



Complementary and alternative medicine use in children with autistic spectrum disorder in Mauritius

Shafeeq Mahomed, Fawzi Mahomoodally

ABSTRACT

Aim: The aim of the study was to explore the use of complementary and alternative medicine (CAM) in the management of autistic spectrum disorder (ASD) in Mauritius. **Methods:** Parents/legal guardians of ASD patients were surveyed. Effectiveness, method of use, possible side effects, reasons behind the use of CAM, source of recommendation, and beliefs behind the cause of ASD were explored. **Results:** Out of the 23 individuals with ASD recruited, 73.9% were formally diagnosed with ASD while 26.1% showed traits of autism. Educational techniques (13.6%, $n = 8$), prescribed drugs (35.6%, $n = 21$), speech therapy (15.3%, $n = 9$), occupational therapy interventions (22.0%, $n = 13$), and applied behavioral analysis (13.6%, $n = 8$) were employed by ASD patients as conventional therapies. Only 18 CAM interventions have been observed to be commonly used by the sample of ASD surveyed in the present study. The most used therapies were omega-3 (6.6%), vitamins (7.9%), music therapies (9.2%), sensory integration therapy (7.9%), spiritual healing (14.5%), hippotherapy (7.9%), and hydrotherapy 6.6%. Interestingly, studies have found that omega-3 was helpful in attention deficit hyperactivity disorder while vitamins can improve nutritional and metabolic status and decrease stereotyped behaviors among children with ASD. Likewise, equine-assisted therapy was found to improve social functioning, motor abilities, and executive functioning. Although spiritual healing was reported to be effective in this study, its mechanism and clinical applications remain anecdotal and controversial. **Conclusion:** The use of CAM is in common use among ASD patient and is gaining popularity.

KEY WORDS: Autism, autistic spectrum disorder, complementary and alternative therapies, Mauritius

Department of Health Sciences, Faculty of Science, University of Mauritius, Moka, Mauritius

Address for correspondence:

Fawzi Mahomoodally,
University of Mauritius,
Moka, Mauritius.
E-mail: f.mahomoodally@uom.ac.mu

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INTRODUCTION

According to the World Health Organization [1], autistic spectrum disorder (ASD) encompass a group of complex developmental disorders which is characterized by significant social, communication, and behavioral difficulties [2]. The causes of the ASD are not well known although these disorders are currently seen as genetic conditions and multifactorial in nature. Furthermore, while there are many behavioral and educational interventions that enhance communication and management of ASD, promote developmental progress, and manage behavioral difficulties, and none are curative [1-12].

A global median prevalence estimation of 62/10,000 has been projected, which can be further interpreted as more than 7.6 million disability life years and 0.3% of the global burden of disease [3]. Moreover, it has also been shown that one in 68 children are affected by ASD in the United States [4]. The recent criteria set by CDC has been suggested to reduce the estimated prevalence of ASD from 1 in 88 to 1 in 100 cases diagnose [5].

Developing countries, such as Mauritius, have not been spared, whereby the prevalence of ASD in Mauritius has shown to be increasing from 2012 to 2015. ASD is manifested by qualitative impairment in social interaction, qualitative impairments in communication, restricted repetitive, and stereotyped patterns of behavior, interests and activities, and delays or abnormal functioning in certain areas [6]. Despite the alarming figures and the complexity behind the diagnosis of ASD, presently there is no known cure for ASD [7].

Nonetheless, medications and treatment approaches that can help improve the functional status of the affected individuals are available [8]. These can be classified as behavior and communication approaches, dietary approaches, and medication which comprise facilitated communication, vitamin therapy, auditory training, sensory integration, occupational therapy, and physical therapy (also known as physiotherapy) among others [7]. Furthermore, the only Food and Drug Administration permitted drugs has been “risperidone” since 2006 which is utilized to manage irritability in individuals with ASD, who are between 5 and 16 years of age [8] and “aripiprazole” since 2009 [9]. Despite the fact,

there are other drugs which are commonly used to alleviate the symptoms associated with ASD, these drugs present risks which in some cases can be critical [8]. Likewise, it has been suggested that decreased efficacy and more adverse effects are experienced from psychiatric medications, such as behavioral toxicity with tricyclic antidepressants and social withdrawal and irritability with methylphenidate, by individuals with ASD [9].

Due to the current dearth of risk-free medications and patient's dissatisfaction in conventional drugs, ASD patients and health-care professionals tend to resort to complementary and alternative medicine (CAM). According to the National Center for CAM, CAM encloses a category of varied medical and health-care systems, practices, and products which usually do not form part of conventional medicine [10]. It has been reported that as many as one-third of parents of children with ASD may have tried CAM [4] and that the prevalence of the use of CAM in children with ASD is among the highest population, with reported use between 52% and 95% [11].

