

A Cross-Sectional Study on the Assessment of Physical Literacy among Medical Students of Sri Venkateswara Medical College, Tirupathi

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ABSTRACT

BACKGROUND

Physical literacy (PL) is the motivation, confidence, physical competence, knowledge & understanding to value and take responsibility for engagement in physical activities for life. Physical literacy can be identified as a basis for the characteristics, attributes, behaviours, awareness, knowledge & understanding, towards a healthy lifestyle, as well as a foundation to an elite sport. Research shows that without the development of physical literacy, many children and youth withdraw from physical activity and sport and turn to more inactive &/or unhealthy choices during their leisure time. The objective of this study is to determine the physical literacy and the factors influencing it among medical students.

METHODS

This was a cross sectional study. Selection of participants was based on simple random sampling method by computer generated random numbers and then questionnaires were administered to all the participants. The questionnaire consisted of questions pertaining to sociodemographic and cultural factors, anthropometric measurements, and PLAY (physical literacy assessment for youth) self-tool. PLAY self-tool has the following sub-sections - environment, physical literacy self-description, relative ranking of literacies and fitness.

RESULTS

The mean physical literacy total score in our study was 59.5 ± 11.3 . About 19 % of the subjects scored PLAY self-total score grade of less than or equal to 50.0. Nearly 30 % scored physical literacy self-efficacy score of less than 600. Our results demonstrate significant associations between PLAY self-total score grade and gender, waist hip ratio, leisure time activity, Asian BMI, physical literacy self-efficacy score, fitness, and the most common mode of transport between college and home/hostel ($P < 0.05$).

CONCLUSIONS

Future research should explore and standardize the tools to assess physical literacy objectively in the young adults (18 - 25 years). We recommend increasing the physical activity hours in the medical curriculum and encourage active modes of transport (bicycles/walk etc) within the campus.

KEYWORDS

Physical Literacy, Physical Activity, Medical Students, Dr. Kriellaars's PLAY Self-Tool, Canadian Sport for life CS4L, Physical Literacy Assessment for Youth PLAY)

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BACKGROUND

Physical literacy (PL) is the motivation, confidence, physical competence, knowledge & understanding to value and take responsibility for engagement in physical activities for life.¹ Physical literacy can be identified as a basis for the characteristics, attributes, behaviours, awareness, knowledge & understanding, towards a healthy lifestyle, as well as foundation to the elite sport.² The individual who has physical literacy moves with poise, economy and confidence in a wide variety of physically challenging situations.³

Physical literacy is not a pure 'bodily' capacity, rather it describes a holistic engagement that encompasses physical capacities embedded in perception, experience, memory, anticipation and decision making.³ Research shows that without the development of physical literacy, many children and youth withdraw from physical activity and sport and turn to more inactive &/or unhealthy choices during their leisure time.^{4,5,6} The health benefits of physical activity are well established and include a lower risk of cardiovascular disease, hypertension, diabetes and breast and colon cancer. Additionally, physical activity has positive effect on mental health, delays the onset of dementia, and can help the maintenance of a healthy weight.⁷

In 2016, globally 28 % and in India 14 % of all adults aged 18 years and older were insufficiently physically active – defined as not meeting the world health organization (WHO) recommendation to perform at least 150 minutes of moderate-intensity physical activity per week, or the equivalent.⁸ 1.6 million deaths annually can be attributed to insufficient physical activity.⁹ In 2016, non-communicable diseases (NCDs), including heart disease, stroke, cancer, diabetes and chronic lung disease, are collectively responsible for almost 70 % of all deaths world-wide. Almost three quarters of all NCD deaths, and 82 % of the 16 million people who died prematurely, or before reaching 70 years of age, occur in low- and middle-income countries. The rise of NCDs has been driven by primarily four major risk factors: tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diets. In 2016, in India NCDs are estimated to account for 63 % of all deaths out of which 27 % due to cardiovascular diseases, 9 % due to cancers, 11 % due to chronic respiratory diseases, 3 % due to diabetes and 13 % due to other NCDs.¹⁰

