consulting with their parents. Then, questionnaires were shared with the subjects. The data was gathered within a period of four months. The girls filled the questionnaires in their classrooms under the supervision of the researcher. 600 questionnaires were handed out but only 510 were filled properly and were used for analysis.

2.7. Ethical Approval

Ethical clearance was sought and granted by the ethical committee of the Faculty of Basic Medical Sciences, Delta State University. (RBC/FBMS/DELSU/ UG/18/03)

2.8. Sampling technique

The study was done using the Random sampling technique resulting in a total of 510 participants in both rural and urban areas. The selection of females was done considering the relative proportion of various age distribution of the sampled population in rural and urban communities.

2.9. Sampling size

The study involved 510 participants. The formula for sample size determination is:

$$n = \frac{Z^2 \times p(1 - p)}{e^2}$$

n = required Sample Size

z = confidence level at 95% (Standard value of 1.96)

p = estimated prevalence in project area (assumed = 0.3)

q = 1 - p

e = margin of error at 4% (0.04)

$$\begin{aligned} n &= \frac{1.962 \times 0.3 (1 - 0.3)}{(0.02)^2} \quad (25) \\ &= \frac{3.84 \times 0.3 (0.7)}{0.0004} \\ &= \frac{3.84 \times 0.21}{0.0004} \\ &= \frac{0.8064}{0.0004} \\ n &= 504 \end{aligned}$$

2.10. Statistical Analysis

Data collection was done using a self-administered questionnaire and its entry with subsequent analysis was done using SPSS Software version 22. Qualitative variable, frequency and percentage were calculated. Quantitative variables, mean (SD) were calculated, T-Test and Analysis of Variance (ANOVA) were used to find significant difference. A value of P < 0.05 was taken as significant.

3. Results

Table 1 Distribution of respondents according to age of menarche in rural areas (n=113)

| Menarche (Years) | Age | Number of respondents that attained menarche at this age (Frequency) | Percentage of the frequency in total population (%) |
|------------------|-----|--|---|
| 8 | | | - |
| 9 | 1 | 1 | 0.4 |
| 10 | 1 | 1 | 0.4 |
| 11 | 3 | 3 | 1.2 |
| 12 | 25 | 25 | 9.8 |
| 13 | 37 | 37 | 14.5 |
| 14 | 27 | 27 | 10.6 |
| 15 | 17 | 17 | 6.7 |
| 16 | 2 | 2 | 0.8 |
| TOTAL | | 113 | 44.3 |

Table 1 shows the distribution of respondents according to age of menarche in rural areas. The most frequent age of menarche was 13 years, with a total of 37 girls that attained menarche at 13 and a percentage of 14.5. The lowest age of menarche was 9 with 0.4% who attained menarche and the highest was 16 years, 0.8% of the respondents. 0.4% attained menarche at 10 years, 1.2% attained menarche at 11 years, 9.8% at 12 years, 10.6% at 14 years and 6.7% at 15 years.

Table 2 Distribution of respondents according to age of menarche in urban areas (n=130)

| Menarche (Years) | Age | Number of respondents that attained menarche at this age (Frequency) | Percentage of the frequency in total population (%) |
|------------------|-----|--|---|
| 8 | 2 | 2 | 0.8 |
| 9 | - | - | - |
| 10 | 12 | 12 | 4.7 |
| 11 | 17 | 17 | 6.7 |
| 12 | 48 | 48 | 18.8 |
| 13 | 31 | 31 | 12.2 |
| 14 | 18 | 18 | 7.1 |
| 15 | 2 | 2 | 0.8 |
| 16 | - | - | - |
| TOTAL | | 130 | 51.0 |

Table 2 shows the distribution of respondents according to age of menarche in urban areas. The most frequent age of menarche was 12 years, with a total of 48 girls that attained menarche at 12 and a percentage of 18.8. The lowest age of menarche was 8 with 0.8% who attained menarche and the highest was 15 years, 0.8% of the respondents. 4.7% attained menarche at 10 years, 6.7% attained menarche at 11 years, 12.2% at 13 years and 7.1% at 14 years.

Table 3 Comparison between the mean ages of the rural and urban areas

| Area | N | Age of Menarche Mean (SD) | t-test | P-value |
|-------|-----|---------------------------|--------|---------|
| Urban | 130 | 12.18 ± 1.29 | -6.628 | 0.001* |
| Rural | 113 | 13.26 ± 1.22 | -6.652 | |

Table 3 shows the comparison between the mean ages of the rural and urban areas using Independent T-test.