Evidence shows that CAM is gaining much momentum due to their large range of benefits and low side effects which reflect on the increasing use of CAM in both developed and developing countries including Mauritius. However, information in relation to the use of CAM for the management of ASD is still fragmented in Mauritius, and to the best of our knowledge, there has been no research conducted in Mauritius to probe into the management of ASD using CAM. Therefore, this study sets out to investigate into the use of CAM for the management of ASD.

METHODS

Study Sample

Parents and/or legal guardians of patients ($n = 40$) who have been diagnosed with ASD and attending special educational needs (SENs) schools in Mauritius were surveyed. Parents and/or legal guardians were identified with the assistance of therapists working at SENs schools. They were questioned about the use and perceived usefulness of CAM for the individuals with ASD. Data collection were initiated during the academic year 2015-2016.

Information required to meet the aim and objectives of this project was gathered from participants by answering key questions in an interviewer-administered questionnaire. All information was collected from the parents of the children with ASD [12]. It is only after the ethics committee of the department of health sciences had reviewed and authorized the study protocol, and the respondents had been given all the necessary information about the study and have agreed to participate after signing an informed consent that data collection was initiated. The main selection criteria include (1) diagnosis made as from the age of 2 years which is considered as very reliable and (2) individuals diagnosed with ASD for at least 6 months preceding the study [12].

Questionnaire Design

The questionnaire was designed and constructed following intensive literature research through key databases such as PubMed, Scopus, and Science Direct. The questionnaire consisted of three sections. Section A inquired about the sociodemographic information of the parents and/or legal guardians; Section B about the medical information of the subject with ASD; Section C about the use of CAM, including its effectiveness, method of consumption, possible side effects, reasons behind using CAM, and source of recommendation and beliefs behind the cause of ASD. The sociodemographic and clinical features, reasons for utilizing CAM, source of recommendation for the usage of CAM and parents and/or legal's beliefs behind the cause of ASD, as described by Bilgiç *et al.* [12] and Re *et al.* [13]. The list of CAM used in Section C, biologically and non-biologically based treatments, was taken from a previous study [14].

The ratings of the perceived effectiveness of CAM were presented on a Likert scale, using a scale of 1-5, whereby the participants were asked to rate the perceived effectiveness of each CAM and the scale was expanded into: 1 = Strongly agree, 2 = Agree, 3 = Neutral, 4 = Disagree and 5 = Strongly disagree. Likewise, the degree of any adverse effect following any CAM was rated as: 1 = None, 2 = Low, 3 = Moderate, 4 = Substantial and 5 = Severe. Furthermore, the perceived effectiveness of conventional therapies for the management of ASD was rated as: 1 = Very effective, 2 = Somewhat effective, 3 = Neutral, 4 = Somewhat ineffective, and 5 = Very ineffective.

Data Collection and Analysis

The interviewer-administered questionnaire was used to gather information during interviews of parents/guardians. The respondents were made aware that the survey was entirely voluntary and that they had the right to refuse to participate. They were provided with relevant information, including the purpose of the study and were requested to sign an informed consent form before any interview was conducted. The informed consent was adapted from the Informed Consent Form Template for Clinical Studies set by the Research Ethics Review Committee [15]. All information collected remained confidential, where anonymity was respected, and the information was available only to the research team.

Data were stored in Microsoft Excel Spreadsheets 2007 and were imported in the Statistical Package for the Social Sciences 20.0 database. Descriptive statistics, comprising of frequencies, means, and standard deviation, were used to illustrate sociodemographic characteristics, medical information on the ASD subject, and the use of CAM.

RESULTS

Sociodemographic Profile

Of the 23 individuals with ASD, 52.2% was male with a mean age of 16.9 ± 8.5 . 73.9% presented with a doctor's diagnosis of

autistic disorder while 26.1 had only traits of autism [Table 1]. The major challenge was to recruit patients with a formal diagnosis of ASD by a health-care professional and also its prevalence is quite low in Mauritius.

Conventional Therapies

Out of the 23 individuals with ASD, only two were not following any conventional therapy. Out of the 21 individuals, 13.6% ($n = 8$) has used educational techniques, 35.6% ($n = 21$) has used prescribed drugs, 15.3% ($n = 9$) has followed speech therapy interventions, 22.0% ($n = 13$) has followed occupational therapy interventions and 13.6% ($n = 8$) has followed applied behavioral analysis.