Physical literacy is one of the health education topics in Swasthya Vidya Vahini programme that is being organized by the Government of Andhra Pradesh in which medical students of Andhra Pradesh state are directed to attend the villages and provide health education on various health topics. But there is no structured training and education to the medical students about physical literacy. Hence, there is a need to assess physical literacy among medical students as they are the future doctors who are going to counsel the patients as well as the general public regarding healthy lifestyle. Travis J Saunders et al. conducted a study using Canadian Assessment of Physical Literacy and self-reported questionnaire to identify the aspects of physical literacy that are associated with key modes of sedentary behaviour in 8,307 children aged 8.0 to 12.9 years and observed that physical competence, motivation and confidence were

negatively associated with all modes of sedentary behaviour, whereas knowledge and understanding was negatively associated with screen-based modes of sedentary behaviour and positively associated with non-screen sedentary behaviour.¹¹ Peter Holler et al. conducted a non-randomised controlled study in intervention group (IG) of 31 and control group (CG) of 30 physically inactive adults, respectively to investigate the effect of a holistic physical exercise training on PL among physically inactive adults and observed that the IG showed significant improvements in PL ($P = 0.001$), with no changes over served for the CG regarding PL.¹²

Erica Dugas conducted a study to pilot a PL assessment tool for disabled children and youth, by modifying components from Canadian Sport for Life Physical Literacy Assessment for Youth and observed that participants scores in individual PLAY self-categories paralleled their ranking of PL as the most significant category of literacy. However, this was contradicted by ~ 70 % of participants who testified to partaking in sedentary activities during their leisure time and reported limited participation in a wide range of physical activities.¹³ Belanger et al. conducted a cross-sectional study in 2956 Canadian children aged 8 - 12 years to examine the relationship between physical literacy scores in Canadian children who meet or do not meet physical activity and sedentary behaviour guidelines. Knowledge and understanding of physical activity principles was not related to guideline adherence in either model.¹⁴

Tremblay et al. conducted a study in 10,034 Canadian children aged 8 - 12 years to establish the current physical literacy level of Canadian children and observed that total physical literacy scores (out of 100) were on average 63.1 ± 13.0 for boys and 62.2 ± 11.3 for girls.¹⁵

Objectives

1. To determine physical literacy among medical students.
2. To determine the factors influencing physical literacy.

METHODS

This is a cross-sectional study conducted for a period of two months from July 2019 to August 2019 at Sri Venkateswara Medical College, Tirupati using Dr. Kriellaars's PLAY self-tool.

Sample Size

As studies related to this are meagre, assuming the prevalence as 50 % with 95 % confidence interval and allowable error of 10 %, the sample size was calculated using the formula

$$N = Z^2 \times 1 - P / \epsilon^2$$

Where,

N= required sample size

Z = reliability coefficient at 95 %confidence interval

P= proportion of population with characteristics of interest

ϵ = margin of error at 10 %of prevalence

The minimum sample size was estimated as

$$N = 4 \times 50 \times 50 / 5 \times 5, N = 400$$

Inclusion Criteria

Undergraduate medical students (first year to final year) who were willing to participate in the study.

The annual admissions of medical students in Sri Venkateswara Medical College is 200. At any point of time there will be 800 medical students in total for all four years. Around 100 medical students from each batch were selected by simple random sampling method using computer generated random numbers and then questionnaires were administered to all the participants and took care that they did not refer to any source of information or discuss among themselves. The questionnaire consists of the following sections - socio-demographic and cultural factors, anthropometric measurements, PLAY self-tool. PLAY self-tool has the following sub-sections: environment, physical literacy self-description, relative ranking of literacies and fitness. PLAY self-tool which was originally designed by Dr. Kriellaars was slightly modified to match with the Indian scenario. The following modifications were only done. How good are you at doing sports and activities 'on ice?' and 'on snow?' were replaced with 'on mud / sand?' and 'on mountain?' in the environment section. Anthropometric measurements include height, weight, body mass index (BMI), waist circumference, hip circumference and waist-to-hip ratio. Height was measured by stadiometer, weight by weighing machine, waist and hip circumference by fibre reinforced measuring tape. The students did not receive any compensation or reward for participating in the study.

