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North American perception of the prestige of biomechanics serials

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Abstract

Biomechanics is a discipline with many applications and sub-areas so scholars often publish their work in journals in different subject categories used in the ISI Journal Citation Reports (JCR). It is not known whether the quality/prestige of journals in the discipline of biomechanics matches the ISI Impact Factor (IF) ratings reported in JCR. A survey of the membership of the American Society of Biomechanics (ASB) was conducted to rate the quality/prestige of typical papers in serials publishing biomechanics research on a five point scale. Seventy-eight of 610 ASB members responded to the survey. Mean journal prestige ratings were only weakly correlated ($r = 0.35$) with the IF for 2005, with serial ratings differing across the interest areas of the ASB respondents. It was concluded that IF's should be used with caution in evaluating the prestige of journals publishing biomechanics research. Furthermore, investigators should consider interest area specific ratings within biomechanics when selecting journals for publishing their research.

Keywords: Impact factor; Journal quality; Citation; Bibliometrics

1. Introduction

Since 1975, the Institute of Scientific Information (ISI) has published Journal Citation Reports (JCR) annually and presented citation statistics of scientific journals (http://portal.isiknowledge.com/). The impact factor (IF) reported in JCR is an important bibliographic tool for academic librarians. Over the years the IF provided a systematic way to evaluate scientific journals and their impact and influence in the global research community. The IF is essentially a citation index representing the mean number of citations an average article in a journal had in a year in the over 12,000 journals indexed relative to the number of papers published in that journal in the last 2 years.

While data reported in JCR can be useful in evaluating research productivity of an area of study [1] or different geographic regions within a discipline [2], a number of studies and authors have pointed out several limitations of the IF in evaluating journal quality [3–9]. The possible abuses and misuses of IF in evaluating institutional and individual faculty scholarship have also been discussed [6,8,10,11].

The IF, if used inappropriately, may have serious implications for researchers being compared across different fields of study. Decisions on funding of laboratories, equipment, retention, tenure, and promotion that are tied to IF all may have an adverse affect on researchers.

There is evidence that the IF is biased against smaller disciplines [5,8,12] and correcting the index for the size of the field/discipline cannot always be achieved [8]. Uncritical counting of citations provides more an index of popularity, rather than prestige or quality [3]. There are very poor correlations between the IF of a journal and citation rate of individual papers or scientists [8]. The wide variation, skew, and kinds of papers cited and counted are also well documented problems that confound the IF [5,6,8]. Another issue is the relatively short citation period (2 years) used in the computation of IF's. The short period may inflate the IF's of journals in fields with rapid publication and citation of papers and underestimates impact in disciplines with longer citation patterns [6,8]. Finally, the IF is not a measure of research quality based on the utility of the results in the field

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[10,13]. All these issues lead to concerns that true quality of a paper is different from the IF of the journal in which it is published [8,13] and evaluating individuals' research productivity based on IF of their publications has serious dangers [6,11]. In spite of several limitations, some contented that journal IF could be used as a rough indicator of scientific quality in specific subject categories [14].

Researchers in the field of biomechanics utilize methods of mechanics to study structure and function of biological systems. Biomechanics is a relatively small discipline with many applications and sub-areas. As a result, biomechanics scholars often publish their work in journals in different subject categories used in JCR. The above-mentioned limitations and possible misuses of IF may also apply to the field of biomechanics. It is not known whether the quality/prestige of journals in the discipline of biomechanics matches the IF reported in JCR. To address this question, it was the purpose of this study to document the perceived quality or prestige of English language peer-reviewed serials publishing biomechanical papers by the North American biomechanics community and evaluate the association between these ratings and the IF. A secondary purpose was to explore the potential differences in perceived quality/prestige of journals publishing biomechanical papers across different interest areas within biomechanics. It was hypothesized that there would be no association between serial ratings of prestige and the IF.

2. Methods

2.1. Instrument

An electronic mail survey was developed that listed 62 English language journals and regularly published proceedings that represented the variety of fields and publications focusing on biomechanics or using biomechanical research. Some journals were selected to represent general science, review, and relatively new journals. The journals and proceedings included in the survey are listed in Table 1. Participants in the study were asked to rate the journals based on their assessment of the mean quality or impact of papers from these journals in the field of biomechanics on a five-point scale:

- 4 Likely high quality/impact
- 3
- 2 Likely moderate quality/impact
- 1
- 0 Likely low quality/impact or unknown

When a respondent did not rate a particular serial, a score of zero was recorded. The survey was approved by the institutional human subjects review committee.