The participants rated the effectiveness of conventional therapies as follows: 21.7% ($n = 5$) very effective, 47.8% ($n = 11$) somewhat effective, 13.0% ($n = 3$) were neutral about their effectiveness, 4.3% ($n = 1$) somewhat ineffective, and 13.0% ($n = 3$) has found them very ineffective [Figure 1].

Participants (13.0%) have experienced adverse effects with the use of conventional therapies, namely, drowsiness while 73.9% has not found any adverse effect. Out of three participants who observed adverse effects, 8.7% rated the effects as moderate, and 4.3% rated it as substantial [Figure 2 and Table 2].

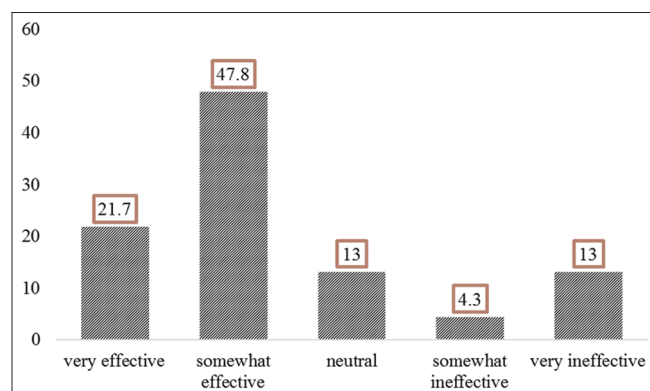


Figure 1: Effectiveness of conventional therapies

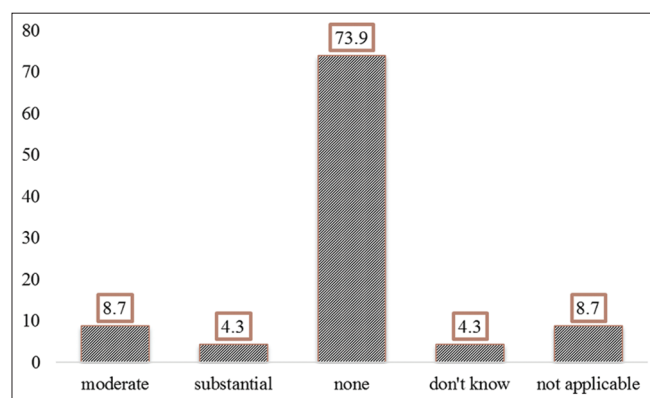


Figure 2: Rating of adverse effects observed with conventional therapies

CAM Interventions

We found that individuals with ASD have been subjected to only 18 interventions, which is further described as: 3.9% ($n = 3$) elimination diets, 3.9% ($n = 3$) ketogenic diets (KDs), 2.6% ($n = 2$) camel milk, 1.3% ($n = 1$) Chinese herbal medicine, 6.6% ($n = 5$) omega-3, 7.9% ($n = 6$) vitamins, 9.2% ($n = 7$) music therapies, 7.9% ($n = 6$) sensory integration therapy (SIT), 1.3% ($n = 1$) drama therapy, 2.6% ($n = 2$) dance therapy, 14.5% ($n = 11$) spiritual healing, 3.9% ($n = 3$) pet therapy, 1.3% ($n = 1$) acupuncture/acupressure, 3.9% ($n = 3$) massage therapy, 7.9% ($n = 6$) hippotherapy, 10.5% ($n = 8$) has done special exercises, and 6.6% ($n = 5$) has used hydrotherapy [Table 3].

Effectiveness of CAM

Out of the three participants who used elimination diets, 13.0% strongly agreed (Likert scale score 1) that they were effective and the remaining were neutral (Likert scale score 3) (4.3%). 8.7% ($n = 2$) strongly agreed (Likert scale score 1) that KD was effective while 4.3% ($n = 1$) only agreed (Likert scale score 2) that it was effective. The only participant who used camel milk rated its effectiveness as 2 on the Likert scale while the

Table 1: Medical information about individuals with ASD

Variables	Frequency (%)
Gender	
Male	12 (52.2)
Female	11 (47.8)
Mean age (SD), $n=23$	16.9 (± 8.5)
Doctor's diagnosis	
Autistic disorder	17 (73.9)
Traits of autism	6 (26.1)
Mean years since diagnosis (SD), $n=23$	12.7 (± 27.4)

SD: Standard deviation, ASD: Autistic spectrum disorder

Table 2: Conventional therapies use their effectiveness, adverse effect, and rating of adverse effects