The age group of recruited students for the study was 18 - 24 years. Modified B.G. Prasad's classification 2019¹⁶ was used to assess the socioeconomic status of studied subjects. The reference cut offs for waist circumference and waist-hip ratio were 90 cm & 0.9 for men and 80 cm & 0.8 for women respectively.¹⁷

Sl. No.	Nutritional Status	Asian Criteria BMI Cutoff ¹⁸
1	Underweight	<18.5
2	Normal	18.5-22.9
3	Overweight	23-24.9
4	Pre obese	25-29.9
5	Obese	≥30
Asian Criteria for BMI (kg/m²) Cut Off		

PLAY self-total score grade was divided into group 1 (≤ 50.0) and group 2 (> 50.0). Physical literacy self-efficacy score was divided into low and high by clubbing very low/relatively low and relatively high/very high groups, respectively. Moderate intensity physical activity per week in minutes was calculated by multiplying number of days in a week and minimum time spent on physical activity each day. Leisure time activity was divided into two groups - physical activity and sedentary activity.

Statistical Analysis

The data was entered in MS Excel and statistical analysis was done by using Epi info software package version 7.1. The data was represented in frequency and percentage for socio demographic data and physical literacy total score grade. Chi square test and Fisher's exact test were done to

find the association between physical literacy and various sociodemographic factors of the medical students and P value < 0.05 was considered to be significant. Mann Whitney test was also used to determine the association between the physical literacy total score grade and gender.

Ethical Considerations

Informed written consent was taken from the participants. Permission for using the PLAY self-tool was taken from the concerned authorities. Ethical clearance was obtained from the Institutional Ethical Committee.

RESULTS

	Variable	Frequency %
Age group	18 - 21 years	329 (82.3 %)
	22 - 25 years	71 (17.8 %)
Gender	Male	180 (45 %)
	Female	220 (55 %)
Residence	Urban	274 (68.5 %)
	Rural	126 (31.5 %)
Socioeconomic status	Upper class	306 (76.5 %)
	Upper middle class	59 (14.8 %)
	Middle class	21 (5.3 %)
	Lower middle class	11 (2.8 %)
Mode of transport between college and home/hostel	Lower class	3 (0.8 %)
	Bike/car/auto	192 (48 %)
Waist-to-hip ratio	Walk	208 (52 %)
	Normal	330 (82.5 %)
Waist circumference	Abnormal	70 (17.5 %)
	Normal	318 (79.5 %)
BMI	Abnormal	82 (20.5 %)
	Underweight	58 (14.5 %)
	Normal	176 (44 %)
	Overweight	67 (16.8 %)
	Pre obese	85 (21.3 %)
	Obese	14 (3.5 %)

Table 1. Baseline Data of Study Subjects

The mean age of the study subjects was 20.2 ± 1.3 . Nearly 82 % of the subjects were in 18 - 21 years age group. Out of total study subjects, 55 % were female and 45 % were male. Most of them reside in urban (68.5 %). Majority of them belong to upper class (76.5 %) (Modified B.G. Prasad's socioeconomic status classification-2019). Walking (52 %) was the most common mode of transport between college and home/hostel. 207 (99.5 %) of the subjects who walk, had less than or equal to 1 kilometre distance between college and home/hostel. The mean waist circumference of the total study subjects, male and female was 77.3 ± 9.9 cm, 81.1 ± 9.8 cm, 74.2 ± 8.9 cm respectively. Majority of the total study subjects (82.5 %), male (96.7 %) and female (70.9 %) had normal waist-to-hip ratio respectively. Majority of the total study subjects (79.5 %), male (81.1 %) and female (78.2 %) had normal waist circumference respectively. The mean BMI of the study subjects was 22.4 ± 3.8 kg/m². Majority of the total study subjects (44 %), male (37.8 %) and female (49.1 %) had normal BMI respectively. (Table 1).

The mean PLAY self-total score grade was 59.5 ± 11.3 . Nearly 82 % scored more than 50.0 of PLAY self-total score grade. (Table 2). The mean physical literacy self-efficacy score was 673.8 ± 170.8 . Nearly 70 % scored high physical literacy self-efficacy score. The mean of environment sub section of PLAY self-tool was 279.9 ± 114.0 . The mean of literary, numeracy and physical literacy in relative ranking of

literacies was 196.9 ± 55.7 ; 207.1 ± 63.6 and 250.7 ± 45.8 respectively. The study shows that majority were active in all seasons (31.5 %) of the year while majority agreed (69 %) with the statement regarding fitness i.e. "My fitness is good enough to let me do all the activities I choose." About 84 % of the subjects were insufficiently physically active - defined as not meeting the WHO recommendation to perform at least 150 minutes of moderate-intensity physical activity per week, or the equivalent. Physical activity was the most common leisure time activity in only 9 % of the subjects.