2.2. Population

With the assistance from the American Society of Biomechanics (ASB), the survey was sent to all 2006/2007 ASB members (630 in total) by electronic mail in the early 2007. Besides ratings of journal prestige in biomechanics, survey respondents were also asked to indicate their primary area of interest within biomechanics by selecting from the five options used by ASB: Biological Sciences, Engineering and Applied Physics, Ergonomics and Human Factors, Exercise and Sport Science, and Health Sciences. Twenty email addresses were invalid, so 610 members of the ASB were contacted. After 6 weeks, a reminder and survey were again emailed to all ASB members. Data collection was terminated 9 weeks after the initial email.

2.3. Data analysis

The mean and S.D. of prestige rating of each journal were calculated. The distribution of journal ratings was examined and percentiles were calculated. Mean ratings were correlated with the IF reported for 2005 with statistical significance accepted at the $P < 0.05$ level. Serials without IF in 2005 were excluded from the correlation analysis. To examine potential differences in prestige within interest areas, ratings were also sorted by respondent interest area.

3. Results

A total of 78 ASB members (13%) responded to the survey. Although the response rate was low, the respondents were representative of the ASB with a similar distribution of interest areas (biological sciences—10%, engineering/applied physics—38%, ergonomics/human factors—6%, exercise/sport science—23%, and health sciences—22%) to the ASB membership (7, 50, 10, 20, 13%, respectively).

Mean ratings of the serials were normally distributed ($W = 0.96$, $P < 0.13$) with a slightly positive skew and a mean (95% CI) rating of 1.6 (1.8–1.4). The median rating was 1.5, with approximately one third of the ratings above 2.0, a third between 2.0 and 1.0, and a third below 1.0. The mean and S.D. of prestige ratings are listed in rank order in Table 1. For those journals listed in Table 1 that had IF's in 2005 ($n = 48$), the mean IF was 3.1 (min: 0.3–max: 30.9). The mean was 1.7 (min: 0.3–max: 4.3) when the four review journals were excluded. There was a significant ($r_{46} = 0.35$, $P < 0.016$) but weak correlation between mean ratings and the IF for 2005. The correlation coefficient increased slightly when the four journals that publishing primarily review articles (see Table 1) were excluded from the analysis ($r_{42} = 0.42$, $P < 0.005$) or the Spearman rank correlation ($r_s = 0.49$, $P < 0.001$) was calculated from all 48 scores.

There was high variability of journal ratings across respondents with coefficients of variation between 13 and 167%. Some of the variability of ratings was due to the different research interest areas of the biomechanists who responded. Table 2 presents the 20 highest rated serials (approximately top 33%), excluding the four exclusively review journals, sorted by the five ASB interest areas.

4. Discussion

The survey responses provided the first quantitative ratings of serial quality or prestige in the field of

Table 1
Mean ± S.D. prestige ratings of biomechanics serials

Serial	Prestige rating
Journal of Biomechanics	3.8 ± 0.5
Clinical Biomechanics	3.0 ± 1.0
Journal of Bone & Joint Surgery	2.9 ± 1.3
Journal of Orthopaedic Research	2.9 ± 1.3
Nature*	2.8 ± 1.5
Science*	2.8 ± 1.6
Gait & Posture	2.7 ± 1.2
Journal of Biomechanical Engineering	2.7 ± 1.3
Journal of Applied Biomechanics	2.5 ± 1.2
Journal of Applied Physiology	2.4 ± 1.5
Medicine & Science in Sports & Exercise	2.4 ± 1.5
American Journal of Sports Medicine	2.3 ± 1.3
Journal of Biomedical Engineering#	2.3 ± 1.4
Journal of Electromyography & Kinesiology	2.2 ± 1.3
Experimental Brain Research	2.2 ± 1.6
Journal of Physiology	2.2 ± 1.7
Archives of Physical Medicine & Rehabilitation	2.1 ± 1.2
American Journal of Physiology	2.1 ± 1.5
Journal of Neurophysiology	2.1 ± 1.7
Exercise & Sports Sciences Reviews*	2.0 ± 1.6
Journal of Experimental Biology	1.9 ± 1.5
Muscle & Nerve	1.9 ± 1.5
European Journal of Applied Physiology	1.9 ± 1.3
Ergonomics	1.8 ± 1.3
Human Movement Science	1.8 ± 1.3
American J of Physical Med & Rehabilitation	1.7 ± 1.2
Physical Therapy	1.7 ± 1.3
Computer Methods in Biomech & Biomed Eng	1.7 ± 1.4
Motor Control	1.7 ± 1.4
Journal Orthopaedic & Sports Physical Therapy	1.6 ± 1.3
Human Factors	1.5 ± 1.3
Journal Human Movement Studies	1.5 ± 1.3
Journal of Motor Behavior	1.5 ± 1.3
Acta Physiologicia Scandinavica	1.4 ± 1.3
Medical & Biological Eng & Computing	1.4 ± 1.3
Applied Ergonomics	1.3 ± 1.2
British Journal of Sports Medicine	1.3 ± 1.3
Sports Biomechanics	1.3 ± 1.3
International Journal of Sports Medicine	1.3 ± 1.3
J Biomechanical Science & Engineering	1.3 ± 1.4
Journal of Science & Medicine in Sport	1.2 ± 1.3
Sports Medicine*	1.2 ± 1.3
Clinical Journal of Sports Med	1.1 ± 1.2
Journal of Sport Rehabilitation	1.1 ± 1.2
Journal Mechanics in Medicine & Biology	1.1 ± 1.3
Journal of Sports Sciences	1.1 ± 1.2
European Journal Sport Science	1.0 ± 1.2
Research Quarterly for Exercise & Sport	1.0 ± 1.1
Proceedings: Int Soc of Biomech in Sports	1.0 ± 1.2
Scand J Science in Medicine & Sport	1.0 ± 1.2
J Strength & Conditioning Research	0.9 ± 1.0
Journal of Athletic Training	0.9 ± 1.1
J of Sports Medicine & Physical Fitness	0.9 ± 1.0
Perceptual & Motor Skills	0.9 ± 1.1
Pediatric Exercise Science	0.8 ± 1.1
Sports Engineering	0.8 ± 1.1
International Journal of Sport & Health Science	0.8 ± 1.2
Isokinetics & Exercise Science	0.7 ± 1.0
Proceedings: Sport-Specific	0.7 ± 1.0
Proceedings: Int Sport Eng Assoc	0.7 ± 1.0
Japanese Journal of Biomech in Sports & Exercise	0.6 ± 1.0
Research in Sports Medicine	0.6 ± 1.0