Variables	Frequency (%)
Therapies	
Educational techniques	8 (13.6)
Prescribed drugs	21 (35.6)
Speech therapy	9 (15.3)
Occupational therapy	13 (22.0)
ABA	8 (13.6)
Effectiveness	
Very effective	5 (21.7)
Somewhat effective	11 (47.8)
Neutral	3 (13.0)
Somewhat ineffective	1 (4.3)
Ineffective	3 (13.0)
Adverse effect	
Yes	3 (13.0)
No	17 (73.9)
Do not know	1 (4.3)
Rating of adverse effect	
Moderate	2 (8.7)
Substantial	1 (4.3)
None	17 (73.9)
Do not know	1 (4.3)

ABA: Applied behavioral analysis

Table 3: Complementary and alternative therapies used, number of times CAM used in the past 3 months, method of CAM utilization, their effectiveness and the rating of adverse effects observed

CAM	CAM used	Number of times used	Mode of use (%)*	Effectiveness (%)*	Adverse effect (%)*
	<i>n</i>	Days (%)*			
Elimination diets	3	43-49 (4.3) 85-91 (8.7)	Oral (13.0)	Strongly agree (13.0)	None (13.0)
Ketogenic diets	3	22-28 (4.3) 36-42 (8.7)	Oral (13.0)	Strongly agree (8.7) Agree (4.3)	None (8.7) Low (4.3)
Camel milk	2	1-7 (4.3) Don't know (4.3)	2 (8.7)	Agree (8.7)	None (8.7)
Chinese herbal medicine	1	8-14 (4.3)	Oral (4.3)	Strongly agree (4.3)	None (4.3)
Omega-3	5	36-42 (13.0) 57-63 (4.3) Don't know (4.3)	Oral (21.7)	Strongly agree (13.0) Agree (4.3) Neutral (4.3)	None (17.4) Low (8.7) Moderate (4.3)
Vitamins		57-63 (4.3) 85-91 (13.0) Don't know (8.7)	Oral (21.7) Do not know (4.3)	Strongly agree (8.7) Agree (8.7) Neutral (8.7)	None (21.7) Do not know (4.3)
Music therapies	7	36-42 (4.3) 43-49 (4.3) 85-91 (21.7)	Listening (30.4)	Strongly agree (13.0) Agree (17.4)	None (30.4)
SIT	6	8-14 (8.7) 36-42 (17.4)	Stimulation of senses (21.7) Do not know (4.3)	Strongly agree (17.4) Agree (8.7)	None (26.1)
Drama therapy	1	85-91 (4.3)	Watching (4.3)	Strongly agree (4.3)	None (4.3)
Dance therapy	2	22-28 (8.7)	Moving body parts (8.7)	Strongly agree (8.7)	None (8.7)
Spiritual healing	1	1-7 (4.3) 8-14 (34.8) 22-28 (4.3) 85-91 (4.3)	Recitation/reading (13.0) Listening (30.4) Do not know (4.3)	Strongly agree (43.5) Neutral (4.3)	None (47.8)
Meditation/relaxation	3	22-28 (4.3) 85-91 (8.7)	Listening (13.0)	Strongly agree (4.3) Agree (8.7)	None (13.0)
Pet therapy	3	85-91 (13.0)	Playing (13.0)	Strongly agree (13.0)	None (8.7) Low (4.3)
Acupuncture	1	1-7 (4.3)	Application through skin (4.3)	Strongly disagree (4.3)	Substantial (4.3)
Massage therapy	3	8-14 (4.3) 36-42 (4.3) 85-91 (4.3)	Application on skin (13.0)	Agree (13.0)	None (8.7) Moderate (4.3)
Hippotherapy	6	8-14 (26.1)	Riding (26.1)	Strongly agree (21.7) Neutral (4.3)	None (26.1)
Special exercises	8	8-14 (4.3) 15-21 (4.3) 22-28 (8.7) 36-42 (17.4)	Exercise (30.4) Do not know (4.3)	Strongly agree (17.4) Agree (8.7) Neutral (8.7)	None (34.8)
Hydrotherapy	5	1-7 (8.7) 8-14 (13.0)	Water activities (21.7)	Strongly agree (21.7)	None (21.7)

*Percentage calculated based on number of respondents. CAM: Complementary and alternative medicine

only respondent who used Chinese herbal medicine rated its effectiveness as 1 (strongly agree) on the Likert scale. Out of five respondents who used omega-3 for the management of ASD, 13.0% rated its effectiveness as 1, 4.3% rated it as 1 and 4.3% was neutral about its effectiveness. Out of six participants, 8.7% rated the effectiveness of vitamins as 1 (strongly agree), 8.7% as 1 (agree), and 8.7% was neutral about its effectiveness. Out of the two participants who used music therapy for the management of ASD, 13.0% strongly agreed that it was effective while 17.4% only agreed that it was effective. Out of 23 participants, only six used SIT, whereby, 17.4% rated its effectiveness as 1 and 8.7% rated it as 2. The only respondent who used drama therapy rated its effectiveness as 1 and the only two participants who used dance therapy rated its effectiveness as 1 on the Likert scale. Out of the 11 participants who used spiritual healing, 43.5% rated its effectiveness as 1 and 4.3% rated it as 3 on the Likert scale. Out of the three respondents who used meditation/relaxation, 4.3% rated its effectiveness as 1 and 8.7% rated it as 2 [Table 4].