Table 4 Association between socioeconomic classes and age of menarche in rural areas

| Socioeconomic Classes | Frequency (%) | Age of Menarche Mean (SD) | ANOVA (F) | P-value |
|-----------------------|---------------|---------------------------|-----------|---------|
| Upper Class I | 3 (2.7) | 11.67 ± 0.58 | 2.957 | 0.023* |
| Upper Class II | 15 (13.3) | 12.93 ± 0.96 | | |
| Middle Class III | 42 (37.2) | 13.43 ± 1.35 | | |
| Lower Class IV | 44 (38.9) | 13.45 ± 1.15 | | |
| Lower Class V | 9 (8.0) | 13.26 ± 1.22 | | |

Table 4 shows the age of menarche and the frequency distribution across the five different socioeconomic classes in rural areas. The socioeconomic scale used was a modified version of Ayodeji . The one-way ANOVA analysis showed a significant difference between the mean age of menarche among the five socioeconomic classes of the respondents in the rural areas. (F= 2.957; df= 4, 108; p= 0.023).

Table 5 Association between socioeconomic classes and age of menarche in urban areas

| Socioeconomic Classes | Frequency (%) | Age of Menarche Mean (SD) | ANOVA (F) | P-value |
|-----------------------|---------------|---------------------------|-----------|---------|
| Upper Class I | 22 (16.9) | 11.45 ± 1.54 | 6.901 | 0.001* |
| Upper Class II | 37 (28.5) | 11.70 ± 1.08 | | |
| Middle Class III | 50 (38.5) | 12.76 ± 1.15 | | |
| Lower Class IV | 17 (13.1) | 12.35 ± 1.06 | | |
| Lower Class V | 4 (3.1) | 12.75 ± 0.50 | | |

Table 5 shows the age of menarche and the frequency distribution across the five different *socioeconomic classes in urban areas. The socioeconomic scale used was the modified version of Oyedeji [24]. The one-way ANOVA analysis showed a significant difference between the mean age of menarche among the five socioeconomic classes of the respondents in the urban areas. (F= 6.901; df= 4, 125; p= 0.000).

4. Discussion

In this study, the age range was 8 to 16 years and the mean age of menarche is reported as 12.68 ± 1.37. This is in agreement with previous study by Khatoun *et al.*[26] in Lucknow 2011, in Greece by Steingraber [27], in Kuwait by Al-Awadhi *et al.* [28] and Cabrera *et al.*[29] in U.S for non-hispanic Caucasians (2014) that found the mean age of menarche was 12.43 years, 12.3 years, 12.41 years and 12.8 years respectively. However, our finding disagree with similar study carried out on Indo-Pakistani girls which Ulijaszek *et al.* [30] reported as 13.06 years, by Al-Awadhi *et al.*, [28], in Ethiopia which was 13.9 years and in Finland by Steingraber [27] which was 13.3 years. The possible reason for this difference could be as a result of the influence of environmental, cultural and socio-economic interplay in these locations

The mean age of menarche in rural areas is 13.26 ± 1.223 and the mean age of menarche in urban areas is 12.18 ± 1.287 . There is significant difference between the age of menarche, so this presupposes that place of residence plays a role in the onset of menarche. The findings for urban area agrees with Khatoon *et al* [26], which found the mean age to be 12.37 ± 1.46 but disagrees with the age of menarche in rural areas which Khatoon *et al.* [26] found to be 12.51 ± 1.55 and that of Adadevoh *et al.*, [31] which they found to be 14.75.

In rural areas, the mean age of menarche in Upper Class I is (11.67 ± 0.577), Upper Class II is (12.93 ± 0.96), Middle Class III is (13.43 ± 1.346), Lower Class IV is (13.45 ± 1.150) and Lower Class V is (13.26 ± 1.223). In urban areas, the mean age of menarche in Upper Class I is (11.4 ± 1.535), Upper Class II is (11.70 ± 1.077), Middle Class III is (12.76 ± 1.153), Lower Class IV is (12.35 ± 1.057) and Lower Class V is (12.75 ± 0.500).

Our finding show that there is significant difference between the mean age of menarche of Class I and Class III and there is significant difference between the mean age of menarche of Class II and Class III. This shows that the onset of menarche seems to be earlier with those in higher socioeconomic class possibly because of better nutritional status and consequent growth and maturity-onset when compared to those in lower socio-economic class with associated poor nutritional status and stunted growth pattern and resulting in delay maturity.

In this study, the lowest age of menarche was 8 years, reported in two girls, one 11 years old and the other 14 years old. This was gotten in the urban areas. The highest age of no menarche was 16. There were 10 respondents, 7 in rural areas and 3 in urban areas. In rural areas, age of menarche is earlier in Socioeconomic Upper class I, followed by Upper class II, and then, Lower class V. It is delayed in Lower class IV. In urban areas, age of menarche is earlier in Socioeconomic Upper class I, followed by Upper class II, and then, Lower class IV. It is delayed in Lower Class V. Thus the trend of lowering of age at menarche is almost well marked moving from lower and middle to higher socioeconomic stratum. The mean age at menarche in urban areas is (12.18 ± 1.287 .) and in rural areas, it is (13.26 ± 1.223), there is significant difference.