Sl. No.	Play Self-Total Score Grade	Frequency %
1.	≤ 50.0	74 (18.5 %)
2.	> 50.0	326 (81.5 %)

Table 2. Play Self Total Score Grade

Among study subjects with below or equal to 50.0 PLAY self-total score, Females were more than males and the difference between genders was found to be significant at 5 % level ($P < 0.05$). Subjects with normal waist to hip ratio were more than abnormal waist to hip ratio and difference between them was found to be significant at 5 % level ($P < 0.05$). Subjects with normal BMI were more compared to other categories and the difference between the BMI groups was found to be significant at 1 % level ($P < 0.01$). Subjects with low physical literacy self-efficacy score were more than high physical literacy self-efficacy score and the difference between the two groups was found to be significant at 1 % level ($P < 0.01$). Subjects who disagreed with the statement regarding fitness were more than others and the difference

between the groups was found to be significant at 1 % level ($P < 0.01$). Subjects with sedentary activity were more than physical activity and the difference between the groups was found to be significant at 5 % level ($P < 0.05$). Subjects whose mode of transport was walk were more than motorized transport and the difference between the groups was found to be significant at 1 % level ($P < 0.01$). The median physical literacy scores for male and female were 62.9 and 57.48. The P value suggests that there was a significant difference between males and females.

Gender	N	PL scores Mean \pm SD	PL Scores Median (Min, Max)	P Value
Male	180	62.7 ± 11.5	62.935, 92.6)	$P = 0.00$; S
Female	220	56.9 ± 10.4	57.4819, 82.4)	

Table 3. Mann-Whitney Test

DISCUSSION

The purpose of our study was to assess physical literacy and determine the factors influencing physical literacy. About 19 % of the subjects scored PLAY self-total score grade of less than or equal to 50.0. Nearly 30 % scored physical literacy self-efficacy score of less than 600. The results demonstrate significant associations between PLAY self-total score grade and gender, waist hip ratio, leisure time activity, BMI, physical literacy self-efficacy score, fitness, and most common mode of transport between college and home/hostel ($P < 0.05$).