Adverse Effects Following Use of CAM

As illustrated in Table 4, 43.5% ($n = 10$) of the participants have not observed any adverse effect from the use of CAM for the management of ASD while 8.7% ($n = 2$) reported that the individuals with ASD experienced diarrhea, 4.3% ($n = 1$) experienced insomnia, 8.7% ($n = 2$) suffered from generalized body discomfort, and 13.0% ($n = 3$) suffered from stomach discomfort.

Reasons for Using CAM for the Management of ASD

As shown in Table 5, 26.1% ($n = 6$) of the participants reported that the reason behind using CAM was because conventional therapies were ineffective while 13.0% ($n = 3$) reported that it was because of cultural/family tradition. Likewise, 21.7% ($n = 5$) used CAM to avoid side effects associated with pharmacotherapy while 4.3% ($n = 1$) believed that the etiology of ASD was related

to CAM theories. Similarly, 13.0% ($n = 3$) used CAM so as to improve the efficacy of conventional intervention while 17.4% ($n = 4$) used CAM because they preferred natural therapies.

Source of Recommendation for the Use of CAM

As shown in Table 6, 34.8% ($n = 8$) of the participants was recommended by their family members to use CAM for the management of ASD while 21.7% ($n = 5$) used CAM based on the information obtained from media/websites. Similarly, 8.7% ($n = 2$) was recommended by special educators, 13.0% ($n = 3$) by other parents who had children with ASD, 4.3% ($n = 1$) by physician and 17.4% ($n = 4$) was recommended by their traditional practitioners. Likewise, 4.3% ($n = 1$) used CAM due to personal belief and information obtained from research papers.

Belief behind the Cause of ASD

As reported in Table 7, 8.7% ($n = 2$) of the participants thought that the cause of ASD was due to genetic/congenital factors and due medical interventions/mistakes of physicians while 26.1% ($n = 6$) believed that was because of birth complications. Likewise, 17.4% ($n = 4$) thought that the etiology of ASD was due to toxicity of mercury, foods, and prematurity. Similarly, 26.1% ($n = 6$) believed that ASD was the result of destiny and 4.3% ($n = 1$) thought it was because of environmental factors while 13.0% ($n = 3$) had no idea about the possible etiology of ASD.

Difficulties Faced by the Individuals with ASD

As shown in Figure 3, 56.5% presented with difficulty in coordination, 34.8% with difficulty in muscle strength, 52.2% with impaired balance, 30.4% presented with tip-toe walking, 56.5% presented with impaired cardiorespiratory endurance, 39.1% had difficulty in sleeping, 34.8% had difficulty in attaining relaxation, 21.7% had constipation, 52.2% presented

with improper posture, only 4.3% presented with seizure, 13.0% presented with diarrhea, 56.5% was distressed by changes, 73.9% was fussy eaters, 65.2% presented with fixation, 73.9% indulged in repetitive activity, 69.6% had difficulty in exploring the environment, 73.9% indulged in repetitive movements, 60.9% had rigid routines, 60.9% present with low confidence level, and 65.2% had difficulty in self-help skills.

DISCUSSION

Dietary Interventions

Three out of the 23 participants who used elimination diet strongly agreed that the dietary intervention was effective with no adverse effects recorded. A randomized, double-blinded, placebo-controlled and partly-crossover study by showed significant improvement in Autism Diagnostic Observation Schedule-communication and repetitive domains and Childhood Autism Rating Scale (CARS) social domain after 12 and 24 months [14]. However, Brondino *et al.* [14] showed no significant clinical improvement which may be due to small sample size and short duration of the intervention. The main reason put forward by parents for not using elimination diets was its high cost [14].