5. Conclusion

The lowest age of menarche is 8 years and the highest is 16 years while the mean age at menarche is earlier in those that stay in urban areas. The effect of place of residence as well as socio-economic status, were found to affect the mean age of menarche. It is our recommendation that women be enlightened on the higher risk of premature menopause if they started menstruating at a young age, particularly individuals with fertility challenge so that they can make informed decisions.

Compliance with ethical standards

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Disclosure of conflict of interest

No potential conflict of interest was reported by the authors

Statement of ethical approval

Ethical clearance was sought and granted by the ethical committee of the Faculty of Basic Medical Sciences, Delta State University. (RBC/FBMS/DELSU/ UG/18/03)

Statement of informed consent

Verbal consent were duly obtained from the parents, the subjects and the school heads

References

- [1] Fritz MA, Speroff L. Normal and abnormal growth and pubertal development: In Fritz MA, Speroff L, editors. *Clinical gynaecologic endocrinology and infertility*. 8th ed. Philadelphia: Lippincott Williams & Wilkins. 2011 p. 391-434.
- [2] Hwang, J. Y., Shin, C., Frongillo, E. A., Shin, K. R. and Jo, I. Secular trend in age at menarche for South Korean women born between 1920 and 1986: the Ansan Study. *Ann Hum Biol.* 2003, 30, pp. 434-442. DOI: 10.1080/0301446031000111393
- [3] Herman-Giddens, M. E. The decline in the age of menarche in the United States: should we be concerned? *J Adolesc Health.* 2009, 40 pp. 201-203. DOI: <https://doi.org/10.1016/j.jadohealth.2006.12.019>
- [4] Anderson, S. E., Dallal, G. E. and Must, A. Relative weight and race influence average age at menarche: results from two nationally representative surveys of US girls studied 25 years apart. *Pediatrics.* 2003, 111, pp. 844-850.
- [5] Al-Sahab B, Ardern CI, Hamadeh MJ, Tamim H. Age at menarche in Canada: results from the national longitudinal survey of children & youth. *BMC Public Health.* 2010 10:736. doi: 10.1186/1471-2458-10-736.
- [6] Hamilton-Fairley, Diana. "Obstetrics and Gynaecology: Lecture Notes (2nd ed.)"(PDF). Blackwell Publishing. 2004.
- [7] Panti, A. A., Ekele, B. A., Nwobodo, E. I. and Ahmed, Y. The age at menarche amongst secondary school girls in Sokoto metropolis, North-West Nigeria. *OJM.* 2011, (23), pp. 1-4
- [8] Osemwenkha, A. P., Osaikhuwuomwan, J. A and Chukwudi, E. O. Age at menarche among secondary school girls in an urban population of Nigeria. *Niger J Exp Clin Biosci.* 2014, 2, pp. 95-99. DOI: 10.4103/2348-0149.144844
- [9] McKibben, S. L. and Poston, D. L. Jr. The influence of age at menarche on the fertility of Chinese women. *Soc Biol.* 2003, 50, pp. 222-237. DOI: 10.1080/19485565.2003.9989073
- [10] Pascual, J., Garcia-Moro, C. E., Hernandez, M. Biological and behavioral determinants of fertility in Tierra del Fuego. *Am J Phys Anthropol.* 2005, 127, pp. 105-113. DOI: 10.1002/ajpa.20065
- [11] Peeters, P. H., Verbeek, A. L., Krol, A., Matthyssen, M. M. and de Waard, F. Age at menarche and breast cancer risk in nulliparous women. *Breast Cancer Res Treat.* 1995, 33, pp. 55-61. DOI: 10.1007/bf00666071
- [12] Fujita, M., Tase, T., Kakugawa, Y., Hoshi, S., Nishino Y, Nagase, S., Ito, K., Niikura, H., Yaegashi, N. and Minami, Y. Smoking, earlier menarche and low parity as independent risk factors for gynecologic cancers in Japanese: a case-control study. *Tohoku J Exp Med.* 2008, 216, pp. 297-307. DOI: 10.1620/tjem.216.297
- [13] Cooper, G. S., Ephross, S. A., Weinberg, C. R., Baird, D. D., Whelan, E. A. and Sandler, D. P. Menstrual and reproductive risk factors for ischemic heart disease. *Epidemiology.* 1999, 10, pp. 255-259.
- [14] Lakshman, R., Forouhi, N. G., Sharp, S. J., Luben, R., Bingham, S.A., Khaw, K. T., Wareham, N. J. and Ong, K. K. Early age at menarche associated with cardiovascular disease and mortality. *J Clin Endocrinol Metab.* 2009, 94, pp. 4953-4960. doi: 10.1210/jc.
- [15] Remsberg, K. E., Demerath, E. W., Schubert, C. M., Chumlea, W. C., Shumei S. Sun, S.S. and Siervogel, R. M. Early Menarche and the development of cardiovascular disease risk factor in adolescent girls: the Fels Longitudinal Study. *The Journal of Clinical Endocrinology & Metabolism*, 2005, 5(90), pp. 2718–2724. DOI: 10.1210/jc.2004-1991
- [16] Ito M, Yamada M, Hayashi K, Ohki M, Uetani M, Nakamura T. Relation of early menarche to high bone mineral density. *Calcif Tissue Int;* 1995, 57:11– 14. DOI: 10.1007/bf00298989
- [17] Feng, Y., Hong, X., Wilker, E., Li, Z., Zhang, W., Jin, D., Liu, X., Zang, T. and Xu, X. Effects of age at menarche, reproductive years, and menopause on metabolic risk factors for cardiovascular diseases. *Atherosclerosis.* 2008, 196, pp. 590-597. DOI: 10.1016/j.atherosclerosis.2007.06.016
- [18] Cho, G. J., Park, H. T., Shin, J. H., Hur, J. Y., Kim, Y. T., Kim, S. H., Lee, K. W. and Kim, T. Age at menarche in a Korean population: secular trends and influencing factors. *EURJ Pediatr.* 2010, 169, pp. 89-94. doi: 10.1007/s00431-009-0993-1
- [19] Kotsopoulos, J., Lubinski, J., Lynch, H. T., Neuhausen, S. L., Ghadirian, P., Isaacs, C., et al. Age at menarche and the risk of breast cancer in BRCA1 and BRCA2 mutation carriers. *Cancer Causes Control.* 2005, 16, pp. 667-674. DOI: 10.1007/s10552-005-1724-1