		Physical Literacy Total Score Grade		Total %	Statistical Significance
		≤ 50.0 %	> 50.0 %		
Age groups	18-21 years	6385.1%	26681.5 %	32982.2 %	$\chi^2 = 0.51$ $P = 0.47$; NS
	22-25 years	1114.9 %	6022.5 %	7117.8 %	
Gender	Male	2533.8 %	15547.5 %	18045 %	$\chi^2 = 4.61$ $P = 0.03$; S
	Female	4966.2 %	17152.5 %	22055 %	
Residence	Urban	4763.5 %	22769.6 %	27468.5 %	$\chi^2 = 1.04$ $P = 0.30$; NS
	Rural	2736.5 %	9930.4 %	12631.5 %	
Socioeconomic status classification	Upper class	5168.9 %	25578.2 %	30676.5 %	Fisher's Exact test = 4.62 $P = 0.28$; NS
	Upper middle class	1621.6 %	4313.2%	5914.8 %	
	Middle class	45.4 %	175.2 %	215.3 %	
	Lower middle class	34.1%	82.5 %	112.8 %	
Waist hip ratio	Lower class	00 %	30.9 %	30.8 %	$\chi^2 = 4.20$ $P = 0.04$; S
	Normal	5574.3 %	27584.4 %	33082.5 %	
Waist circumference	Abnormal	1925.7 %	5115.6 %	7017.5 %	$\chi^2 = 0.81$ $P = 0.36$; NS
	Normal	5675.7 %	26280.4 %	31879.5 %	
BMI	Abnormal	1824.3 %	6419.6 %	8220.5 %	$\chi^2 = 16.35$ $P = 0.003$; S
	Underweight	2027 %	3811.7 %	5814.5 %	
	Normal	2432.4 %	15246.6 %	17644 %	
	Overweight	912.2 %	5817.8 %	6716.8 %	
Physical literacy self-efficacy score	Pre obese	2027 %	6519.9%	8521.3 %	$\chi^2 = 123.32$ $P = 0.000$; S
	Obese	11.4 %	134 %	143.5 %	
	Low	6283.8 %	5918.1 %	12130.3 %	
	High	1216.2 %	26781.9 %	27969.8 %	
Most active seasons	Summer	810.8 %	3310.1 %	4110.3 %	$\chi^2 = 10.19$ $P = 0.17$; NS
	Winter	56.8%	154.6 %	205 %	
	Rainy season	68.1 %	164.9 %	225.5 %	
	Summer, Winter	45.4 %	195.8 %	235.8 %	
	Summer, Rainy	68.1 %	5817.8 %	6416 %	
	Rainy, Winter	1216.2 %	5015.3 %	6215.5 %	
	All seasons	2027 %	10632.5 %	12631.5 %	
	I don't know	1317.6 %	298.9 %	4210.5 %	
Fitness	Disagree	3243.2 %	6018.4 %	9223 %	$\chi^2 = 42.48$ $P = 0.000$; S
	Agree	2837.8 %	24876.1 %	27669 %	
	I don't know	1418.9 %	185.5 %	328 %	
Moderate intensity physical activity per week (most of the times)	< 150 minutes	6587.8 %	27183.1 %	33684 %	$\chi^2 = 0.99$ $P = 0.31$; NS
	≥ 150 minutes	912.2 %	5516.9 %	6416 %	
Leisure time activity (most of the times)	Physical activity	22.7 %	3410.4 %	369 %	$\chi^2 = 4.39$ $P = 0.03$; S
	Sedentary activity	7297.3 %	29289.6 %	36491 %	
Mode of transport	Bike/car/auto	2331.1 %	16951.8 %	19248 %	$\chi^2 = 10.41$ $P = 0.001$; S
	Walk	5168.9 %	15748.2 %	20852 %	

Table 4. Association between Play Self-Total Score with Variable Parameters

S-Statistically Significant, NS-Not Statistically Significant

The mean physical literacy total score in our study was 59.5 ± 11.3 . It was slightly higher in previous studies done by Tremblay et al.¹⁵ and Saunders et al.¹¹ in which it was 62.7 ± 12.2 and 62.0 ± 11.0 , respectively and the difference might be due to use of different assessment tools and variation in the age group of participants.

In the present analysis, mean scores of total physical literacy score was more in males (62.7 ± 11.5) than females (56.9 ± 10.4). These findings were supported by previous research done by Tremblay et al. who also found mean scores of total physical literacy score was more in males (63.1 ± 13.0) than females (62.2 ± 11.3).¹⁵

The mean waist circumference (77.3 ± 9.9 cm) in our study was higher compared to the studies conducted by Tremblay et al.¹⁵ and Saunders et al.¹¹ in which it was about 67.3 ± 10.8 cm and 67.2 ± 10.7 cm and this difference was probably due to variation in the age group of participants.

The mean BMI (22.4 ± 3.8 kg/m²) in our study was more than another study conducted by Tremblay et al. in which it was about 19.0 ± 3.8 kg/m² and this difference was probably due to variation in the age group of participants.¹⁵

In this study, physical activity as most common leisure time activity was seen only in 9 % of the study subjects, where as it was about 30 % in a study done by Erica Dugas and the difference might be due to variations in the age and nationality of participants.¹³

In the present analysis, we found about 84 % of the subjects were insufficiently physically active defined as not meeting the WHO recommendation to perform at least 150 minutes of moderate-intensity physical activity per week, or the equivalent. These findings were highly contrast to a report of trends of physical inactivity in world (28 %) and India (14 %).⁹ This huge difference was due to participants being only young adults in our study whereas those findings in WHO report were for all adults aged above 18 years and also rapid changing patterns of lifestyle habits of people, with the advancing years.