Participants who used KDs found this intervention to be effective with low adverse effects. This intervention was used during 22-28 days and between 36 and 42 days. The improvement of the symptoms associated with ASD have been justified by the minor improvement of CARS following a prospective study involving a KD, consisting of 30% energy derived from medium-chain triglyceride oil, 30% fresh cream, 11% saturated fat, 19% carbohydrates, and 10% protein, for 30 children with

Table 4: Adverse effects reported from the use of CAM

Adverse effects observed	Frequency (%)
None	10 (43.5)
Diarrhoea	2 (8.7)
Insomnia	1 (4.3)
Generalized body discomfort	2 (8.7)
Stomach discomfort	3 (13.0)
Other adverse effects	2 (8.7)

CAM: Complementary and alternative medicine

Table 5: Reasons for using CAM

Reasons	Frequency (%)
Ineffective conventional therapies	6 (26.1)
Cultural/family tradition	3 (13.0)
Avoiding side effects of pharmacotherapy	5 (21.7)
Belief that the etiology of ASD is related to CAM theories	1 (4.3)
To improve efficacy of conventional interventions	3 (13.0)
Preferred natural therapies	4 (17.4)
Other reasons	1 (4.3)

CAM: Complementary and alternative medicine, ASD: Autistic spectrum disorder

Table 6: Source of recommendation for the use of CAM

Source	Frequency (%)
Family members	8 (34.8)
Media/websites	5 (21.7)
Special educator	2 (8.7)
Other parents who had children with ASD	3 (13.0)
Physician	1 (4.3)
Traditional practitioner	4 (17.4)
Personal belief	1 (4.3)
Research papers	1 (4.3)

CAM: Complementary and alternative medicine, ASD: Autistic spectrum disorder

Table 7: Beliefs of participants about the causes of ASD

Causes	Frequency (%)
Genetic/congenital factors	2 (8.7)
Medical interventions/mistakes of the physicians	2 (8.7)
Birth complications	6 (26.1)
Toxicity of mercury	4 (17.4)
Foods	4 (17.4)
Prematurity	4 (17.4)
No idea	3 (13.0)
Destiny	6 (26.1)
Environmental factors	1 (4.3)