* Journal publishing primarily review papers.
# Since 1993 this journal has been published under the name *Medical Engineering & Physics*.

biomechanics. The overall ratings in Table 1 are useful to scholars wishing to publish their research in serials considered of high quality/impact for a broad audience of biomechanics scholars in North America. Several biomechanics and orthopaedic journals were rated higher than the prestigious review journals such as *Nature* and *Science* (IF's > 29). Several journals from the areas of clinical biomechanics, kinesiology, physiology, and sports medicine were also rated as high prestige outlets for biomechanics research.

The hypothesis of no correlation between prestige ratings and the 2005 IF was not supported. The fact that this correlation was weak (r^2 = 12%), however, is evidence that the IF alone is inappropriate for evaluating journal prestige within the field of biomechanics. This result is consistent with studies using larger samples (33–75) of journals that report low (0.45–0.58) correlations between disciplinary ratings of journal quality and IF [15,16] and research on business scholars who consider survey-based quality data twice as important as citation-based ratings [17]. Studies that have reported higher correlations [7,18] between disciplinary ratings and IF have limited credibility because they used very small samples (5–9) of selected journals. The current survey data and the limitations and issues of the IF summarized in Section 1 support the conclusion that the IF should be used with caution in biomechanics.

Some respondents spontaneously commented about being reluctant to rate journals with a zero when they were not familiar with many papers in those journals, even though these serials often published biomechanics research. This is a limitation of the rating scale used in this study that contributed to the variability in the ratings, but this scale was needed to provide evidence on the overall prestige of serials in biomechanics. It should be noted that the overall ratings are likely influenced by the high percentage of respondents from the Engineering and Applied Physics and low percentage of respondents from the Ergonomics and Human Factors interest areas.

The variability in the overall ratings of many biomechanical serials was related to the interest area of the respondents. A comparison of Tables 1 and 2 indicates that some journals received mean prestige ratings up to one point higher or lower within an interest area compared to the global ratings. The influence of specificity of research interest was also apparent in several unsolicited recommendations from respondents for other journals they considered important to the field. The *IEEE Transactions on Biomedical Engineering*, *ISB Proceedings*, the *Journal of Gerontology*, and *Spine* represent just some of the serials recommended. These data suggest that researchers in biomechanics should consider the journals in Table 2 for publishing their research in order to be more visible and credible to an interest area within biomechanics. Since serial prestige in biomechanics is influenced by interest area, persons wanting to understand the prestige of biomechanics journals or articles must take