CONCLUSIONS

These cross-sectional findings provide the PLAY self-total score grades and associations of variable parameters with PLAY self-total score grade in Indian medical students. To our knowledge, this is the first study on assessment of physical literacy among Indian medical students. Canadian sport for life PLAY self-tool can be used to assess and keep track of one's physical literacy journey by self. Future research should explore and standardize the tools to assess physical literacy objectively in the young adults (18 - 25 years).

Our findings show that PLAY self-total score grade was positively associated with gender, waist to hip ratio, leisure time activity, BMI, physical literacy self-efficacy score, fitness, and the most common mode of transport between college and home/hostel and negatively associated with residence urban/rural), socioeconomic status, waist to circumference, most active season, and minutes of moderate intensity physical activity per week.

We recommend awareness sessions on physical literacy and increase the physical activity hours in the medical curriculum and encourage usage of bicycles with in the campus.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

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REFERENCES

- [1] International physical literacy association, Definition of physical literacy. <https://www.physical-literacy.org.uk/>. Last accessed on Jan 12th 2019).
- [2] Mandigo J, Harber V, Higgs C, et al. Physical literacy within the educational context in Canada. *ICSSPE Bull J Sport Sci Phys Educ* 2013;65:360-366.
- [3] Whitehead M. The concept of physical literacy. *Eur J Phys Educ* 2001;62):127-38.
- [4] Burtton D, Martens R. Pinned by their own goals: an exploratory investigation into why kids drop out of wrestling. *J Sport and Exercise Psychocology* 1986;83):183-197.
- [5] Skard O, Vaglum P. The influence of psychosocial and sport factors on dropout from boys' Soccer: a prospective study. *Scandinavian J Sports Science* 1989;112):65-72.
- [6] Weiss MR, Ferrer-Caja E. Motivational orientations and sport behavior. In: Horn T, edr. *Advances in sport psychology*, champaign. IL: Human Kinetics 2002;2:101-183.
- [7] WHO. Global recommendations on physical activity for health. Geneva: World Health Organisation 2010.
- [8] Guthold R, Stevens GA, Riley LM, et al. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants. *Lancet Global Health* 2018;610):e1077-e1086.

- [9] GBD 2015 risk factors collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental, occupational and metabolic risks or clusters of risks, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016;388(10053):1659-1724.
- [10] Non-communicable diseases country profiles 2018. Geneva: World Health Organization, 2018. Licence: CC BY-NC-SA 3.0 IGO.
- [11] Saunders TJ, MacDonald DJ, Copeland JL, et al. The relationship between sedentary behavior and physical literacy in Canadian children: a cross sectional analysis from the RBC - CAPL Learn to Play Study. *BMC Public Health* 2018;18(Suppl 2):1037.
- [12] Holler P, Jaunig J, Frank-Michael A, et al. Holistic physical exercise training improves physical literacy among physically inactive adults: a pilot intervention study. *BMC Public Health* 2019;19(1):393.
- [13] Dugas EB. Levelling the playing field: assessing physical literacy in children and youth with physical disabilities. Masters Thesis, Brock University, Ontario, Canada. <https://pdfs.semanticscholar.org/3ae7/99d14e735b3461c49cf48ee28b1700f08a78.pdf>. Last accessed on Oct 31st 2019)
- [14] Belanger K, Barnes JD, Longmuir PE, et al. The relationship between physical literacy scores and adherence to Canadian physical activity and sedentary behavior guidelines. *BMC Public Health* 2018;18(Suppl 2):1042.
- [15] Tremblay MS, Longmuir PE, Barnes JD, et al. Physical literacy levels of Canadian children aged 8-12 years: descriptive and normative results from the RBC Learn to Play-CAPL project. *BMC Public Health* 2018;18(Suppl 2):1036.
- [16] Pandey VK, Aggarwal P, Kakkar R. Modified BG Prasad Socio-economic Classification, Update – 2019. *Indian J Comm Health* 2019;31(1):123-125.
- [17] Meshram 2nd, Rao MV, Rao VS, et al. Regional variation in the prevalence of overweight/obesity, hypertension and diabetes and their correlates among the adult rural population in India. *British Journal of Nutrition* 2016;115(7):1265-1272.
- [18] World Health Organization. Western Pacific Region and International Association for the Study of Obesity (IASO). The Asia-Pacific perspective: redefining obesity and its treatment. Health Communications Australia Pty Limited 2000.