ASD: Autistic spectrum disorder

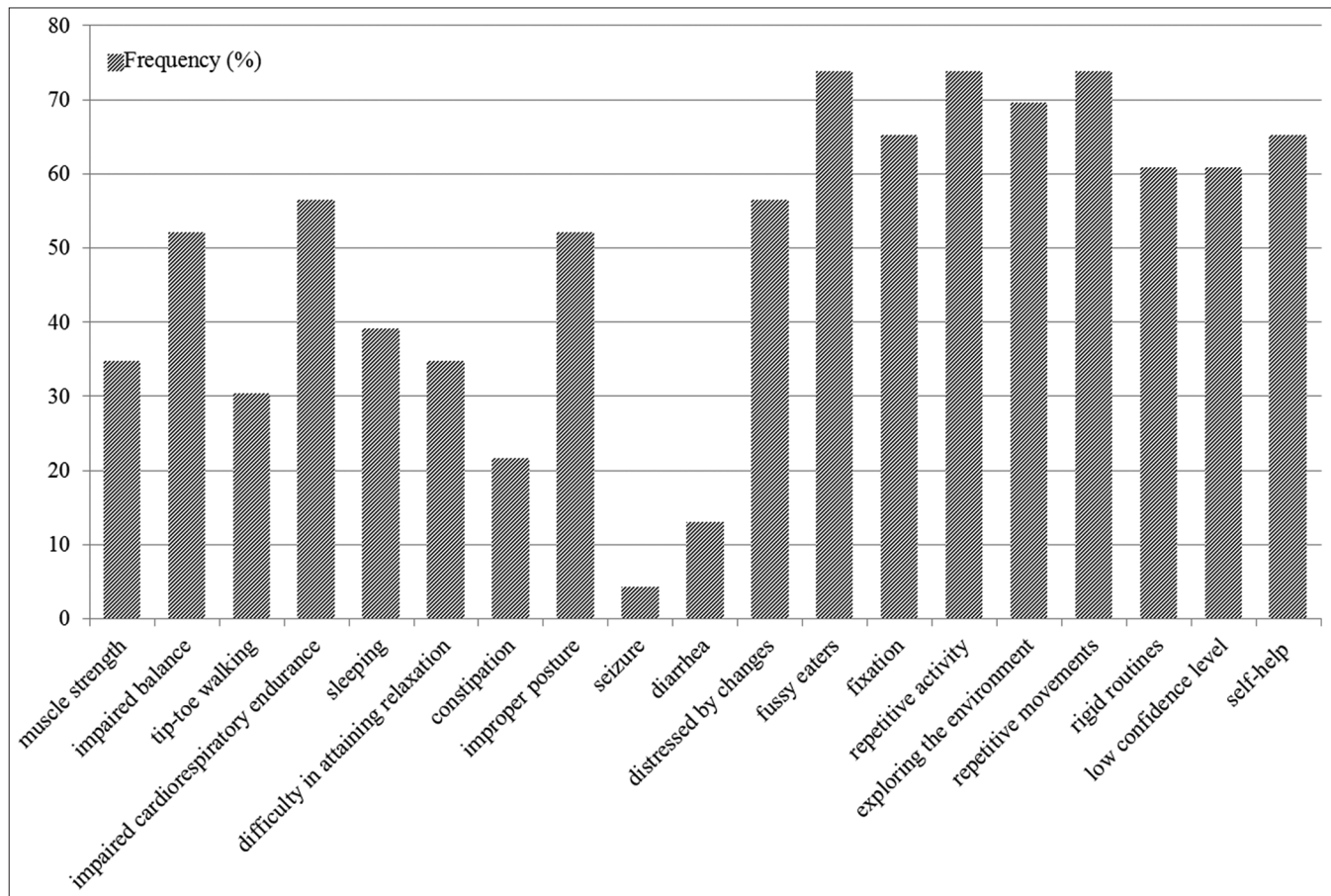


Figure 3: Difficulties faced by individuals with autistic spectrum disorder

ASD [14]. Likewise, a case study showed improvement in seizure activity, electroencephalogram, cognitive and social skills, language function, and resolved stereotypic behaviors but it was difficult to assess whether the diet was solely responsible for these improvements [16].

Two participants used camel milk between 1 and 7 days with no adverse effect observed. The participants found camel milk to be effective. This can be explained by the constituents of camel milk which are essential to prevent food allergy and with immunomodulatory potential [17]. Although the duration of use and the dosage of camel milk are yet to be determined on a larger scale, it has been suggested by Al-Ayadhi and Elamin [17] that camel milk plays a crucial role in reducing oxidative stress and in the improvement of autistic behavior since individuals with ASD have shown to be vulnerable to oxidative stress. Likewise, it has also been demonstrated significant improvement in CARS following consumption of raw camel milk [14].

Nutraceuticals

The consumption of omega-3, in the form of fish oil or supplements, was found to be commonly used with moderate to low adverse effects. Out of six key studies from 2007 to 2014, only one has reported improvement in children with ASD [14]. However, it was argued that the statistical analysis was

incorrect with an open label design and small sample size [14]. Although there was no statistically significant improvement in hyperactivity for children affected by ASD, there has been a greater decrease, of standardized effect size of 0.38 when compared to the placebo group [18]. Despite the lack of known mechanism for omega-3 in the management of ASD and limited studies on a large scale to prove its efficacy, since it is safe, easy, cheap, and logical to us as it is an essential part in nutrition for cardiovascular health, attention deficit hyperactivity disorder, and mood disorder, it has passed the SECS criterion and is allowed for use for the management of ASD [19].

It was found in this study that the intake of vitamins was effective with no side effects. This can relate to the findings of Adams *et al.* [20] which showed that nutritional and metabolic status of children with autism can be improved by supplements of oral vitamin/mineral, whereby the dose was increased during the first 3 weeks, suggesting that these supplements should be taken into consideration as a complementary therapy. Likewise, it has been observed that Vitamin C can decrease stereotyped behaviors in children with ASD [14].

Mind-body Interventions

Music therapy was found to have positive effects on individuals with ASD, with no side effects involved. A review by

Geretsegger *et al.* [21] of all randomized controlled trials or controlled clinical trials demonstrated that social interaction, verbal communication, initiating behavior, social-emotional reciprocity, and non-verbal communication, social adaptation skill can be improved in children with ASD with the help of music therapy.

SIT is commonly implemented by occupational therapists and was effective in managing the symptoms associated with ASD. The association between sensory symptoms and severity of social communicative symptoms of autism was partially demonstrated by the findings of Watson *et al.* [22] which laid emphasis on the use of SIT for the management of the symptoms associated with ASD. Furthermore, a systematic review of 19 studies showed that positive effects were observed in child performance and behaviors relation to sensory impairments [23].

The only participant who used drama therapy found it to be effective with no side effects observed. A recent study of Corbett *et al.* [24], which tested a peer-mediated theater-based intervention, showed group effects on social ability, communication problems, group play with toys being in the presence of peers, immediate memory of faces, theory of mind immediately after treatment while group effects were observed on communication skills at a follow-up after 2 months.

Following a hourly sessions once per week for 7 weeks, a dance movement therapy intervention was found to improve well-being, body awareness, self-other distinction, and social skills in young adults with ASD, mainly high-functioning and Asperger's syndrome [25]. This tends to justify why the two participants who used dance therapy found it to be effective.