- [20] Freedman, D. S., Khan, L. K., Serdula, M. K., Dietz, W. H., Srinivasan, S. R. and Berenson, G. S. The relation of menarcheal age to obesity in childhood and adulthood: the Bogalusa heart study. *BMC Pediatr.* 2003, 3, pp. 11-18. DOI: 10.1186/1471-2431-3-3
- [21] Rees, M. The age of menarche. *ORGYN.* 1995, 4, pp. 2-4. PMID: 12319855
- [22] Cui, R., Iso, H., Toyoshima, H., Date, C., Yamamoto, A., Kikuchi, S., et al. Relationships of age at menopause and reproductive year with mortality from cardiovascular disease in Japanese Postmenopausal women: The JACC Study. *J. Epidemiol.* 2006, 16, pp. 177-184. DOI: 10.2188/jea.16.177
- [23] Komura, H., Miyake, A., Chen, C. F., Tanizawa, O. and Yoshikawa, H. Relationship of age at menarche and subsequent fertility. *Eur. J. Obstet. Gynecol. Reprod. Biol.* 1992, 44, pp. 201-203. DOI: 10.1016/0028-2243(92)90099-k
- [24] Oyedeji GA. Socio-economic and cultural background of hospitalized children in Ilesa. *Niger J Paediatr*; 1985, 12:111-7.
- [25] Cochran, W. G. *Sampling techniques* (3rd ed.). New York: John Wiley & Sons 1977.
- [26] Khatoon, T., Verma, A. K., Kumari, R., Rupani, R., Singh, M. and Rizvi, A. Age at menarche and affecting Bio-Social factors among the girls of Lucknow, Uttar Pradesh. *J Indian Acad Forensic Med.* 2011, 3(33), p. 221.
- [27] Steingraber S. *The Falling Age of Puberty In U.S. Girls: What We Know, What We Need To Know.* Breast Cancer Fund.2015
- [28] Al-Awadhi, N., Al-Kandari, N., Al-Hasan, T., Al-Murjan, D., Ali, S. and Al-Taiar, A. Age at menarche and its relationship to body mass index among adolescent girls in Kuwait. *BMC Public Health.* 2013, 13, p. 29. DOI: 10.1186/1471-2458-13-29
- [29] Cabrera S. M, Bright G. M, Frane, Blethen L. S and Lee P. A. Age of thelarche and menarche in contemporary US females: a cross-sectional analysis. *J Pediatr Endocrinol Metab.* 2014, 47–51. doi: 10.1515/jpem-2013-0286
- [30] Ulijaszek, S. J., Evans, E. and Miller, D. S. Age at menarche of European, Afro-Caribbean and Indo-Pakistani schoolgirls living in London. *Ann Hum Biol.* 1991, 18(2), pp. 167-175. DOI: 10.1080/03014469100001502
- [31] Adadevoh, S. W., Agble, T. K., Hobbs, C. and Elkins, T. E. Menarcheal age in Ghanaian school girls. *Int J Gynaecol Obstet.*1989, 30(1), pp. 63-68