Table 2
Top 20 original research journals by respondent ASB interest area

Biol. Sciences ($n = 8$)		Eng. & Appl. Physics ($n = 30$)		Ergo. & Hum. Factors ($n = 5$)		Ex. & Sport Sciences ($n = 18$)		Health Sciences ($n = 17$)	
J Biomech	3.6	J Biomech	3.7	J Biomech	4.0	J Biomech	3.9	J Biomech	3.8
J App Physiol	3.5	J Biomec En	3.2	Clin Biom	3.8	M Sci Sp Ex	3.6	Gait & Post	3.4
J Neurophys	3.3	J Orth Res	3.0	J Orth Res	3.4	J App Biom	3.3	J Orth Res	3.2
J Physiol	3.1	Clin Biom	2.8	Ergonomics	3.0	Clin Biom	3.2	J B Jnt Surg	3.1
Exp Br Res	3.1	J B Jnt Surg	2.8	J Biomec En	3.0	Am J Sp Med	2.8	Clin Biom	2.9
J Exp Biol	2.9	Gait & Post	2.5	J B Jnt Surg	3.0	Gait & Post	2.8	Exp Br Res	2.9
Am J Physiol	2.9	J App Biom	2.3	Hum Factors	2.8	J EMG Kine	2.8	J Physiol	2.9
J B Jnt Surg	2.8	*J Biomed Eng*	2.2	J EMG Kine	2.8	J B Jt Surg	2.7	J EMG Kine	2.6
Clin Biom	2.5	J App Physiol	2.1	J App Physio	2.6	Exp Br Res	2.6	J Neurophys	2.6
J Biomec Eng	2.5	J C M B B E	1.8	J Biomed Eng	2.4	J App Physio	2.6	*J Biomed Eng*	2.6
J Orth Res	2.4	J Physiol	1.8	Am J Physiol	2.4	Sp Biomech	2.4	J Biomec Eng	2.4
E J App Phy	2.4	M Sci Sp Ex	1.7	Am J Sp Med	2.4	J Sports Sci	2.4	M Sci Sp Ex	2.4
J Orth Res	2.4	Ergonomics	1.7	Ar Ph Med Re	2.4	J Orth Res	2.4	Ar Ph Med Re	2.4
J Biomed Eng	2.4	Ar Ph Med Re	1.7	J Hum Mov St	2.4	Int J Sp Med	2.3	Am J Physiol	2.3
Gait & Post	2.3	J EMG Kine	1.6	Hum Mov Sci	2.2	Ar Ph Med Re	2.3	J App Biom	2.2
Mus & Nerve	2.3	Med Bi En C	1.5	J Physiol	2.2	Mus & Nerve	2.3	Am J Sp Med	2.2
Ar Ph Med Re	2.3	Hum Mov Sci	1.5	Per Mot Skills	2.2	J Biomec En	2.3	Mus & Nerve	2.2
M Sci Sp Ex	2.3	J Exp Biol	1.4	Mus & Nerve	2.0	J Exp Biol	2.3	J App Physiol	2.1
J EMG Kine	2.0	Exp Br Res	1.4	J App Biom	2.0	*J Biomed Eng*	2.2	E J App Phy	2.1
Motor Cont	2.0	Am J P M R	1.4	Gait & Post	2.0	J Or Sp Ph Th	2.2	Phys Therapy	2.1

The four journals publishing primarily review papers (see Table 1) were excluded from these rankings.
Abbreviations: CMBBE for Computer Methods in Biomechanics and Biomedical Engineering and Med Bi En C for Medical & Biological Engineering & Computing.

into account the interest area or application of the research.

Despite this variability in prestige ratings in many journals, there were also several journals that were consistently highly rated across interest areas (Table 2). Anecdotal evidence of the reliability and consistency of these ratings can be observed in consistency of the ratings of the *Journal of Biomedical Engineering*. This journal was identified by its old name (it has been published as *Medical Engineering & Physics* since 1993) in the survey to examine if ratings would be affected. All five interest areas rated this journal in the top 20 with consistent (Table 2) mean prestige ratings (2.4 ± 0.1). The consistency of the high prestige ratings for long standing journals in biomechanics and the lower ratings for newer journals supports the face validity of the survey scale and the ratings.

Other limitations of the present study include a potential bias from the serials selected for rating and the low response rate to the electronic mail survey. The response rate may have been low given the rather long number of serials (62) to rate and the finding that ratings tended to be related to ASB interest area within biomechanics.

The rankings reported in this study should only be used to supplement the other assessments of scientific quality like critical review of individual papers, citation counts, and acceptance rates of biomechanics serials. Even though these ratings provide an overall picture of serial prestige in biomechanics, there is no substitute for the critical judgment of quality of research by peers in the discipline. Research papers should be primarily evaluated on the merits of the study, not by the serial or journal in which they are published. The modeling study reported by Starbuck [19] showed that the low acceptance rates and vigorous review procedures in most journals ensures that many highly influential papers will be published in lower prestige journals.

Conflict of interest statement

In reference to our manuscript submitted for review for possible publication in Gait & Posture. We have no financial or personal relationships that constitute a conflict of interest with any of the journals examined in our study.

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