The theory behind spiritual healing is highly controversial in the medical world [26]. In a study to investigate the use of spiritual healing for the treatment of rheumatoid arthritis, explanations put forward to explain statistically but not clinically significant improvement following active healing when compared to sham healing were either because the patients experienced a decrease in arthritic activity by "chance" or because conventional science has not yet understood the mechanisms behind "energy healing" [27]. In this study, 10 out of 11 participants found spiritual healing very effective which can be explained by the fact that Mauritius being a multicultural country has a deep-rooted practice of rituals with potential positive psychological effects as reported previously [27].

Children with ASD have been shown to develop a strong bonding with pet dogs [28], and it has been shown that children with ASD are sensitive to the presence of service dogs which may be beneficial in managing behaviors [29]. A case study which involved 14 sessions of animal-assisted play therapy demonstrated that it helped improve social communication, including joint attention and waiting behaviors [30]. Likewise, the smile caused during animal-assisted activities has been reported to improve positive social behaviors and decreased negative social behaviors [31]. It has also been reported that the presence of a pig in the classroom, with contact time with the animal was at least 40 min/week, helped improve

social functioning, social approach behaviors decreased social withdrawal behaviors and increased social skills [32]. Furthermore, Wright *et al.* [33] argued that pet dogs can help decrease the stress level in primary carers of children with ASD. Finally, animal-assisted activities with farm animals have been shown to have positive effects on self-efficacy and coping ability in patients with psychiatric problems [34]. Participants in this study confirmed the presence of a bond between the individuals with ASD and pet dogs, helping in managing the symptoms associated with ASD.

Manipulative and Body-based Practices

The only participant who used acupuncture reported substantial adverse effects. The most recent article in relation to the use of acupuncture for the management of ASD was not conclusive [35]. Adverse effects such as bleeding, crying due to fear or pain, irritability, disturbed sleep, and increase hyperactivity, were observed. After reviewing 10 trials, there was no evidence to support the use the acupuncture for the treatment of ASD [36]. However, it was demonstrated by Zhao *et al.* [37] that electroacupuncture was useful to manage childhood autism, whereby its effectiveness can be assessed using single-photon emission computed tomography.

Parents reported that they followed a training and support program to deliver massage therapy to their children with ASD. It comprised of stimulating social and self-regulatory activity, first by making the children aware and receptive to massage, second enhancing eye contact and smile and then promoting deep relaxation with touch. These developed a relationship between them and the children, thereby improving receptive language for both low- and high-functioning children [38]. Likewise, a study showed that ASD children who received massage from their mothers displayed high-salivary concentration of oxytocin which was shown to be beneficial to social and emotional processes in individuals with psychiatric disorder [39].

It has been reported that individuals with ASD enjoyed the presence of horses and riding them. In a recent study by Borgi *et al.* [40] who assessed structured activities in the presence of horses, done both on the ground and while riding the horses, showed that equine-assisted therapies (EAT)-improved social functioning, mildly motor abilities, and executive functioning. Similarly, Lanning *et al.* [41] demonstrated that equine assisted activities can help improve physical, emotional, and social functioning which correlates to the work of Ajzenman *et al.* [42] who found that hypnotherapy can help decrease postural sway and improve adaptive behaviors, which is receptive communication and coping, participation in self-care, low-demand leisure, and social interactions. However, Holm *et al.* [43] observed that the dosage of therapeutic riding is very critical, whereby it can cause changes in behaviors for the better or the worse. Although this study presented with a few limitations, such as very small sample size (considering only three children with ASD), it demonstrated that there was consistent increase in verbalization and that the subjects learned to adjust their posture, depending on the gait and rhythm of the horse.

Hydrotherapy session involving the Halliwick method with an average duration of 75 min for over 10-16 weeks demonstrated a decrease in stereotypical movements, improvements in social interactions and behaviors, decreased hostile/irritable behaviors, improved social, emotional, school and physical function, improved social interaction with peers/siblings and teachers [44]. Moreover, a study surveying aquatic occupational therapists reported that they observed considerable improvement in swim skill, attention, muscle strength, balance, tolerance toward touch, and initiating/maintaining eye contact in young children with autism [45].

CONCLUSION

This study endeavored to study the pattern of use of CAM among a sample of individuals with ASD in Mauritius. Parents/guardians perceived many therapies as effective for improving the overall health status of individuals with ASD. The most used therapies were consumption of omega-3 and vitamins, SIT, spiritual healing, hippotherapy, and hydrotherapy. Elimination diets were found to be helpful, but due to the high-cost involved, parents were reluctant to sustain this intervention. This research can be considered as the first attempt to document different CAM used for ASD management which can open novel avenues in the quest for safer, more effective, and validated interventions for ASD.

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